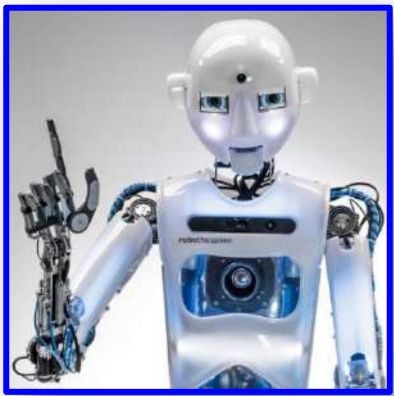
МИНИСТЕРСТВО ОБРАЗОВАНИЯ, НАУКИ И МОЛОДЁЖНОЙ ПОЛИТИКИ
КРАСНОДАРСКОГО КРАЯ

ГОСУДАРСТВЕННОЕ БЮДЖЕТНОЕ ПРОФЕССИОНАЛЬНОЕ ОБРАЗОВАТЕЛЬНОЕ
УЧРЕЖДЕНИЕ КРАСНОДАРСКОГО КРАЯ

«НОВОРОССИЙСКИЙ КОЛЛЕДЖ РАДИОЭЛЕКТРОННОГО ПРИБОРОСТРОЕНИЯ»

УЧЕБНОЕ ПОСОБИЕ



«Инновации в области техники:

робототехника, искусственный интеллект»

по учебной дисциплине «Иностранный язык»

для специальности 09.02.03 Программирование в компьютерных системах

2019

СОГЛАСОВАНО	УТВЕРЖДАЮ
На заседании Совета по методическим	Зам. директора по УР
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________ Е.В. Заслонова	

Одобрено на заседании УМО

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от 10 01 2019 г.

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Председатель УМО ________ М.А. Марарь

Организация – разработчик: государственное бюджетное профессиональное образовательное учреждение Краснодарского края «Новороссийский колледж радиоэлектронного приборостроения» (ГБПОУ КК НКРП)

Разработчик:

Преподаватель ГБПОУ КК НКРП ________________ И.Ю. Грушина

Рецензенты

Е.А. Задорожная	Заместитель директора по учебно-методической работе, преподаватель высшей квалификационной категории ГБПОУ КК НСПК Преподаватель английского языка
М.А. Марарь	Преподаватель первой квалификационной категории ГБПОУ КК НКРП Лингвист, преподаватель английского языка

Рецензия

на учебное пособие по иностранному языку (английский)

«Инновации в области техники:

робототехника, искусственный интеллект»

преподаватель Грушина Ирина Юрьевна

ГБПОУ КК НКРП

Учебное пособие «Инновации в области техники: робототехника, искусственный интеллект» преподавателя И.Ю. Грушиной предназначено для студентов 1 и 2 курсов специальности 09.02.03 Программирование в компьютерных системах.

Автор акцентирует внимание на том, что изучение иностранного языка в учебных заведениях СПО имеет профессиональную направленность. В связи с присоединением России к движению World Skills International и участием в конкурсах профессионального мастерства, появилась необходимость языковой подготовки студентов к участию в конкурсах по стандартам World Skills International. Одной из компетенций данного чемпионата является «Промышленная робототехника». Компьютерные технологии, применяемые в робототехнике — это элементы информационных технологий, программирование роботизированных систем управления и технологии, обеспечивающие связь между роботизированными системами, периферийным технологическим оборудованием и человеком.

Цель профессионально-ориентированного обучения иностранному языку в СПО, прежде всего, заключается в том, чтобы научить пользоваться языком как средством общения в своей профессиональной деятельности. Занятия по иностранному языку должны обеспечить для этого прочный фундамент из основных знаний, умений и навыков в иноязычной, мыслительной, коммуникативной деятельности и научить ориентироваться в ситуациях общения с зарубежными партнерами.

Актуальность данного учебного пособия определяется следующим: работа с робототехникой требует хорошей языковой подготовки по иностранному языку при создании модели робота. Студентам необходим определенный лексический запас, чтобы усвоить язык программирования, конструирования роботов, облегчить восприятие англоязычных инструкций.

Основной целью данного учебного пособия является формирование навыков и умений работы с оригинальными научно-техническими текстами. Учебное пособие включает разделы: робототехника, устройство роботов, виды роботов и их применение. Задания преимущественно основаны на текстовом материале аутентичного характера. Большое внимание автор уделяет освоению профессиональной лексики и терминологии, о чём свидетельствуют задания различного характера. Необходимо отметить сочетаемость грамматического и лексического материала, что является эффективным при обучении. Следует отметить оформление пособия рисунками и таблицами.

Учебное пособие обладает практической значимостью и решает актуальные проблемы совершенствования процесса подготовки и участия студентов в чемпионате профессионального мастерства.

Рецензируемое учебное пособие актуально для системы образования, интересно по содержанию, будет доступно и понятно как преподавателю, так и студентам.

Таким образом, данное пособие учебной дисциплины «Иностранный язык (английский)» может быть рекомендовано для использования в образовательном учреждении ГБПОУ КК «Новороссийский колледж радиоэлектронного приборостроения».

Рецензент: Е.А. Задорожная

(Ф.И.О. рецензента)

ГБПОУ КК НСПК, преподаватель высшей квалификационной категории зам. директора по учебно-методической работе

(должность, место работы)

преподаватель английского языка

(квалификация по диплому)

05 февраля 2019г.

Рецензия

на учебное пособие по иностранному языку (английский)

«Инновации в области техники: робототехника, искусственный интеллект»

преподавателя Грушиной Ирины Юрьевны

ГБПОУ КК НКРП

Учебное пособие «Инновации в области техники: робототехника, искусственный интеллект» предназначено для студентов 1-2 курсов специальности 09.02.03 Программирование в компьютерных системах. Учебное пособие может быть использовано, как для аудиторной, так и для самостоятельной работы студентов.

Цель учебного пособия – формирование коммуникативной компетенции на английском языке, развитие умения читать и переводить современные оригинальные тексты по специальности, а также подготовка студентов к использованию иностранного языка в их будущей профессиональной деятельности.

Учебное пособие состоит из двух разделов, каждый из которых посвящен определенной теме: робототехника и искусственный интеллект. Каждый раздел включает в себя кроме профессионально-ориентированных текстов для изучения и ознакомительного чтения, словарь с профессионально-ориентированной лексикой, а также комплекс разнообразных упражнений: лексико-грамматических, на развитие умений устного и письменного перевода технических текстов. Ценным с методической точки зрения является то, что по каждому разделу детально разработаны задания и имеется глоссарий, что, несомненно, способствует эффективному и равномерному развитию у обучающихся всех видов речевой деятельности. В заданиях соблюдается принцип повторяемости лексики от задания к заданию, что является одним из основных условий запоминания слов, словосочетаний и специальных терминов.

Лексические упражнения представлены в двух категориях – упражнения, нацеленные на достижение максимального количества повторных обращений к тексту, что способствует его усвоению; и упражнения, основной задачей которых является дальнейшее расширение навыков говорения и аудирования по теме. Такой комплекс разноплановых упражнений, несомненно, позволит достичь поставленной автором пособия цели.

Данное учебное пособие предусматривает формирование следующих компетенций: умение общаться на иностранном языке на профессиональные темы, переводить иностранные тексты профессиональной направленности, самостоятельно совершенствовать устную и письменную речь, пополнять словарный запас.

Содержание учебного пособия соответствует выбранной теме. Достаточно высока практическая значимость работы. В частности, все материалы учебного пособия могут быть использованы преподавателями иностранного языка, работающими в системе профессионального образования.

Рецензент: ______________ М.А. Марарь

(Ф.И.О. рецензента)

преподаватель первой квалификационной категории, ГБПОУ КК НКРП

(должность, место работы)

лингвист, преподаватель английского языка

(квалификация по диплому)

10 01 2019г.

Аннотация

Учебное пособие «Инновации в области техники: робототехника, искусственный интеллект» предназначено для общеобразовательной и профессионально-ориентированной подготовки по иностранному языку студентов специальности 09.02.03 Программирование в компьютерных системах. Материал учебного пособия позволяет обеспечить успешное освоение терминологической лексики по специальности, выработку навыков чтения, формирование умения иноязычного общения по темам «Робототехника» и «Искусственный интеллект».

Цель пособия – помочь студентам освоить термины и понятия по специальности, расширить словарный запас, читать, понимать и переводить профессионально-ориентированные тексты на английском языке, а также подготовить студентов к использованию иностранного языка в их профессиональной деятельности.

Пособие включает 2 раздела и охватывает такие темы, как: робототехника, области применения роботов, компоненты роботов, способы перемещения и системы управления, вычислительные приложения в робототехнике, искусственный интеллект. Первая часть учебного пособия включает 8 текстов по теме «Робототехника» и 4 текста для дополнительного чтения. Вторая часть учебного пособия включает 3 текста по теме «Искусственный интеллект», тексты для дополнительного чтения. Разделы включают следующие задания:

Vocabulary Development: упражнения на усвоение лексического материала, задание на подбор синонимов, подбор терминов к дефинициям и их перевод. Упражнения помогают лучше запомнить и расширить лексический запас в области профессиональной терминологии;

Writing: упражнения на развитие навыков двустороннего перевода, развития навыков и умений понимания, извлечения, обработки и воспроизведения информации из специальных текстов;

Speaking and Creative work: упражнения на развитие навыков говорения, задания, которые предполагают творческую работу: подготовка презентаций, проектная работа.

Каждый раздел состоит из оригинальных текстов, словарных пояснений, лексико-грамматических и речевых упражнений. Основу текстового материала данного учебного пособия составили аутентичные тексты, взятые с Интернет-сайтов. Цель каждого раздела – формирование навыков устной и письменной речи по профессиональной тематике. Этим определяется подбор текстов, их последовательность и характер тренировочных упражнений.

СОДЕРЖАНИЕ

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Part 1 Robotics

1.Robotics

Read the text «Robotics» carefully paying attention to the words and word combinations in bold type and do the tasks on it:

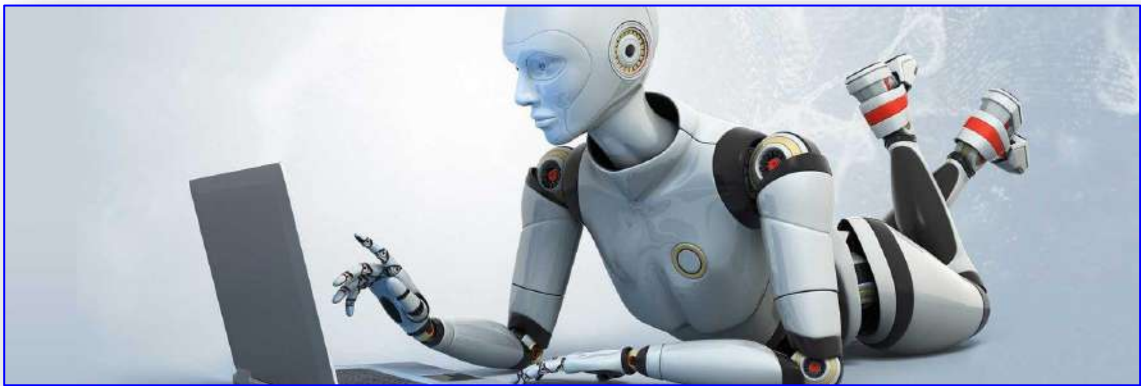
Robotics is **an interdisciplinary branch of engineering** and science that includes **mechanical engineering**, **electronic engineering, information engineering**, computer science, and others. Robotics deals with the design, **construction, operation**, and use of robots, as well as computer systems for their control, **sensory feedback**, and **information processing**. These technologies are used to develop machines that can **substitute** for humans and **replicate** human actions. Robots can be used in many situations and for lots of purposes, but today many are used in dangerous environments (including bomb **detection** and deactivation), manufacturing processes, or where humans cannot survive (e.g. in space, under water, in high heat, and clean up and **containment of hazardous materials** and radiation). Robots can take on any form but some are made **to resemble** humans in appearance. This is said to help in the acceptance of a robot in certain **replicative behaviors** usually performed by people. Such robots **attempt** to replicate walking, lifting, speech, **cognition**, or any other human activity. Many of today's robots **are inspired** by nature, contributing to the field of **bio-inspired robotics**. The concept of creating machines that can operate **autonomously** dates back to classical times, but research into the functionality and potential uses of robots did not grow substantially until the 20th century. Throughout history, it has been frequently assumed by various scholars, inventors, engineers, and technicians that robots will one day be able to mimic human behavior and manage tasks in a **humanlike** fashion. Today, robotics is a rapidly growing field, as technological advances continue; researching, designing, and building new robots serve various practical purposes, whether **domestically**, **commercially**, or **militarily**. Many robots are built to do jobs that

are hazardous to people, such as **defusing bombs**, **finding survivors in unstable ruins**, and **exploring mines and shipwrecks**. Robotics is also used in **STEM (science, technology, engineering, and mathematics)** as a teaching aid. **The advent of nanorobots**, microscopic robots that can **be injected into** the human body, could revolutionize medicine and human health. Robotics is a branch of engineering that involves the conception, design, manufacture, and operation of robots. This field **overlaps** with electronics, computer science, **artificial intelligence**, **mechatronics**, **nanotechnology** and **bioengineering**.

Exercises

Vocabulary Development

1. **Practice the pronunciation of the following words and word combinations. Study these words and word combinations. Find and translate the sentences where they are used.**
2. **Prepare to write a dictation.**



robotics	|rəʊˈbɒtɪks| робототехника	**an interdisciplinary branch of engineering**	|ɪntəˈdɪsɪplɪn(ə)ri| |brɑːn(t)ʃ||ɛndʒɪˈnɪərɪŋ| междисциплинарная отрасль техники
mechanical engineering	|mɪˈkanɪk(ə)l| |ɛndʒɪˈnɪərɪŋ| машиностроение	**electronic engineering**	электронная техника, электронная промышленность
information engineering	|ɪnfəˈmeɪʃ(ə)n| |ɛndʒɪˈnɪərɪŋ| информационная	**construction**	|kənˈstrʌkʃ(ə)n| составление программы управления машиной,

	инженерия; инфотехника		конструкция, построение, конструирование
operation	управление, эксплуатация операция, цикл обработки	**sensory feedback**	|ˈsɛns(ə)ri| |ˈfiːdbak| сенсорная обратная связь
information processing	|ˈprəʊsesɪŋ| обработка данных	**substitute**	|ˈsʌbstɪtjuːt| заменять; подменять; использовать вместо
replicate	|ˈreplɪkeɪt| копировать, повторять	**detection**	|dɪˈtɛkʃ(ə)n| обнаружение, выявление
deactivation	дезактивация; обезвреживание	**containment of hazardous materials**	|kənˈteɪnm(ə)nt| |ˈhazədəs| локализации опасных материалов
to resemble	|rɪˈzɛmb(ə)l| походить на, иметь сходство, быть похожим	**replicative behaviors**	репликативное поведения
attempt **to attempt**	|əˈtɛm(p)t| попытка, проба; пытаться, пробовать; сделать попытку	**cognition**	|kɒɡˈnɪʃ(ə)n| познание, знание, познавательная способность
to inspire	|ɪnˈspʌɪə| вдохновлять, вдохновить, внушать, воодушевить, воодушевлять, вселить, вселять	**bio-inspired robotics**	био-робототехника, биотехнологическая робототехника
autonomously	[ɔːˈtɒnəməslɪ] автономно, автономный	**humanlike**	человекоподобный
domestically	|dəˈmɛstɪkli| внутри страны, на внутреннем рынке, по-семейному, по-домашнему, внутри семьи	**commercially**	|kəˈməːʃ(ə)li| в торговом отношении, с коммерческой точки зрения

militarily	|ˈmɪlɪt(ə)rəli| в военном отношении, воинственно, применяя военную силу	**hazardous**	|ˈhazədəs| опасный, рискованный
to defuse bombs	|diːˈfjuːz| обезвреживать мины	**to find survivors in unstable ruins**	|səˈvʌɪvə| |ʌnˈsteɪb(ə)l| |ˈruːɪn| находить выживших в развалинах
to explore mines and shipwrecks	|ɪkˈsplɔː| |maɪnz| |ˈʃɪpreks| исследовать шахты и затонувшие корабли	**STEM (science, technology, engineering, and mathematics)**	естественные науки, технологии, инженерное искусство, математика
the advent of nanorobots	|ˈadv(ə)nt| появление нанороботов	**to inject**	|ɪnˈdʒɛkt| вводить, вставлять
to overlap	|ˌəʊvəˈlæp| заходить один за другой, частично покрывать, перекрывать, частично совпадать	**artificial intelligence**	|ɑːtɪˈfɪʃ(ə)l| |ɪnˈtɛlɪdʒ(ə)ns| искусственный интеллект
mechatronics	|mɛkəˈtrɒnɪks| мехатроника, механотроника	**nanotechnology**	|ˌnanə(ʊ)tɛkˈnɒlədʒi| нанотехнология
bioengineering	|ˌbʌɪəʊɛndʒɪˈnɪərɪŋ| биоинженерия, биотехника, биотехнология		

3. Write the following words in their normal spelling.

|rəʊˈbɒtɪks|	|ˈprəʊsesɪŋ|	|ˌbʌɪəʊɛndʒɪˈnɪərɪŋ|	|ˌnanə(ʊ)tɛkˈnɒlədʒi|
|ɛndʒɪˈnɪərɪŋ|	|kənˈstrʌkʃ(ə)n|	|ɑːtɪˈfɪʃ(ə)l| |ɪnˈtɛlɪdʒ(ə)ns|	|kənˈteɪnm(ə)nt|
|ˈhazədəs|	|ɪkˈsplɔː|	|mɛkəˈtrɒnɪks|	|mɪˈkanɪk(ə)l|

4. Find in the text words close in their meaning to the words given below.

Example: to use – to apply; an aim – a purpose

often independently
hazardous independent
acknowledgment discovering
to contain to transform

5. Find in the text the English equivalents for the following Russian words and phrases.

1) могут заменить людей и повторить человеческие действия	2) чтобы воспроизвести ходьбу, подъем, речь, познание или любую другую человеческую деятельность
3) некоторые из них сделаны, чтобы походить на людей по внешнему виду	4) может работать автономно
5) часто предполагалось	6) может быть введен в организм

различными учеными, изобретателями, инженерами и техниками	человека

6. Complete the following sentences with the appropriate word in bold.

1) These technologies are used to develop _______that can substitute for humans and replicate human actions.

machines	**units**	**vehicles**	**devices**

2) Throughout history, it has been frequently assumed by various scholars, inventors, engineers, and technicians that robots will one day be able to mimic _______ and manage tasks in a humanlike fashion.

human behavior	**robot behavior**	**animal-like behavior**	**machines behavior**

3) The concept of ________machines that can operate autonomously dates back to classical times, but research into the functionality and potential uses of robots did not grow substantially until the 20th century.

utilizing	**creating**	**programming**	**drawing**

4) The advent of nanorobots, microscopic robots that can be injected into the human body, could ________medicine and human health.

change	**eliminate**	**revolutionize**	**upgrade**

5) This field _______with electronics, computer science, artificial intelligence, mechatronics, nanotechnology and bioengineering.

contradicts	**interacts**	**cooperates**	**overlaps**

7. Find in the text sentences containing the words given below. Consult the dictionary to pick out all their meanings. Illustrate these meanings with your own examples.

containment	**to resemble**
advent	**to inject**
feedback	**to replicate**
cognition	**to substitute**

8. Match the terms with the definitions. Write their English and Russian equivalents.

feedback	**nanobot**	**artificial intelligence**
bioengineering	**electronic engineering**	**robotics**

Definition	**English term**	**Russian term**
1)an extremely small robot (= a machine controlled by a computer that can do things automatically)		
2)the study of how to produce machines that have some of the qualities that the human mind has, such as the ability to understand language, recognizepictures, solve problems, and learn		
3)the return back into a machine or system of part of what it produces, especially to improve what is produced		
4)the science of making and using robots		
5)is an electrical engineering discipline which utilizes nonlinear and active electrical components (such as semiconductor devices, especially transistors, diodes and integrated		

circuits) to design electronic circuits, devices, VLSI devices and their systems		
6)is the application of principles of biology and the tools of engineering to create usable, tangible, economically viable products.		

Writing

9. Prepare a written translation of the following passage.

Robotics is an interdisciplinary branch of engineering and science that includes mechanical engineering, electronic engineering, information engineering, computer science, and others. Robotics deals with the design, construction, operation, and use of robots, as well as computer systems for their control, sensory feedback, and information processing. These technologies are used to develop machines that can substitute for humans and replicate human actions. Robots can be used in many situations and for lots of purposes, but today many are used in dangerous environments (including bomb detection and deactivation), manufacturing processes, or where humans cannot survive (e.g. in space, under water, in high heat, and clean up and containment of hazardous materials and radiation).

10. Match the phrases to make sentences. Translate the sentences into Russian.

1 Robotics is	**a** also used in STEM (science, technology, engineering, and mathematics) as a teaching aid. The advent of nanorobots, microscopic robots that can be injected into the human body, could revolutionize medicine and human health.
2 Robotics is	**b** with the design, construction, operation, and use of robots, as well as computer systems for their control, sensory feedback, and information processing.
3 Robotics is	**c** a branch of engineering that involves the conception, design, manufacture, and operation

	of robots. This field overlaps with electronics, computer science, artificial intelligence, mechatronics, nanotechnology and bioengineering.
4 Robots can	**d** take on any form but some are made to resemble humans in appearance. This is said to help in the acceptance of a robot in certain replicative behaviors usually performed by people. Such robots attempt to replicate walking, lifting, speech, cognition, or any other human activity.
5 Robots are	**e** inspired by nature, contributing to the field of bio-inspired robotics.
6 Robots	**f** a rapidly growing field, as technological advances continue; researching, designing, and building new robots serve various practical purposes, whether domestically, commercially, or militarily.
7 Robotics deals	**g** an interdisciplinary branch of engineering and science that includes mechanical engineering, electronic engineering, information engineering, computer science, and others.
8Robots are	**h** attempt to replicate walking, lifting, speech, cognition, or any other human activity.
9 Robotics is	**i** built to do jobs that are hazardous to people, such as defusing bombs, finding survivors in unstable ruins, and exploring mines and shipwrecks.
10 Robots can	**j** be used in many situations and for lots of

	purposes, but today many are used in dangerous environments (including bomb detection and deactivation), manufacturing processes, or where humans cannot survive (e.g. in space, under water, in high heat, and clean up and containment of hazardous materials and radiation).

Reading

2. Etymology and History

Read the text «Etymology and History» carefully paying attention to the words and word combinations in bold type and do the tasks on it:

The word ***robotics*** **was derived** from the word *robot*, which was introduced to the public by **Czech** writer Karel Čapek in his play ***R.U.R.*** *(Rossum's Universal Robots)*, which was published in 1920. The word *robot* comes from **the Slavic word** *robota*, which means labour/work. The play begins in a factory that makes **artificial people** called *robots*, **creatures** who can **be mistaken** for humans – very similar to the modern ideas of androids. Karel Čapek himself did not **coin** the word. He wrote a short letter in reference to **an etymology** in the *Oxford English Dictionary* in which he named his brother Josef Čapek as its **actual originator**. According to the *Oxford English Dictionary*, the word *robotics* was first used in print by Isaac Asimov, in his **science fiction short story** *"Liar!"*, published in May 1941 in *Astounding Science Fiction*. Asimov **was unaware** that he was coining the term; since the science and technology of **electrical devices** is ***electronics***, he **assumed** *robotics* already referred to the science and technology of robots. In some of Asimov's other works, he states that the first use of the word *robotics* was in his short story *Runaround* (Astounding Science Fiction, March 1942), where he introduced his concept of The Three Laws of Robotics. However, the original publication of "Liar!" **predates** that of "Runaround" by ten months, so the former is generally cited as the word's origin. In 1948, Norbert Wiener formulated **the principles of cybernetics**, **the basis of practical robotics**. **Fully autonomous** only appeared in the second half of the 20th century. The first **digitally operated** and **programmable robot**, the Unimate, **was installed** in 1961 to lift hot pieces of metal from **a die casting machine** and **stack** them. **Commercial and industrial robots** are **widespread** today and used **to perform jobs** more cheaply, more accurately and more **reliably**, than humans. They are also employed in some jobs which are too dirty, dangerous, or **dull** to be **suitable** for humans. Robots are widely used in **manufacturing**, **assembly**, **packing** and **packaging**, **mining**, transport, **earth and space exploration**, **surgery, weaponry, laboratory research, safety,** and the **mass production** of **consumer** and **industrial goods**.

Date	Significance	Robot	Inventor
Third century B.C. and earlier	One of the earliest **descriptions** of **automata** appears in the *Lie Zi* text, on a much earlier **encounter** between King Mu of Zhou (1023–957 BC) and a **mechanical engineer** known as Yan Shi, an 'artificer'. The latter **allegedly** presented the king with **a life-size, human-shaped figure** of his **mechanical handiwork**.		Yan Shi (Chinese)
First century A.D. and earlier	Descriptions of more than 100 machines and automata, including a **fire engine**, a **wind organ**, a **coin-operated machine**, and a **steam-powered engine**, in *Pneumatica* and *Automata* by Heron of Alexandria		Ctesibius, Philo of Byzantium, Heron of Alexandria, and others
c. 420 B.C	A wooden, **steam propelled bird**, which was able to fly	Flying pigeon	Archytas of Tarentum
1206	Created early **humanoid automata**, **programmable automaton band**	Robot band, hand-washing automaton, automated moving peacocks	Al-Jazari
1495	Designs for a humanoid robot	Mechanical Knight	Leonardo da Vinci
1738	Mechanical duck that was able to eat, **flap** its wings, and **excrete**	Digesting Duck	Jacques de Vaucanson
1898	Nikola Tesla demonstrates first **radio-controlled vessel**	Teleautomaton	Nikola Tesla
1921	First fictional automatons called "robots" appear in the play *R.U.R.*	Rossum's Universal Robots	Karel Čapek
1930s	Humanoid robot exhibited at the 1939 and 1940 World's Fairs	Elektro	Westinghouse Electric

			Corporation
1946	First general-purpose digital computer	Whirlwind	Multiple people
1948	Simple robots exhibiting **biological behaviors**	Elsie and Elmer	William Grey Walter
1956	First commercial robot, from the Unimation company founded by George Devol and Joseph Engelberger, based on Devol's patents	Unimate	George Devol
1961	First installed industrial robot	Unimate	George Devol
1967 to 1972	First **full-scale humanoid intelligent robot**, and first android. Its **limb control system** allowed it to walk with the lower limbs, and **to grip** and transport objects with hands, using **tactile sensors**. Its **vision system** allowed it to **measure** distances and **directions** to objects using **external receptors**, **artificial eyes and ears**. And its conversation system allowed it to communicate with a person in Japanese, with an artificial mouth	WABOT-1	Waseda University
1973	First industrial robot with six **electromechanically driven axes**	Famulus	KUKA Robot Group
1974	The world's first microcomputer controlled electric industrial robot,IRB 6 from ASEA, was delivered to a small mechanical engineering company in southern Sweden. The design of this robot had been patented already 1972	IRB 6	ABB Robot Group
1975	**Programmable universal manipulation arm**, a Unimation product	PUMA	Victor Scheinman
1978	First **object-level robot** programming language, allowing robots **to handle variations** in object position, shape, and sensor noise	Freddy I and II, RAPT robot programming language	Patricia Ambler and Robin Popplestone
1983	First **multitasking, parallel programming language** used for a robot control. It was the Event Driven Language (EDL) on the IBM/Series/1 process computer, with **implementation** of both **inter process** communication (WAIT/POST) and **mutual exclusion (ENQ/DEQ) mechanisms** for robot control.	ADRIEL I	Stevo Bozinovski and Mihail Sestakov

Exercises

Vocabulary Development

1. **Practice the pronunciation of the following words and word combinations. Study these words and word combinations. Find and translate the sentences where they are used.**
2. **Prepare to write a dictation.**

to derive	|dɪˈrʌɪv| получать, выводить, происходить, извлекать	**fully autonomous**	|ɔːˈtɒnəməs| полностью автономный
Czech	|tʃɛk| чех; чешка; чешский	**digitally operated**	|ˈdɪdʒɪt(ə)li| |ˈɒpəreɪtɪd| с цифровым управлением
R.U.R. (Rossum's Universal Robots)	(сокращение от чеш. Rossumovi univerzální roboti, «Россумские универсальные роботы») — научно-фантастическая пьеса, написанная Карелом Чапеком в 1920 году. Премьерный показ пьесы состоялся 25 января 1921 года в Праге.	**programmable robot**	|prəʊˈɡræməbl̩| программируемый робот
the Slavic word	славянское слово	**to install**	|ɪnˈstɔːl| устанавливать, монтировать
artificial people	|ɑːtɪˈfɪʃ(ə)l| искусственные людей	**a die casting machine**	|daɪ| |ˈkɑːstɪŋ| машина для литья под давлением; прессовая формовочная машина
creature	|ˈkriːtʃə| создание, творение, живое существо	**to stack**	|stak| укладывать, складывать в кучу, складывать в штабель, стопку или столбик
to mistake	|mɪˈsteɪk| ошибаться; заблуждаться	**commercial robot**	|kəˈməːʃ(ə)l| серийный робот
to coin	|kɔɪn| создавать, придумывать, штамповать	**industrial robot**	|ɪnˈdʌstrɪəl| промышленный робот
an etymology	|ˌɛtɪˈmɒlədʒi| этимология	**to perform jobs**	|pəˈfɔːm| выполнять задания
actual originator	|ˈaktʃʊəl| |əˈrɪdʒɪneɪtə| настоящий создатель	**widespread**	|ˈwʌɪdsprɛd| широко

			распространенный
science fiction short story	|ˈsʌɪəns| |ˈfɪkʃ(ə)n| научно-фантастический рассказ	**reliably**	|rɪˈlaɪəbli| надежно
be unaware that	|ʌnəˈwɛː| не знать	**dull**	|dʌl| скучный, тупой, унылый, тусклый
electrical devices	|dɪˈvʌɪs| электротехническое устройство	**suitable**	|ˈsuːtəb(ə)l| подходящий, соответствующий, годный
electronics	|ɪlɛkˈtrɒnɪks| электроника, электронная аппаратура	**manufacturing**	|ˌmænjʊˈfæktʃərɪŋ| производство, производственный, промышленный
to assume	|əˈsjuːm| предполагать, принимать, брать на себя, допускать, принимать на себя	**assembly**	|əˈsɛmbli| монтаж, сбор, сборочный, монтажный, сборка
runaround	|ˈrʌnəraʊnd| отговорки, увиливание от ответа, оборка, паронихия	**packing**	|ˈpakɪŋ| упаковка, набивка, уплотнение, укладка, упаковочный
to predate	|priːˈdeɪt| датировать задним, более ранним числом, произойти до какого-л. числа	**packaging**	|ˈpakɪdʒɪŋ| упаковка, фасовочный
the principles of cybernetics	|ˈprɪnsɪp(ə)l| |sʌɪbəˈnɛtɪks| принципы кибернетики	**mining**	|ˈmʌɪnɪŋ| добыча, минирование, горный, горнорудный, горнопромышленн ый
the basis of practical robotics	основы практической робототехники	**earth and space exploration**	|əːθ| |ɛkspləˈreɪʃ(ə)n| исследование земли и космоса
surgery	|ˈsəːdʒ(ə)ri| хирургия	**weaponry**	|ˈwɛp(ə)nri| оружие, вооружение, боевая техника, боетехника
laboratory research	|ləˈbɒrəˌt(ə)ri| |rɪˈsəːtʃ| лабораторная научно-	**safety**	|ˈseɪfti| безопасность,

	исследовательская работа; лабораторные исследования		сохранность, надежность, предохранительный
mass production	|mæs| |prəˈdʌkʃ(ə)n| массовое, поточное, серийное производство	**consumer goods**	|kənˈsjuːmə| товары народного потребления
industrial goods	|ɪnˈdʌstrɪəl| промышленные изделия	**description**	|dɪˈskrɪpʃən| описание, изображение, вид, род, сорт
automata	|ɔːˈtɒmətə| автомат	**to encounter** **encounter**	|ɪnˈkaʊntə| сталкиваться, наталкиваться, столкновение, схватка, стычка
mechanical engineer	|mɪˈkanɪk(ə)l||ɛndʒɪˈnɪə| инженер-механик; машиностроитель	**allegedly**	|əˈlɛdʒɪdli| якобы, как утверждают, будто бы
a life-size	|ˈlʌɪfsʌɪz| натуральная величина, в натуральную величину	**human-shaped figure**	фигура в форме человека (в образе человека)
mechanical handiwork	|ˈhandɪwəːk| механическое изделие ручной работы	**fire engine**	пожарный автомобиль; пожарная машина; пожарный насос
wind organ	|wɪnd| |ˈɔːg(ə)n| ветровой орган	**coin-operated machine**	монетный автомат; автомат
steam-powered engine	|stiːm| |ˈpaʊə| |ˈɛndʒɪn| паровой двигатель	**steam propelled bird**	|prəˈpɛl| паровая самоходная птица
humanoid automata	|ˈhjuːmənɔɪd| гуманоидный(человеко подобный) автомат		
to flap	|flæp| махать, хлопать	**to excrete**	|ɪkˈskriːt| выделять, извергать
radio-controlled vessel	|ˈvɛs(ə)l| радиоуправляемое судно	**biological behaviors**	|bʌɪə(ʊ)ˈlɒdʒɪk(ə)l| биологическое поведение
full-scale humanoid intelligent robot	|ɪnˈtɛlɪdʒ(ə)nt| полномасштабный человекоподобный умный робот	**limb control system**	система управления конечностями
to grip	|grɪp| схватить; сжать; крепко	**tactile sensors**	|ˈtaktʌɪl| измерительный

	держать		преобразователь касания; тактильный рецептор; датчик касания
vision system	система технического зрения, СТЗ	**to measure**	|ˈmɛʒə| измерять, мерить
direction	|dɪˈrɛkʃ(ə)n| направление	**external receptors**	|ɪkˈstəːn(ə)l| |rɪˈsɛptə| внешние рецепторы
artificial eyes and ears	|ɑːtɪˈfɪʃ(ə)l| искусственные глаза и уши	**electromechanically driven axes**	оси с электромеханическим приводом
programmable universal manipulation arm	|prəʊˈɡræməbl̩| программируемый универсальный рычаг манипуляции	**first object-level robot programming language**	первый объектно-ориентированный язык программирования роботов
to handle	|ˈhand(ə)l| управлять; регулировать; манипулировать, управлять; осуществлять контроль; распоряжаться	**multitasking**	многофункциональный, многозадачный
parallel programming language	|ˈparəlɛl| язык параллельного программирования	**implementation**	|ɪmplɪmɛnˈteɪʃ(ə)n| осуществление, реализация, выполнение
inter process communication	|kəˌmjuːnɪˈkeɪʃənz| связь между процессами	**mutual exclusion (ENQ/DEQ) mechanisms** ENQ - to gain exclusive control for a resource (получить эксклюзивный контроль над ресурсом) DEQ - to remove the control gathered by ENQ (удалить	|ˈmjuːtʃʊəl| |ɪkˈskluːʒ(ə)n| механизмы взаимного исключения

		контроль, собранный ENQ)	

3. Write the following words in their normal spelling

[ˌmænjʊˈfæktʃərɪŋ]	[ˈdɪdʒɪt(ə)li] [ˈɒpəreɪtɪd]	[sʌɪbəˈnɛtɪks]
[ɪkˈstəːn(ə)l] [rɪˈsɛptə]	[ɑːtɪˈfɪʃ(ə)l]	[prəʊˈgræməbl̩]

4. Find in the text words similar in meaning to the following

Example: to use – to apply; an aim – a purpose

unreal **up-to-date**	**manlike** **creator**
independent **appropriate**	**to believe** **to arrive**

5. Find in the text the English equivalents for the following Russian words and phrases.

1)существа, которых можно принять за людей	2)коммерческие и промышленные роботы широко распространены сегодня и используются для выполнения рабочих задач
3)первый цифровой и программируемый робот	4)широко используются в производстве, сборке, упаковке, горнодобывающей

	промышленности, транспорте, освоении земли и космоса, хирургии, вооружении, лабораторных исследованиях, технике безопасности и массовом производстве потребительских и промышленных товаров
5)проявление биологического поведения	6)был установлен в 1961 году, чтобы поднимать горячие куски металла из машины литья под давлением и укладывать их

6. Complete the following sentences with the appropriate word in bold

1) The play begins in a factory that makes _________called robots, creatures who can be mistaken for humans – very similar to the modern ideas of androids.

mechanical people	**artificial people**	**intelligent people**

2) The first digitally operated and programmable robot, the Unimate, ________in 1961 to lift hot pieces of metal from a die casting machine and stack them.

was utilized	**was disposed**	**was installed**

3) Commercial and industrial _______are widespread today and used to perform jobs more cheaply, more accurately and more reliably, than humans.

robots	**devices**	**machines**

4) Asimov was unaware that he was coining the term; since the science and technology of ________is electronics, he assumed robotics already referred to the science and technology of robots.

mechanical devices	**electronic devices**	**electrical devices**

5) In 1948, Norbert Wiener formulated the________, the basis of practical robotics.

principles of electronics	**principles of cybernetics**	**principles of robotics**

7. Find in the text sentences containing the words given below. Consult the dictionary to pick out all their meanings. Illustrate these meanings with your own examples.

to assume	**dull**
to predate	**assembly**
to perform	**manufacturing**

8. Match the terms with the definitions. Write their English and Russian equivalents.

cybernetics	**artificial**	**electronics**
electrical device	**digitally**	**autonomous**

Definition	English term	Russian term
1)the scientific study of how information is communicated in machines and electronic devices, comparing this with how information is communicated in the brain and nervous system		
2)made by people, often as a copy of something natural		
3)the scientific study of electric current and the technology that uses it		
4)independent and having the power to make your own decisions		
5)in a way that records or stores information as a series of the numbers 1 and 0, to show that		

a signal is present or absent		
6)a device that produces or is powered by electricity		

Writing

9. Prepare a written translation of the following table.

Date	Significance	Robot	Inventor
Third century B.C. and earlier	One of the earliest **descriptions** of **automata** appears in the *Lie Zi* text, on a much earlier **encounter** between King Mu of Zhou (1023–957 BC) and a **mechanical engineer** known as Yan Shi, an 'artificer'. The latter **allegedly** presented the king with **a life-size, human-shaped figure** of his **mechanical handiwork**.		Yan Shi (Chinese)
First century A.D. and earlier	Descriptions of more than 100 machines and automata, including a **fire engine**, a **wind organ**, a **coin-operated machine**, and a **steam-powered engine**, in *Pneumatica* and *Automata* by Heron of Alexandria		Ctesibius, Philo of Byzantium, Heron of Alexandria, and others
c. 420 B.C	A wooden, **steam propelled bird**, which was able to fly	Flying pigeon	Archytas of Tarentum
1206	Created early **humanoid automata**, **programmable automaton band**	Robot band, hand-washing automaton, automated moving peacocks	Al-Jazari
1495	Designs for a humanoid robot	Mechanical Knight	Leonardo da Vinci
1738	Mechanical duck that was able to eat, **flap** its wings, and **excrete**	Digesting Duck	Jacques de Vaucanson
1898	Nikola Tesla demonstrates first **radio-controlled vessel**	Teleautomaton	Nikola Tesla
1921	First fictional automatons called "robots" appear in the play *R.U.R.*	Rossum's Universal Robots	Karel Čapek
1930s	Humanoid robot exhibited at the 1939 and 1940 World's Fairs	Elektro	Westinghouse Electric Corporation
1946	First general-purpose digital computer	Whirlwind	Multiple people
1948	Simple robots exhibiting **biological behaviors**	Elsie and Elmer	William Grey Walter
1956	First commercial robot, from the Unimation company founded by George Devol and Joseph Engelberger, based on Devol's patents	Unimate	George Devol
1961	First installed industrial robot	Unimate	George Devol
1967 to	First **full-scale humanoid intelligent robot**, and first android. Its **limb control system**	WABOT-1	Waseda University

1972	allowed it to walk with the lower limbs, and **to grip** and transport objects with hands, using **tactile sensors**. Its **vision system** allowed it to **measure** distances and **directions** to objects using **external receptors**, **artificial eyes and ears**. And its conversation system allowed it to communicate with a person in Japanese, with an artificial mouth		
1973	First industrial robot with six **electromechanically driven axes**	Famulus	KUKA Robot Group
1974	The world's first microcomputer controlled electric industrial robot,IRB 6 from ASEA, was delivered to a small mechanical engineering company in southern Sweden. The design of this robot had been patented already 1972	IRB 6	ABB Robot Group
1975	**Programmable universal manipulation arm**, a Unimation product	PUMA	Victor Scheinman
1978	First **object-level robot** programming language, allowing robots **to handle variations** in object position, shape, and sensor noise	Freddy I and II, RAPT robot programming language	Patricia Ambler and Robin Popplestone
1983	First **multitasking, parallel programming language** used for a robot control. It was the Event Driven Language (EDL) on the IBM/Series/1 process computer, with **implementation** of both **inter process** communication (WAIT/POST) and **mutual exclusion (ENQ/DEQ) mechanisms** for robot control.	ADRIEL I	Stevo Bozinovski and Mihail Sestakov

10. Match the phrases to make sentences. Translate the sentences into Russian.

1 The word robot comes from the Slavic word robota, which	a widespread today and used to perform jobs more cheaply, more accurately and more reliably, than humans.
2 Robots are	b means labour/work.
3 The word robotics was derived from the word robot, which	c first used in print by Isaac Asimov, in his science fiction short story "Liar!", published in May 1941 in Astounding Science Fiction.
4	d

The word robotics was	widely used in manufacturing, assembly, packing and packaging, mining, transport, earth and space exploration, surgery, weaponry, laboratory research, safety, and the mass production of consumer and industrial goods.
5 Commercial and industrial robots are	e was introduced to the public by Czech writer Karel Čapek in his play R.U.R. (Rossum's Universal Robots), which was published in 1920.

Reading

3. Applications

Applications

There are many types of robots; they are used in many different environments and for many different uses, although **being** very **diverse in application** and form they all share three basic **similarities** when it comes to their construction:

1. Robots all have some kind of **mechanical construction**, a **frame**, form or shape designed **to achieve** a particular task. For example, a robot designed to travel across heavy dirt or mud, might use **caterpillar tracks**. The mechanical aspect is mostly the creator's **solution** to completing the **assigned task** and dealing with the physics of the environment around it. Form follows function.

2. Robots have electrical components which **power** and control the machinery. For example, the robot with caterpillar tracks would need some kind of power to move the **tracker treads**. That power comes in the form of electricity, which will have **to travel through a wire** and **originate from a battery**, a basic **electrical circuit**. Even **petrol powered machines** that get their power mainly from petrol still **require** an **electric current** to start the **combustion process** which is why most petrol powered machines like cars, have batteries. The electrical aspect of robots is used for **movement** (through motors), **sensing** (where electrical signals are used to measure things like heat, sound, position, and energy status) and operation (robots need some level of electrical energy **supplied** to their motors and sensors in order **to activate** and **perform** basic operations)

3. All robots contain some level of **computer programming code**. A program is how a robot decides when or how to do something. In the caterpillar track example, a robot that needs to move across a **muddy** road may have the correct mechanical construction and receive the correct **amount of power** from its battery, but would not go anywhere without a program telling it to move. Programs are **the core essence of a robot**, it could have excellent mechanical and electrical construction, but if its program is **poorly** constructed its **performance** will be very poor (or it may not perform at all). There are three different types of robotic programs: **remote control**, **artificial intelligence** and hybrid. A robot with remote control programming has a **preexisting set of commands** that it will only perform if and when it receives a signal from a control source, typically a human being with a remote control. It is perhaps more **appropriate** to view devices controlled **primarily** by human commands as falling in the discipline of automation rather than robotics. Robots that use artificial intelligence interact with their environment on their own without a control source, and can **determine** reactions to objects and problems they **encounter** using their preexisting programming. Hybrid is a form of programming that **incorporates** both **AI** and **RC functions**.

As more and more robots are designed for specific tasks this method of classification becomes more **relevant**. For example, many robots are designed for **assembly work**, which may not be **readily adaptable** for other applications. They are termed as "**assembly robots**". For **seam welding**, some **suppliers** provide complete welding systems with the robot i.e. the **welding equipment** along with other material **handling facilities** like **turntables**, etc. as an **integrated unit**. Such an integrated robotic system is called a "welding robot" even though its **discrete manipulator unit** could be adapted to **a variety of tasks**. Some robots are specifically designed for **heavy load manipulation**, and **are labeled** as "heavy-duty robots".

Current and **potential applications** include:

- Military robots.
- Industrial robots. Robots are increasingly used in manufacturing (since the 1960s). According to the Robotic Industries Association US data, in 2016 **automotive industry** was the main customer of industrial robots with 52% of total sales. In the auto industry, they can amount for more than half of the "labor". There are even "lights off" factories such as an IBM keyboard manufacturing factory in Texas that was fully automated as early as 2003.
- **Cobots (collaborative robots)**.
- **Construction robots**. Construction robots can be separated into three types: traditional robots, robotic arm, and **robotic exoskeleton.**
- **Agricultural robots** (AgRobots). The use of robots in agriculture is closely linked to the concept of **AI-assisted precision agriculture** and **drone** usage. 1996-1998 research also proved that robots can perform a **herding task**.
- Medical robots of various types (such as da Vinci Surgical System and Hospi).
- Kitchen automation. Commercial examples of kitchen automation are Flippy (burgers), Zume Pizza (pizza), Cafe X (coffee), Makr Shakr (cocktails), Frobot (frozen yogurts) and Sally (salads). Home examples are Rotimatic (**flatbreads baking**) and Boris (**dishwasher loading**).
- **Robot combat for sport** – hobby or sport event where two or more robots fight in an arena **to disable** each other. This has

developed from a hobby in the 1990s to several TV series worldwide.
- **Cleanup of contaminated areas**, such as **toxic waste** or **nuclear facilities**.
- **Domestic robots**.
- **Nanorobots**.
- **Swarm robotics**.
- **Autonomous drones**.
- Sports field line marking.

10 exciting robotics developments and technologies

In this Editorial, we identify 10 exciting robotics developments and technologies, **ranging from** original research that may change the future of robotics to commercial products that **enable** basic science and drive industrial and medical **innovations**.

1. Boston Dynamics' Atlas doing parkour

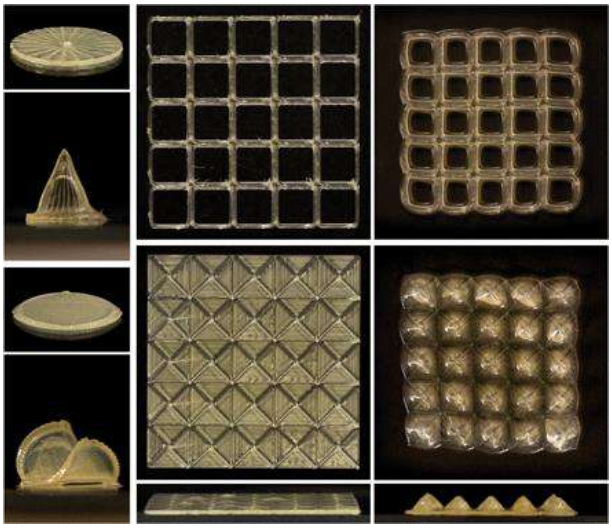
The **performance** of the 1.5-m, 75-kg Atlas keeps surprising us, jumping over a **log** in **stride** with one leg while **jogging** and jumping over wooden boxes with no break in pace. These feats add to walking on **challenging terrain**, keeping its balance when **disturbed**, standing up, lifting and manipulating objects, and **executing** a **back flip** like a gymnast. Marc Raibert's Boston Dynamics team remains the masters of robotic balance and **propulsion**. Raibert observes that "the mechanical system has a mind of its own, governed by the physical structure and laws of physics." Atlas uses its vision system **to align** itself and to measure distances to the **parkour obstacles**. Although Raibert admits that not all **trials** could be successfully mastered, he hopes that the demonstrations serve as an **inspiration** for what robots can do in the near future.

2. Intuitive Surgical's da Vinci SP platform

Robotic surgery represents one of the most important **surgical innovations** in recent years, and procedures such as **radical prostatectomy** are increasingly performed by using a robotic approach, **implying** many **benefits**. More robotic platforms are **emerging**, and increased **clinical uptake** depends on whether issues such as cost effectiveness and barriers to wider clinical **accessibility** will be further addressed. Da Vinci is an early pioneer and a global market leader, and Intuitive Surgical continues to push the **boundaries** of surgical robotics. Through a single 2.5-cm **cannula** and small **incision**, the newly launched da Vinc **single-port system** allows the surgeon to control three **fully wristed**, **elbowed instruments**, combined with **an articulated endoscope** for **deep-seated lesions**.

3. Soft robot that navigates through growth

Navigation by growth at the tip opens a new direction for robots. Imagine if the growth of a vine, **neuron**, or **fungal hyphae** could be **scaled up**, **sped up**, and made **steerable**. The **investigators** took **a tube of soft material** that is folded inside itself but, when **pressurized**, **grows outward** as material at the front of the tube is **pushed outward**. This brilliant design idea addresses several **grand challenges** in robotics and **exemplifies** the use of **bioinspired design** by **extracting** a general biological principle and using it as an analogy to **advance engineering** beyond what is possible in nature. The soft robotic design allows **obstacle avoidance** in complex, **unstructured environments**, which holds promise for **navigation** in pipes and **conduits**, medical devices, and in **exploration** and **search-and-rescue robots**.



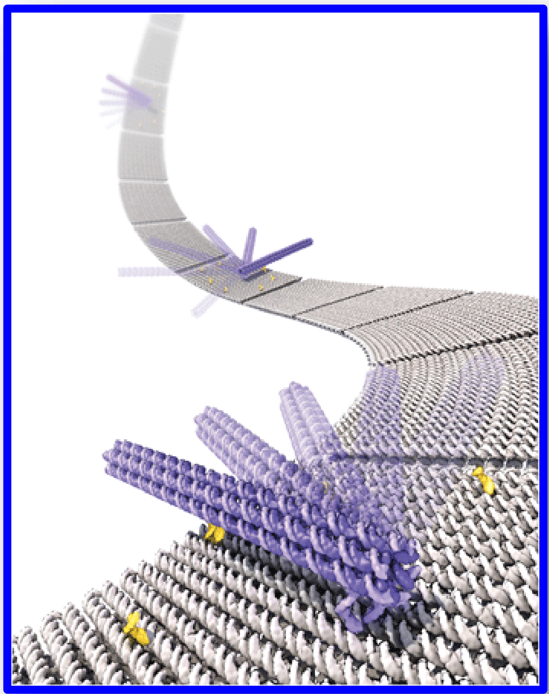
4. 3D-printed liquid crystal elastomers for soft robotics

One of the grand challenges of robotics is to explore new materials and **fabrication schemes** for developing **power-efficient**, **multifunctional** and **compliant actuators**. 2018 saw many new developments in this **burgeoning research** area across different disciplines. **Versatile shape-morphing liquid crystal elastomeric actuators** have been used before, but this publication shows how the elastomers can be **fabricated** with 3D printing using high operating temperature direct ink writing with **spatially** programmed **nematic** order. These actuators demonstrated the ability to lift significantly more weight than other liquid crystal elastomers reported to date. The technique **promises** large area designs and **dynamic** functional architectures for soft robots.

5. Muscle-mimetic, self-healing, and hydraulicallyamplified actuators

Peano-HASEL provides a soft actuator that is **transparent** and self-sensing, with **controllable linear contractions** up to 10%, a **strain rate** of 900% per second, and **actuation** at 50 Hz. The actuator uses both **electrostatic** and **hydraulic principles** to provide **linear contraction** upon application of a voltage without the need for **pre-stretching** the material or any **rigid frames**. The **HASEL** (hydraulically amplified

self-healing electrostatic) actuator is strong and versatile but cheap to produce, according to the authors, who only used **a facile heat-sealing method** with **inexpensive** commercially available materials to produce this promising technology. **Remarkably**, this actuator is able to lift more than 200 times its weight.



6. Self-assembled nanoscale robot from DNA

DNA origami can form different shapes at the **nanoscale**. By controlling a **self-assembling** DNA origami structure combined with a system of **latches** formed by **single-stranded DNAs**, **precise nanoscale movement** is now possible under an **externally applied tunable electric field**. These **nanoscale** robotic systems can be used in parallel for electrically driven transport of **molecules** or **nanoparticles** over tens of **nanometers** or more. The robot **enables programmable synthesis** and assembly of materials from the bottom up. Its positioning state may also be used as **a molecular mechanical memory.**

7. DelFly nimble bioinspired robotic flapper

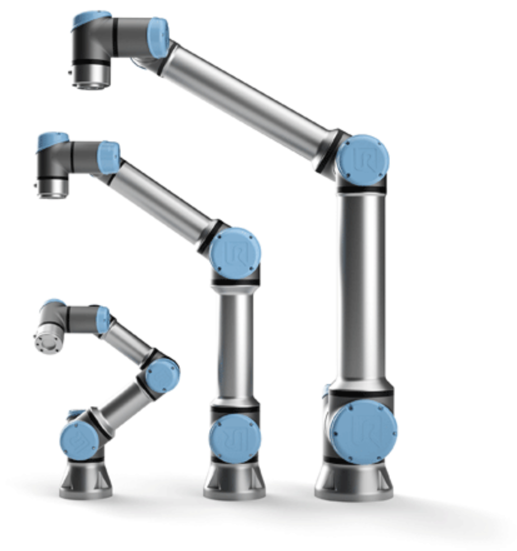
Many **bioinspired robots** serve **a dual purpose**, namely, developing advanced technologies with practical applications and **unveiling** the principles used by nature to build and program living beings. Here, we see the design of a **remarkable**, **tailless**, **untethered**, autonomous, programmable, small (28 g), **flapping**

aerial vehicle with **exceptional agility capable of performing** 360° **roll** and **pitch flips** with **angular accelerations** up to 5000° s−2 (8). Although it is over 50 times the size of a fruit fly and does not mimic the **wing morphology** or **kinematics** of any specific natural flyer, the robot can serve as a **novel physical model** to test how flying organisms perform flight control. Surprisingly, the DelFly Nimble could accurately reproduce the **rapid escape maneuvers of fruit flies** even with no **explicit** control of all its **rotation axes**. We consider it **a paradigmatic example** of "science for robotics and robotics for science" and expect that it will advance the development of flying robots.

8. Soft exosuit wearable robot

When it comes to wearing **an exoskeleton** for everyday life, most people do not want **to resemble** Iron Man. **A lightweight**, **stretchy exosuit** offers new **ways of integrating** fabric design, sensing, robotic control, and **actuation** to increase **a wearer's strength, balance, and endurance**. Potential applications include assisting the elderly in **enhancing their muscular strength**, **supporting their mobility and independence**, and **rehabilitating children and adults** with **movement disorders** due to stroke, **multiple sclerosis**, or **Parkinson's disease**. **Human-in-the-loop control optimization** further allows **seamless integration of the robot with human**, **providing personalized control strategies and adaptation.**

9. Universal Robots (UR) e-Series Cobots



From research laboratories to **assembly lines** and logistics to **surgical guidance**, the UR robotic arms are becoming **ubiquitous** despite their **unassuming appearance**. The company is developing an ecosystem around its **core products**, and their new e-Series **collaborative robot** launched in 2018 echoes the general trend in collaborative automation and learning from hands-on demonstration rather than specialized programming. With enhanced safety features and force/**torque sensing**, we expect to see more intelligent human-robot **interactions** in **a diverse range of environments** where robots can **seamlessly** learn and **collaborate with human operators**.

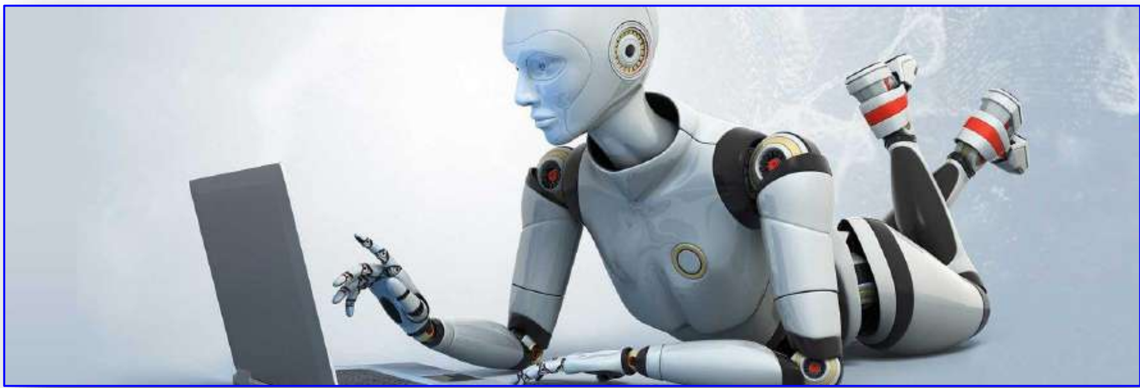
10. Sony's aibo

The return of aibo, Sony's toy dog first introduced nearly 20 years ago, is welcomed by many, and not just because of its new appearance, enhanced voice understanding, and its improved ability to learn from its owners. In addition, the robot has been developed with Sony's increasing **awareness** of the role robots can play in childhood learning or as a companion for the aged, particularly those with **neurodegenerative diseases**. Understanding the **perception, interaction, and expectations** of the people around the robot and developing robot behavior and personality that are context aware (not dependent on **pre-scripted programs** and with personalization and adaptation) are interesting topics in social robotics.

Exercises

Vocabulary Development

1. **Practice the pronunciation of the following words and word combinations. Study these words and word combinations. Find and translate the sentences where they are used.**
2. **Prepare to write a dictation.**



Application

very **diverse in application**	очень разнообразные в применении	**power**	|ˈpaʊə| сила; мощь энергия; мощность; мощность; производительность
similarity	|ˌsɪməˈlærɪtɪ| сходство, подобие	**tracker treads**	трекер протекторов
mechanical construction	|mɪˈkanɪk(ə)l| |kənˈstrʌkʃ(ə)n| механическое построение	**to travel through a wire**	передаваться по (через) проводу
frame	|freɪm| рама, кадр, рамка, каркас, рамочный, создавать, обрамлять	**electrical circuit**	|ˈsəːkɪt| электрическая цепь
to achieve	|əˈtʃiːv| достигать, добиваться, выполнять, успешно выполнять, доводить до конца	**petrol powered machines**	машины работающие на бензине
caterpillar tracks	|ˈkatəpɪlə| а) гусеничная лента; б) трак гусеницы	**electric current**	|ˈkʌr(ə)nt| электрический ток
solution	|səˈluːʃ(ə)n| решение; разрешение (проблемы и	**combustion process**	|kəmˈbʌstʃ(ə)n| процесс горения, процесс сгорания, процесс

	т. п.); объяснение		сжигания
assigned task	|əˈsaɪnd| поставленная задача; порученная задача	**to sense**	|sɛns| чувствовать, осознавать понимать, отдавать себе отчёт
movement	|ˈmuːvm(ə)nt| движение; перемещение, передвижение	**to activate**	|ˈaktɪveɪt| активировать, активизировать, включать, формировать и укомплектовывать
to supply	|səˈplʌɪ| снабжать, поставлять, доставлять, давать; питать, восполнять, возмещать (недостаток, дефект); удовлетворять (нужды, желания)	**computer programming code**	компьютерный код программирования
to perform	|pəˈfɔːm| выполнять, исполнять, совершать, выступать, играть, проделать, представлять	**amount of power**	количество энергии, количество силы
muddy	|ˈmʌdi| грязный, мутный, тусклый, мутноватый, мутить, помутнеть, обрызгать грязью	**poorly**	|ˈpɔːli| плохо, неудачно, скудно, худо, жалко, нездоровый, малолюдный
the core essence of a robot	основная сущность робота	**preexisting set of commands**	существующий набор команд
performance	|pəˈfɔːm(ə)ns| производительность, исполнение, эффективность, выполнение, деятельность	**primarily**	|ˈprʌɪm(ə)rɪli| в первую очередь, прежде всего, главным образом, первоначально, сначала
appropriate	|əˈprəʊpriət| соответствующий, подходящий, присущий	**encounter**	|ɪnˈkaʊntə| сталкиваться, наталкиваться, столкновение, схватка, стычка
determine	|dɪˈtəːmɪn| определять, устанавливать, решать, решаться, измерять	**assembly work**	монтажные работы, сборка
to incorporate	|ɪnˈkɔːpəreɪt| объединять, объединяться, соединяться	**supplier**	|səˈplaɪər| поставщик
relevant	|ˈrɛlɪv(ə)nt| уместный, относящийся к делу; важный, необходимый; насущный	**welding equipment**	|ˈweldɪŋ| |ɪˈkwɪpm(ə)nt| сварочное оборудование
readily	|ˈrɛdɪli|	**handling**	|ˈhændlɪŋ| |fəˈsɪlɪtɪz|

	легко, с готовностью, охотно, быстро, без труда	**facilities**	погрузочно-разгрузочные устройства
adaptable	|əˈdaptəb(ə)l| легко приспосабливающийся, поддающийся адаптации, умеющий приспосабливаться к новой обстановке	**turntable**	|ˈtəːnteıb(ə)l| тех. поворотный стол; поворотная платформа, поворотный круг; поворотный диск вращающиеся платформа, стол, диск различного назначения дека, вертушка, проигрыватель (для пластинок)
"assembly robots"	|əˈsɛmbli| «сборочный робот», сборка роботов	**integrated unit**	|ˈıntıgreıtıd| объединённый блок
seam welding	|siːm| |ˈweldıŋ| линейная сварка	**a variety of tasks**	|vəˈrʌıəti| ряд задач
discrete manipulator unit	|məˈnıpjʊleıtə| отдельный блок манипулятора	**labeled**	|ˈleıbəld| маркированный, с этикеткой
heavy load manipulation	тяжелая манипуляция нагрузки	**automotive industry**	|ˌɔːtəˈməʊtıv| автомобильная промышленность
current and **potential applications**	|ˈkʌr(ə)nt| |pə(ʊ)ˈtɛnʃ(ə)l| |aplıˈkeıʃ(ə)n| текущие и потенциальные области применения	**construction robot**	|kənˈstrʌkʃ(ə)n робот-строитель
cobots (collaborative robots)	|kəˈlabərətıv| роботы для совместной роботы	**agricultural robots**	|agrıˈkʌltʃərəl| сельскохозяйственные роботы
robotic exoskeleton	роботизированный экзоскелет	**drone**	|drəʊn| беспилотный самолёт
AI-assisted precision agriculture	содействие точного земледелия	**robot combat for sport**	боевой робот для спорта
to disable	|dısˈeıb(ə)l| запрещать, калечить, делать неспособным, лишать права, делать непригодным	**cleanup of contaminated areas**	|kənˈtamıneıt| очистка загрязненной территории
toxic waste	токсические отходы; токсичные отходы	**nuclear facilities**	|ˈnjuːklıə| ядерное оборудование; ядерные установки
domestic robots	бытовой робот	**versatile shape-morphing liquid crystal elastomeric actuators**	|ˈvəːsətʌıl| |mɔːfiŋ| |ˈlıkwıd| |ˈkrıst(ə)l| универсальные формообразующие жидкокристаллические эластомерные приводы
autonomous drones	|ɔːˈtɒnəməs| автономные дроны	**spatially**	|ˈspeıʃəli| пространственно, в

			пространственном отношении
research area	|rɪˈsəːtʃ| область исследований		
fabricated	|ˈfæbrɪkeɪtɪd| сборный; из готовых частей	**to fabricate**	|ˈfabrɪkeɪt| производить, фабриковать, изготовлять, выделывать, подделывать, выдумывать, делать
nematic	нематический		

1. Boston Dynamics' Atlas doing parkour

performance	|pəˈfɔːm(ə)ns| производительность, исполнение, эффективность, выполнение, деятельность	**terrain**	|tɛˈreɪn| местность, территория
to disturb	|dɪˈstəːb| беспокоить, нарушать, мешать, побеспокоить	**executing** a **back flip**	выполнение сальто
propulsion	|prəˈpʌlʃ(ə)n| поступательное движение, движение вперёд; приведение в движение, сообщение движения; толчок; проталкивание, движущая сила, побудительная сила	**to align**	|əˈlʌɪn| устанавливать соосно, выравнивать, выстраивать, равняться, ставить в ряд
parkour obstacles	|ˈɒbstək(ə)l| паркур препятствия	**trials**	|ˈtrʌɪəl| испытание, проба
inspiration	|ɪnspɪˈreɪʃ(ə)n| стимулирование, побуждение; воздействие; воодушевление		

2. Intuitive Surgical's da Vinci SP platform

surgical innovations	|ˈsəːdʒɪk(ə)l| |ɪnəˈveɪʃ(ə)n| |хирургические инновации	**radical prostatectomy**	радикальная простатэктомия
		to emerge	|ɪˈməːdʒ| появляться, возникать
clinical uptake	клиническое понимание	**accessibility**	|əksɛsɪˈbɪlɪti|

			доступность, общедоступность, удобство подхода, легкость осмотра
boundary	|ˈbaʊnd(ə)ri| граница, черта	**cannula**	|ˈkanjʊlə| полая игла, трубочка, катетер
incision	|ɪnˈsɪʒ(ə)n| разрез, надрез, рассечение, насечка, разрезание	**single-port system**	однопортовая система
an articulated endoscope	|ˈɛndəskəʊp| сочлененный эндоскоп	**deep-seated lesions**	ˈliːʒ(ə)n| глубинные поражения

3. Soft robot that navigates through growth

fungal	|ˈfʌŋg(ə)l| грибковый, грибной, грибок	**neuron**	|ˈnjʊərɒn| нейрон, нервная клетка
sped up	увеличивать	**scaled up**	в увеличенном масштабе
investigator	|ɪnˈvɛstɪgeɪtə| следователь, исследователь, испытатель	**steerable**	управляемый, регулируемый, ориентируемый
to exemplify	|ɪgˈzɛmplɪfʌɪ| служить примером, снимать и заверять копию, приводить пример	**a tube of soft material**	трубка из мягкого материала
exploration and **search-and-rescue robots**	разведывательные и поисково-спасательные роботы	**grand challenges**	грандиозные задачи

4. 3D-printed liquid crystal elastomers for soft robotics

fabrication	|fabrɪˈkeɪʃ(ə)n| изготовление, производство	**power-efficient**, **multifunctional** and **compliant actuators**	энергоэффективные, многофункциональные и совместимые приводы
schemes burgeoning research area	схемы разрастающейся области исследований	**versatile shape-morphing liquid crystal elastomeric actuators**	универсальные формообразующие жидкокристаллические эластомерные приводы

5. Muscle-mimetic, self-healing, and hydraulicallyamplified actuators

transparent	|tranˈspar(ə)nt| прозрачный,	**controllable linear**	|kənˈtrəʊləb(ə)l| |ˈlɪnɪə| |kənˈtrakʃ(ə)n|

	понятный, ясный, просвечивающий, явный, очевидный	**contractions**	управляемые линейные сокращения
strain rate	скорость деформации	**actuation**	|ˌæktʃuˈeɪʃən| приведение в действие; включение, завод, запуск (оборудования)
electrostatic	|ɪˌlɛktrə(ʊ)ˈstatɪk| электростатический	**hydraulic principles**	|hʌɪˈdrɔːlɪk| гидравлические элементы (принципы)
linear contraction	|ˈlɪnɪə| |kənˈtrakʃ(ə)n| уменьшение линейных размеров; линейная усадка	**pre-stretching** the material	предварительное растягивание материала
rigid frame	|ˈrɪdʒɪd| неподвижная система отсчёта; рама с жёсткими узлами; жёсткий каркас	**HASEL** (hydraulically amplified self-healing electrostatic) actuator	HASEL (гидравлически усиленный самовосстанавливающийся электростатический привод)
heat-sealing method	метод термосварки	**actuator**	|ˈæktʃueɪtə| силовой привод, пускатель, актюатор, датчик, соленоид, воздействующее устройство

6. Self-assembled nanoscale robot from DNA

nanoscale	наноскопический робот	a **self-assembling** DNA origami structure	самособирающиеся структуры ДНК-оригами
latche	|latʃ| защелка, задвижка, щеколда, запор	**single-stranded DNA**	одноцепочечная [однонитевая] ДНК
precise nanoscale movement	точное наноразмерное движение	**tunable electric field.**	настраиваемое электрическое поле
nanoscale robotic systems	наноразмерные робототехнические системы	**molecules** or **nanoparticles**	молекулы или наночастицы
nanometer	миллимикрон, нанометр, нм	**programmable synthesis**	программируемый синтез
a molecular mechanical memory	|məˈlɛkjʊlə| молекулярно-механическая память	**nanoscale robotics**	наноразмерная робототе хника; наноробототехни ка

7. DelFly nimble bioinspired robotic flapper

bioinspired robots	био роботы	**a dual purpose**	двойная цель
to unveil the	|ʌnˈveɪl|	**tailless**	|ˈteɪl ləs|

principles	открывать законы (элементы, принципы)		бесхвостый
exceptional agility capable of performing 360° **roll**	исключительная маневренность, способная выполнять крен на 360°	**angular accelerations**	|ˈaŋgjʊlə| угловое ускорение
wing morphology or **kinematics** of any specific natural flyer	морфология крыла или кинематика любого конкретного естественного летательного аппарата	**explicit** control	|ɪkˈsplɪsɪt| точное управление (контроль)
rotation axes	оси вращения	**a paradigmatic example**	|parədɪɡˈmatɪk| образцовый пример

8. Soft exosuit wearable robot

an exoskeleton	экзоскелет	**to resemble**	|rɪˈzɛmb(ə)l| походить на, иметь сходство, быть похожим
a lightweight, stretchy exosuit	легкий эластичный экзокостюм	**ways of integrating** fabric design	способы интеграции дизайна ткани
to increase **a wearer's strength, balance, and endurance**	|ɪnˈdjʊər(ə)ns| увеличивать силы, баланс и выносливость владельца.	**to enhance their muscular strength**, to **support their mobility and independence**	|ɪnˈhɑːns| повышать (увеличивать) их мышечную силу, поддерживать их подвижность и независимость
multiple sclerosis	|ˈmʌltɪp(ə)l| |sklɪəˈrəʊsɪs| рассеянный склероз	to **rehabilitate children and adults** with **movement disorders**	|riːhəˈbɪlɪteɪt| реабилитировать (восстанавливать) детей и взрослых с двигательными нарушениями
human-in-the-loop	с оператором в контуре упра вления	**Parkinson's disease**	болезнь Паркинсона
seamless integration of the robot with human	бесшовная интеграция робота с человеком	**control optimization**	оптимизация управления
providing personalized control strategies and adaptation	обеспечение персонализированных стратегий контроля и адаптации		

9. Universal Robots (UR) e-Series Cobots

assembly	сборочный	**surgical**	|ˈɡʌɪd(ə)ns|

lines	конвейер	**guidance**	хирургическое руководство
ubiquitous	|juːˈbɪkwɪtəs| повсеместный, вездесущий, встречающийся повсюду	**unassuming appearance**	|ʌnəˈsjuːmɪŋ| |əˈpɪər(ə)ns| непритязательный(скромный)внешний вид
core product	базовая идея товара; обобщенный товар	**collaborative robot**	|kəˈlabərətɪv| объединённый робот
torque sensing	определяющий направление вращающего момента	**interactions** in **a diverse range of environments**	взаимодействие в различных средах
seamlessly	|ˈsiːmləsli| без швов, плавно, без резких переходов, пауз, равномерно, легко	**to collaborate with human**	сотрудничать с человеком

10.Sony's aibo

awareness	[əˈwɛːnəs] осведомлённость, информированность	**neurodegenerative diseases**	нейродегенеративное заболевание
perception, interaction, and expectations of the people	восприятие, взаимодействие и ожидания людей		

Writing

3. Read and translate the texts (Application; 1-10) into Russian in written form (by variants).

Speaking and Creative work

4. Speak about "10 exciting robotics developments and technologies".

5 .Prepare a presentation using information from the texts.

Reading

4. Components

Power source

At present, mostly (lead–acid) batteries are used as a power source. Many different types of batteries can be used as a power source for robots. They range from lead–acid batteries, which are safe and have relatively long shelf lives but are rather heavy compared to silver–cadmium batteries that are much smaller in volume and are currently much more expensive. Designing a battery-powered robot needs to take into account factors such as safety, cycle lifetime and weight. Generators, often some type of internal combustion engine, can also be used. However, such designs are often mechanically complex and need a fuel, require heat dissipation and are relatively heavy. A tether connecting the robot to a power supply would remove the power supply from the robot entirely. This has the advantage of saving weight and space by moving all power generation and storage components elsewhere.

However, this design does come with the drawback of constantly having a cable connected to the robot, which can be difficult to manage. Potential power sources could be:

1. pneumatic (compressed gases)
2. Solar power (using the sun's energy and converting it into electrical power)
3. hydraulics (liquids)
4. flywheel energy storage
5. organic garbage (through anaerobic digestion)
6. nuclear

Actuation

Actuators are the "muscles" of a robot, the parts which convert stored energy into movement. By far the most popular actuators are electric motors that rotate a wheel or gear, and linear actuators that control industrial robots in factories. There are some recent advances in alternative types of actuators, powered by electricity, chemicals, or compressed air.

Electric motors

The vast majority of robots use electric motors, often brushed and brushless DC motors in portable robots or AC motors in industrial robots and CNC machines. These motors are often preferred in systems with lighter loads, and where the predominant form of motion is rotational.

Linear actuators

Various types of linear actuators move in and out instead of by spinning, and often have quicker direction changes, particularly when very large forces are needed such as with industrial robotics. They are typically powered by compressed and oxidized air (pneumatic actuator) or an oil (hydraulic actuator) Linear actuators can also be powered by electricity which usually consists of a motor and a leadscrew. Another common type is a mechanical linear actuator that is turned by hand, such as a rack and pinion on a car.

Series elastic actuators

A flexure is designed as part of the motor actuator, to improve safety and provide robust force control, energy efficiency, shock absorption (mechanical filtering) while reducing excessive wear on the transmission and other mechanical components. The resultant lower reflected inertia can improve safety when a robot is interacting with humans or during collisions. It has been used in various robots, particularly advanced manufacturing robots and walking humanoid robots.

Air muscles

Pneumatic artificial muscles, also known as air muscles, are special tubes that expand(typically up to 40%) when air is forced inside them. They are used in some robot applications.

Muscle wire

Muscle wire, also known as shape memory alloy, Nitinol® or Flexinol® wire, is a material which contracts (under 5%) when electricity is applied. They have been used for some small robot applications.

Electroactive polymers

EAPs or EPAMs are a plastic material that can contract substantially (up to 380% activation strain) from electricity, and have been used in facial muscles and arms of humanoid robots, and to enable new robots to float, fly, swim or walk.

Piezo motors

Recent alternatives to DC motors are piezo motors or ultrasonic motors. These work on a fundamentally different principle, whereby tiny piezoceramic elements, vibrating many thousands of times per second, cause linear or rotary motion. There are different mechanisms of operation; one type uses the vibration of the piezo elements to step the motor in a circle or a straight line. Another type uses the piezo elements to cause a nut to vibrate or to drive a screw. The advantages of these motors are nanometer resolution, speed, and available force for their size. These motors are already available commercially, and being used on some robots.

Elastic nanotubes

Elastic nanotubes are a promising artificial muscle technology in early-stage experimental development. The absence of defects in carbon nanotubes enables these filaments to deform elastically by several percent, with energy storage levels of perhaps 10 J/cm3 for metal nanotubes. Human biceps could be replaced with an 8 mm diameter wire of this material. Such compact "muscle" might allow future robots to outrun and outjump huma.

Sensing

Sensors allow robots to receive information about a certain measurement of the environment, or internal components. This is essential for robots to perform their tasks, and act upon any changes in the environment to calculate the appropriate response. They are used for various forms of measurements, to give the robots warnings about safety or malfunctions, and to provide real-time information of the task it is performing.

Touch

Current robotic and prosthetic hands receive far less tactile information than the human hand. Recent research has developed a tactile sensor array that mimics the mechanical properties and touch receptors of human fingertips. The sensor array is constructed as a rigid core surrounded by conductive fluid contained by an elastomeric skin. Electrodes are mounted on the surface of the rigid core and are connected to an impedance-measuring device within the core. When the artificial skin touches an object the fluid path around the electrodes is deformed, producing impedance changes that map the forces received from the object. The researchers expect that an important function of such artificial fingertips will be adjusting robotic grip on held objects. Scientists from several European countries and Israel developed a prosthetic hand in 2009, called SmartHand, which functions like a real one—allowing patients to write with it, type on a keyboard, play piano and perform other fine movements. The prosthesis has sensors which enable the patient to sense real feeling in its fingertips.

Vision

Computer vision is the science and technology of machines that see. As a scientific discipline, computer vision is concerned with the theory behind artificial systems that extract information from images. The image data can take many forms, such as video sequences and views from cameras. In most practical computer vision applications, the computers are pre-programmed to solve a particular task, but methods based on learning are now becoming increasingly common. Computer vision systems rely on image sensors which detect electromagnetic radiation which is typically in the form of either visible light or infra-red light. The sensors are designed using solid-state physics. The process by which light propagates and reflects off surfaces is explained using optics. Sophisticated image sensors even require quantum mechanics to provide a complete understanding of the image formation process. Robots can also be equipped with multiple vision sensors to be better able to compute the sense of depth in the environment. Like human eyes, robots' "eyes" must also be able to focus on a particular area of interest, and also adjust to variations in light intensities. There is a subfield within computer vision where artificial systems are designed to mimic the processing and behavior of biological system, at different levels of complexity. Also, some of the learning-based methods developed within computer vision have their background in biology.

Other

Other common forms of sensing in robotics use lidar, radar, and sonar.

Manipulation

Robots need to manipulate objects; pick up, modify, destroy, or otherwise have an effect. Thus the "hands" of a robot are often referred to as *end effectors*, while the "arm" is referred to as a *manipulator*. Most robot arms have replaceable effectors, each allowing them to perform some small range of tasks. Some have a fixed manipulator which cannot be replaced, while a few have one very general purpose manipulator, for example, a humanoid hand.

Mechanical grippers

One of the most common effectors is the gripper. In its simplest manifestation, it consists of just two fingers which can open and close to pick up and let go of a range of small objects. Fingers can for example, be made of a chain with a metal wire run through it. Hands that resemble and work more like a human hand include the Shadow Hand and the Robonaut hand. Hands that are of a mid-level complexity include the Delft hand. Mechanical grippers can come in various types, including friction and encompassing jaws. Friction jaws use all the force of the gripper to hold the object in place using friction. Encompassing jaws cradle the object in place, using less friction.

Vacuum grippers

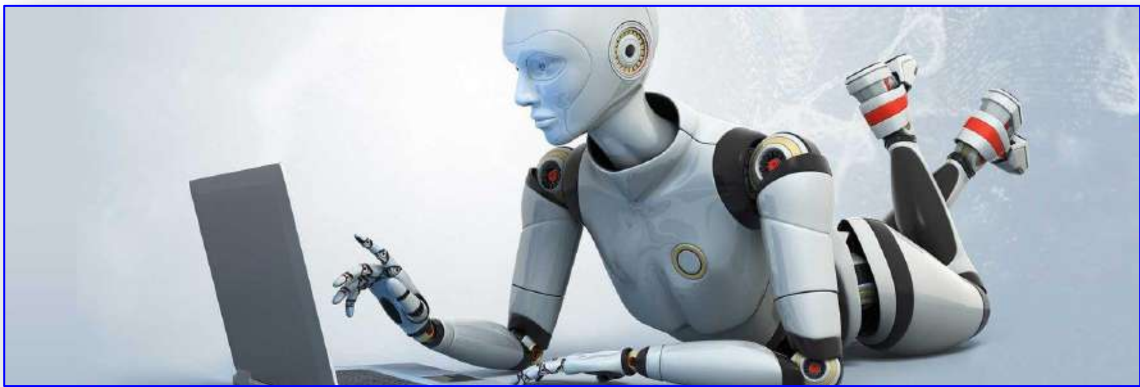
Vacuum grippers are very simple astrictive devices that can hold very large loads provided the prehension surface is smooth enough to ensure suction. Pick and place robots for electronic components and for large objects like car windscreens, often use very simple vacuum grippers.

General purpose effectors

Some advanced robots are beginning to use fully humanoid hands, like the Shadow Hand, MANUS, and the Schunk hand. These are highly dexterous manipulators, with as many as 20 degrees of freedom and hundreds of tactile sensors.

Exercises

Vocabulary Development



1.Create a thematic dictionary.

English term	Russian term

Writing

2.Read and translate the text in written form.

Speaking and Creative work

3.Make a summary of the entire text.

4.Prepare a presentation using information from the text "Components".

Reading

5. Locomotion

Rolling robots

For simplicity, most mobile robots have four wheels or a number of continuous tracks. Some researchers have tried to create more complex wheeled robots with only one or two wheels. These can have certain advantages such as greater efficiency and reduced parts, as well as allowing a robot to navigate in confined places that a four-wheeled robot would not be able to.

Two-wheeled balancing robots

Balancing robots generally use a gyroscope to detect how much a robot is falling and then drive the wheels proportionally in the same direction, to counterbalance the fall at hundreds of times per second, based on the dynamics of an inverted pendulum. Many different balancing robots have been designed. While the Segway is not commonly thought of as a robot, it can be thought of as a component of a robot, when used as such Segway refer to them as RMP (Robotic Mobility Platform). An example of this use has been as NASA's Robonaut that has been mounted on a Segway.

One-wheeled balancing robots

A one-wheeled balancing robot is an extension of a two-wheeled balancing robot so that it can move in any 2D direction using a round ball as its only wheel. Several one-wheeled balancing robots have been designed recently, such as Carnegie Mellon University's "Ballbot" that is the approximate height and width of a person, and Tohoku Gakuin University's "BallIP". Because of the long, thin shape and ability to maneuver in tight spaces, they have the potential to function better than other robots in environments with people.

Spherical orb robots

Several attempts have been made in robots that are completely inside a spherical ball, either by spinning a weight inside the ball, or by rotating the outer shells of the sphere. These have also been referred to as an orb bot or a ball bot.

Six-wheeled robots

Using six wheels instead of four wheels can give better traction or grip in outdoor terrain such as on rocky dirt or grass.

Tracked robots

Tank tracks provide even more traction than a six-wheeled robot. Tracked wheels behave as if they were made of hundreds of wheels, therefore are very common for outdoor and military robots, where the robot must drive on very rough terrain. However, they are difficult to use indoors such as on carpets and smooth floors. Examples include NASA's Urban Robot "Urbie".

Walking applied to robots

Walking is a difficult and dynamic problem to solve. Several robots have been made which can walk reliably on two legs, however, none have yet been made which are as robust as a human. There has been much study on human inspired walking, such as AMBER lab which was established in 2008 by the Mechanical Engineering Department at Texas A&M University. Many other robots have been built that walk on more than two legs, due to these robots being significantly easier to construct. Walking robots can be used for uneven terrains, which would provide better mobility and energy efficiency than other locomotion methods. Typically, robots on two legs can walk well on flat floors and can occasionally walk up stairs. None can walk over rocky, uneven terrain. Some of the methods which have been tried are:

ZMP technique

The zero moment point (ZMP) is the algorithm used by robots such as Honda's ASIMO. The robot's onboard computer tries to keep the total inertial forces (the combination of Earth's gravity and the acceleration and deceleration of walking), exactly opposed by the floor reaction force (the force of the floor pushing back on the robot's foot). In this way, the two forces cancel out, leaving no moment (force causing the robot to rotate and fall over). However, this is not exactly how a human walks, and the difference is obvious to human observers, some of whom have pointed out that ASIMO walks as if it needs the lavatory. ASIMO's walking algorithm is not static, and some dynamic balancing is used (see below). However, it still requires a smooth surface to walk on.

Hopping

Several robots, built in the 1980s by Marc Raibert at the MIT Leg Laboratory, successfully demonstrated very dynamic walking. Initially, a robot with only one leg, and a very small foot could stay upright simply by hopping. The movement is the same as that of a person on a pogo stick. As the robot falls to one side, it would jump slightly in that direction, in order to catch itself. Soon, the algorithm was generalised to two and four legs. A bipedal robot was demonstrated running and even performing somersaults. A quadruped was also demonstrated which could trot, run, pace, and bound. For a full list of these robots, see the MIT Leg Lab Robots page.

Dynamic balancing (controlled falling)

A more advanced way for a robot to walk is by using a dynamic balancing algorithm, which is potentially more robust than the Zero Moment Point technique, as it constantly monitors the robot's motion, and places the feet in order to maintain stability.[91] This technique was recently demonstrated by Anybots' Dexter Robot, which is so stable, it can even jump. Another example is the TU Delft Flame.

Passive dynamics

Perhaps the most promising approach utilizes passive dynamics where the momentum of swinging limbs is used for greater efficiency. It has been shown that totally unpowered humanoid mechanisms can walk down a gentle slope, using only gravity to propel themselves. Using this technique, a robot need only supply a small amount of motor power to walk along a flat surface or a little more to walk up a hill. This technique promises to make walking robots at least ten times more efficient than ZMP walkers, like ASIMO.

Other methods of locomotion

Flying

A modern passenger airliner is essentially a flying robot, with two humans to manage it. The autopilot can control the plane for each stage of the journey, including takeoff, normal flight, and even landing. Other flying robots are uninhabited and are known as unmanned aerial vehicles (UAVs). They can be smaller and lighter without a human pilot on board, and fly into dangerous territory for military surveillance missions. Some can even fire on targets under command. UAVs are also being developed which can fire on targets automatically, without the need for a command from a human. Other flying robots include cruise missiles, the Entomopter, and the Epson micro helicopter robot. Robots such as the Air Penguin, Air Ray, and Air Jelly have lighter-than-air bodies, propelled by paddles, and guided by sonar.

Snaking

Several snake robots have been successfully developed. Mimicking the way real snakes move, these robots can navigate very confined spaces, meaning they may one day be used to search for people trapped in collapsed buildings. The Japanese ACM-R5 snake robot can even navigate both on land and in water.

Skating

A small number of skating robots have been developed, one of which is a multi-mode walking and skating device. It has four legs, with unpowered wheels, which can either step or roll. Another robot, Plen, can use a miniature skateboard or roller-skates, and skate across a desktop.

Climbing

Several different approaches have been used to develop robots that have the ability to climb vertical surfaces. One approach mimics the movements of a human climber on a wall with protrusions; adjusting the center of mass and moving each limb in turn to gain leverage. An example of this is Capuchin, built by Dr. Ruixiang Zhang at Stanford University, California. Another approach uses the specialized toe pad method of wallclimbing geckoes, which can run on smooth surfaces such as vertical glass. Examples of this approach include Wallbot and Stickybot. China's *Technology Daily* reported on November 15, 2008, that Dr. Li Hiu Yeung and his research group of New Concept Aircraft (Zhuhai) Co., Ltd. had successfully developed a bionic gecko robot named "Speedy Freelander". According to Dr. Li, the gecko robot could rapidly climb up and down a variety of building walls, navigate through ground and wall fissures, and walk upside-down on the ceiling. It was also able to adapt to the surfaces of smooth glass, rough, sticky or dusty walls as well as various types of metallic materials. It could also identify and circumvent obstacles automatically. Its flexibility and speed were comparable to a natural gecko. A third approach is to mimic the motion of a snake climbing a pole.

Swimming (Piscine)

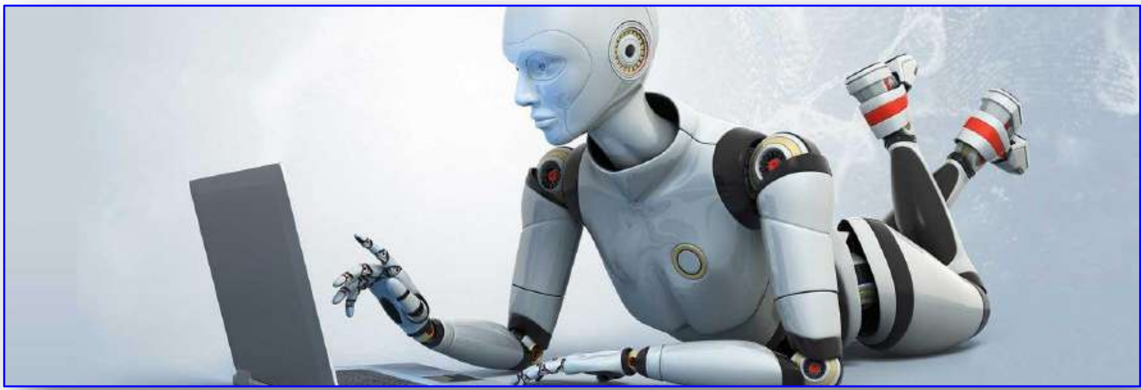
It is calculated that when swimming some fish can achieve a propulsive efficiency greater than 90%. Furthermore, they can accelerate and maneuver far better than any man-made boat or submarine, and produce less noise and water disturbance. Therefore, many researchers studying underwater robots would like to copy this type of locomotion. Notable examples are the Essex University Computer Science Robotic Fish G9, and the Robot Tuna built by the Institute of Field Robotics, to analyze and mathematically model thunniform motion. The Aqua Penguin, designed and built by Festo of Germany, copies the streamlined shape and propulsion by front "flippers" of penguins. Festo have also built the Aqua Ray and Aqua Jelly, which emulate the locomotion of manta ray, and jellyfish, respectively. In 2014 *iSplash*-II was developed by PhD student Richard James Clapham and Prof. Huosheng Hu at Essex University. It was the first robotic fish capable of outperforming real carangiform fish in terms of average maximum velocity (measured in body lengths/ second) and endurance, the duration that top speed is maintained. This build attained swimming speeds of 11.6BL/s (i.e. 3.7 m/s). The first build, *iSplash*-I (2014) was the first robotic platform to apply a full-body length carangiform swimming motion which was found to increase swimming speed by 27% over the traditional approach of a posterior confined waveform.

Sailing

Sailboat robots have also been developed in order to make measurements at the surface of the ocean. A typical sailboat robot is *Vaimos* built by IFREMER and ENSTA-Bretagne. Since the propulsion of sailboat robots uses the wind, the energy of the batteries is only used for the computer, for the communication and for the actuators (to tune the rudder and the sail). If the robot is equipped with solar panels, the robot could theoretically navigate forever. The two main competitions of sailboat robots are WRSC, which takes place every year in Europe, and Sailbot.

Exercises

Vocabulary Development



1.Create a thematic dictionary.

English term	Russian term

Writing

2.Read and translate the text in written form (by variants).

Speaking and Creative work

3.Make a summary of the entire text.

4.Prepare a presentation using information from the text "Locomotion".

Reading

6. Environmental interaction and navigation

Environmental interaction and navigation

Though a significant percentage of robots in commission today are either human controlled or operate in a static environment, there is an increasing interest in robots that can operate autonomously in a dynamic environment. These robots require some combination of navigation hardware and software in order to traverse their environment. In particular, unforeseen events (e.g. people and other obstacles that are not stationary) can cause problems or collisions. Some highly advanced robots such as ASIMO and Meinü robot have particularly good robot navigation hardware and software. Also, self-controlled cars, Ernst Dickmanns' driverless car, and the entries in the DARPA Grand Challenge, are capable of sensing the environment well and subsequently making navigational decisions based on this information. Most of these robots employ a GPS navigation device with waypoints, along with radar, sometimes combined with other sensory data such as lidar, video cameras, and inertial guidance systems for better navigation between waypoints.

Human-robot interaction

The state of the art in sensory intelligence for robots will have to progress through several orders of magnitude if we want the robots working in our homes to go beyond vacuum-cleaning the floors. If robots are to work effectively in homes and other non-industrial environments, the way they are instructed to perform their jobs, and especially how they will be told to stop will be of critical importance. The people who interact with them may have little or no training in robotics, and so any interface will need to be extremely intuitive. Science fiction authors also typically assume that robots will eventually be capable of communicating with humans through speech, gestures, and facial expressions, rather than a command-line interface. Although speech would be the most natural way for the human to communicate, it is unnatural for the robot. It will probably be a long time before robots interact as naturally as the fictional C-3PO, or Data of Star Trek, Next Generation.

Speech recognition

Interpreting the continuous flow of sounds coming from a human, in real time, is a difficult task for a computer, mostly because of the great variability of speech. The same word, spoken by the same person may sound different depending on local acoustics, volume, the previous word, whether or not the speaker has a cold, etc.. It becomes even harder when the speaker has a different accent. Nevertheless, great strides have been made in the field since Davis, Biddulph, and Balashek designed the first "voice input system" which recognized "ten digits spoken by a single user with 100% accuracy" in 1952. Currently, the best systems can recognize continuous, natural speech, up to 160 words per minute, with an accuracy of 95%. With the help of artificial intelligence, machines nowadays can use people's voice to identify their emotions such as satisfied or angry.

Robotic voice

Other hurdles exist when allowing the robot to use voice for interacting with humans. For social reasons, synthetic voice proves suboptimal as a communication medium, making it necessary to develop the emotional component of robotic voice through various techniques. An advantage of diphonic branching is the emotion that the robot is programmed to project, can be carried on the voice tape, or phoneme, already pre-programmed onto the voice media. One of the earliest examples is a teaching robot named leachim developed in 1974 by Michael J. Freeman. Leachim was able to convert digital memory to rudimentary verbal speech on pre-recorded computer discs. It was programmed to teach students in The Bronx, New York.

Gestures

One can imagine, in the future, explaining to a robot chef how to make a pastry, or asking directions from a robot police officer. In both of these cases, making hand gestures would aid the verbal descriptions. In the first case, the robot would be recognizing gestures made by the human, and perhaps repeating them for confirmation. In the second case, the robot police officer would gesture to indicate "down the road, then turn right". It is likely that gestures will make up a part of the interaction between humans and robots. A great many systems have been developed to recognize human hand gestures.

Facial expression

Facial expressions can provide rapid feedback on the progress of a dialog between two humans, and soon may be able to do the same for humans and robots. Robotic faces have been constructed by Hanson Robotics using their elastic polymer called Frubber, allowing a large number of facial expressions due to the elasticity of the rubber facial coating and embedded subsurface motors (servos). The coating and servos are built on a metal skull. A robot should know how to approach a human, judging by their facial expression and body language. Whether the person is happy, frightened, or crazy-looking affects the type of interaction expected of the robot. Likewise, robots like Kismet and the more recent addition, Nexi can produce a range of facial expressions, allowing it to have meaningful social exchanges with humans.

Artificial emotions

Artificial emotions can also be generated, composed of a sequence of facial expressions and/or gestures. As can be seen from the movie Final Fantasy: The Spirits Within, the programming of these artificial emotions is complex and requires a large amount of human observation. To simplify this programming in the movie, presets were created together with a special software program. This decreased the amount of time needed to make the film. These presets could possibly be transferred for use in real-life robots.

Personality

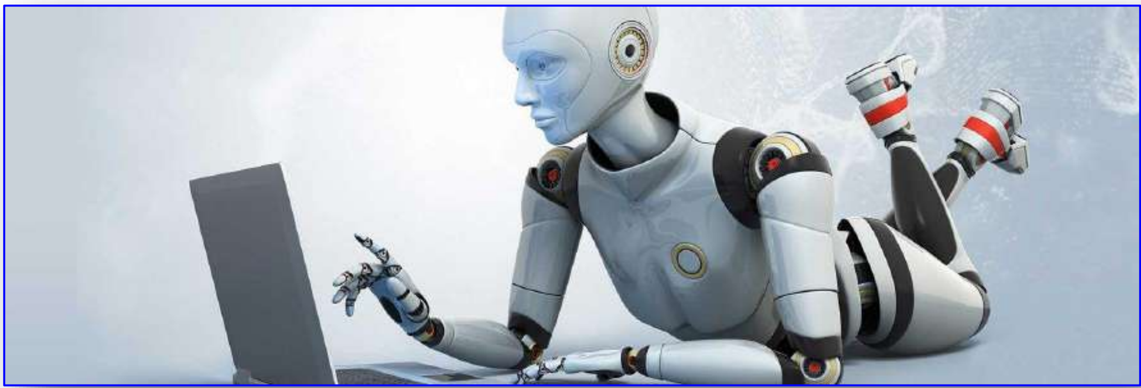
Many of the robots of science fiction have a personality, something which may or may not be desirable in the commercial robots of the future. Nevertheless, researchers are trying to create robots which appear to have a personality: i.e. they use sounds, facial expressions, and body language to try to convey an internal state, which may be joy, sadness, or fear. One commercial example is Pleo, a toy robot dinosaur, which can exhibit several apparent emotions.

Social Intelligence

The Socially Intelligent Machines Lab of the Georgia Institute of Technology researches new concepts of guided teaching interaction with robots. The aim of the projects is a social robot that learns task and goals from human demonstrations without prior knowledge of high-level concepts. These new concepts are grounded from low-level continuous sensor data through unsupervised learning, and task goals are subsequently learned using a Bayesian approach. These concepts can be used to transfer knowledge to future tasks, resulting in faster learning of those tasks. The results are demonstrated by the robot *Curi* who can scoop some pasta from a pot onto a plate and serve the sauce on top.

Exercises

Vocabulary Development



1.Create a thematic dictionary.

English term	Russian term

Writing

2.Read and translate the text in written form.

Speaking and Creative work

3.Make a summary of the entire text.

4.Prepare a presentation using information from the text "Environmental interaction and navigation".

7. Control

Control

The mechanical structure of a robot must be controlled to perform tasks. The control of a robot involves three distinct phases – perception, processing, and action (robotic paradigms). Sensors give information about the environment or the robot itself (e.g. the position of its joints or its end effector). This information is then processed to be stored or transmitted and to calculate the appropriate signals to the actuators (motors) which move the mechanical. The processing phase can range in complexity. At a reactive level, it may translate raw sensor information directly into actuator commands. Sensor fusion may first be used to estimate parameters of interest (e.g. the position of the robot's gripper) from noisy sensor data. An immediate task (such as moving the gripper in a certain direction) is inferred from these estimates. Techniques from control theory convert the task into commands that drive the actuators. At longer time scales or with more sophisticated tasks, the robot may need to build and reason with a "cognitive" model. Cognitive models try to represent the robot, the world, and how they interact. Pattern recognition and computer vision can be used to track objects. Mapping techniques can be used to build maps of the world. Finally, motion planning and other artificial intelligence techniques may be used to figure out how to act. For example, a planner may figure out how to achieve a task without hitting obstacles, falling over, etc.

Autonomy levels

Control systems may also have varying levels of autonomy.

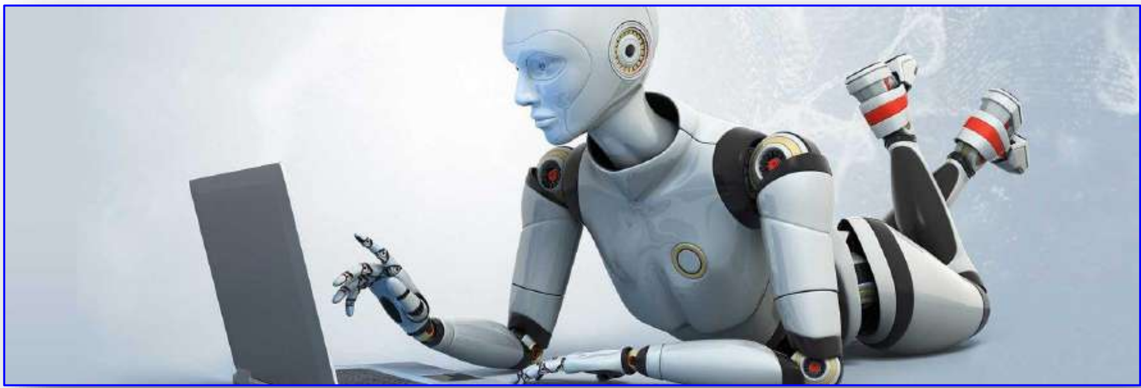
1. Direct interaction is used for haptic or teleoperated devices, and the human has nearly complete control over the robot's motion.
2. Operator-assist modes have the operator commanding medium-to-high-level tasks, with the robot automatically figuring out how to achieve them.
3. An autonomous robot may go without human interaction for extended periods of time. Higher levels of autonomy do not necessarily require more complex cognitive capabilities. For example, robots in assembly plants are completely autonomous but operate in a fixed pattern.

Another classification takes into account the interaction between human control and the machine motions.

1. Teleoperation. A human controls each movement, each machine actuator change is specified by the operator.
2. Supervisory. A human specifies general moves or position changes and the machine decides specific movements of its actuators.
3. Task-level autonomy. The operator specifies only the task and the robot manages itself to complete it.
4. Full autonomy. The machine will create and complete all its tasks without human interaction.

Exercises

Vocabulary Development



1.Create a thematic dictionary.

English term	Russian term

Writing

2.Read and translate the text in written form.

Speaking and Creative work

3.Make a summary of the entire text.

4.Prepare a presentation using information from the text "Control".

Reading

8.Computing Applications in Robotics

1. Read the text «Computing Applications in Robotics» carefully paying attention to the words and word combinations in bold type and do the tasks on it:

Related Stories

- Envelop VR Unveils Fully Immersive Computing Platform, Envelop for Windows
- Quantum Announces New Scalar i6000 HD with Active-Active Dual Robotics
- Benefits Quantum Computing Could Bring to Industrial Automation

All robots must be programmed to function. If their functions are in any way dynamic or more complicated than the static, repetitive tasks required of early robots designed for industrial automation in the mid-twentieth century automotive industry, then their programming must be written and uploaded with the use of computers. In this way, robotics is limited by the processing power of the computers that are available to program them.

Computing applications in robotics include (and are by no means limited to):

- **Input sensing** or **data acquisition**
- **Data processing**, for example, **face recognition** or **gas analysis**
- Programming and then correctly performing functions
- **Generating outputs**, for example in a **human-machine interface (HMI) display**
- Variable user control, for example in **remote control devices** such as drones

- **Automated control systems**, for example, **System Control and Data Acquisition (SCADA) systems** in **industrial automation**
- **Rapid prototyping** and research and development (R&D)

Quantum Computing Applied in Robotics

Quantum supremacy, by bringing **exponentially** faster, more reliable and more powerful processing ability to computers, has the potential to rapidly advance all of these applications and more.

In input sensing and data acquisition, **quantum computers** could be applied to enable robots to identify much smaller, even **nanoscale, particles** and **aberrances**. This would enable exponentially greater **precision** in the fields of **metrology and materials science.**

Onboard quantum computers in robots would much better identify and process the data they gather. This could include **advanced facial and voice recognition for caring robots** in the medical field, or more accurate gas analysis **to prevent toxic leaks in heavy industries.**

Quantum processor chips could be vastly smaller than classical chips with the same **computing ability**. This could enable **microscopic robots to perform multiple, complex tasks.**

Automating processes become much more practical when more processing power is applied, as would be the case in quantum computing when applied to robotics. This means that an automatic computer system could **control entire fleets of drones**, **entire industrial processes**, or even **entire Internet-of-Things connected networks of smart devices**. This could result in **drastic energy efficiency** gains in the future.

Finally, **a quantum-computing powered rapid prototyping process** could lead – alongside machine learning – to new opportunities developing in robotics which researchers are currently unable to imagine.

Exercises

Vocabulary Development

1. **Practice the pronunciation of the following words and word combinations. Study these words and word combinations. Find and translate the sentences where they are used.**
2. **Prepare to write a dictation.**

data acquisition	|ˌakwɪˈzɪʃ(ə)n| сбор данных	**rapid prototyping**	ускоренная разработка программ; быстрое макетирование
data processing	обработка данных	**quantum supremacy**	|ˈkwɒntəm| |s(j)uːˈprɛməsi| квантовое превосходство
face recognition	идентификация по лицу	**exponentially**	[ˌɛkspəˈnɛnʃ(ə)li] в геометрической прогрессии, экспоненциально, по экспоненте, по экспоненциальному закону
to generate outputs	получать результаты	**quantum computer**	квантовый компьютер; КК
human-machine interface (HMI)	человеко-машинный интерфейс	**nanoscale**	наноразмерный, нано
remote control devices	аппаратура телеуправления	**particle**	|ˈpɑːtɪk(ə)l| частица; бесконечно малая частица вещества
automated	автоматизированная	**aberrance**	|æˈberəns|

control system	система управления		отклонение от нормы
System Control and Data Acquisition (SCADA) systems	|ˌakwɪˈzɪʃ(ə)n| Системы управления и сбора данных (SCADA)	**precision**	|prɪˈsɪʒ(ə)n| точность, четкость, аккуратность, точный, меткий
industrial automation	автоматизация промышленного производства	**metrology and materials science.**	метрология и материаловедение
quantum processor	квантовый процессор	**onboard quantum computers in robots**	бортовые квантовые компьютеры в роботах
microscopic robots	микроскопические роботы	**advanced facial and voice recognition**	усовершенствованное распознавание лиц и голоса
a quantum-computing powered rapid prototyping process	быстрый процесс прототипирования на основе квантовых вычислений	**to prevent toxic leaks in heavy industries**	предотвращать токсичные утечки в тяжелой промышленности
industrial processes	промышленные процессы	**computing ability**	вычислительная способность
drastic energy efficiency	радикальное повышение энергоэффективности	**to perform multiple, complex tasks**	выполнять множество сложных задач

3. Write the following words in their normal spelling

[ˈprəʊsesɪŋ]	**[ˈprəʊtətaɪpɪŋ]**	**[ˌɛkspəˈnɛnʃ(ə)li]**
[s(j)uːˈprɛməsi]	**[ˌakwɪˈzɪʃ(ə)n]**	**[æˈberəns]**

4. Find in the text words similar in meaning to the following.

grain	**tiny**	**converter**
modeling	**robotic**	**identification**

5. Find in the text the English equivalents for the following Russian

1)их программы должны быть написаны и загружены с использованием компьютеров	2)переменное управление пользователем, например, в устройствах дистанционного управления, таких как дроны
3)робототехника ограничена вычислительной мощностью компьютеров	4)более мощная обрабатывающая способность компьютеров
5)программирование и затем правильное выполнение функций	6)идентифицировать и обрабатывать данные, которые они собирают
7)исследователи в настоящее время не могут себе этого представить	8)новые возможности, развивающиеся в робототехнике

6. Match the terms with the definitions. Write their English and Russian equivalents.

industrial automation	**quantum computer**	**remote control**
data acquisition	**data processing**	**face recognition**

Definition	English term	Russian term
1)Making products under the control of computers an d programmable controllers.		

2)The phase of data handling that begins with the sensing of variables and ends with a magnetic recording or other record of raw data; may include a complete radio telemetering link.		
3)Computer that exploits the quantum mechanical properties of subatomic particles to allow a single operation to act on a large amount of data.		
4)Control of a system or activity by a person at a different place, usually by means of radio or ultrasonic signals or by electrical signals transmitted by wire.		
5)The ability of a computer to scan, store, and recognize human faces for use in identifying people.		
6) A sequence of operations performed on data, esp by a computer, in order to extract information, reorder files.		

Writing

7. Punctuate the text and add capitals. Prepare a written translation of the following passage.

all robots must be programmed to function if their functions are in any way dynamic or more complicated than the static repetitive tasks required of early robots designed for industrial automation in the mid twentieth century automotive industry then their programming must be written and uploaded with the use of computers in this way robotics is limited by the processing power of the computers that are available to program them computing applications in robotics include (and are by no means limited to) input sensing or data acquisition data processing, for example face recognition or gas analysis programming and then correctly performing functions generating outputs for example in a human-machine interface (HMI) display variable user control for example in remote control devices such as drones automated control systems for example system control and data acquisition (SCADA) systems in industrial automation rapid prototyping and research and development (R&D)

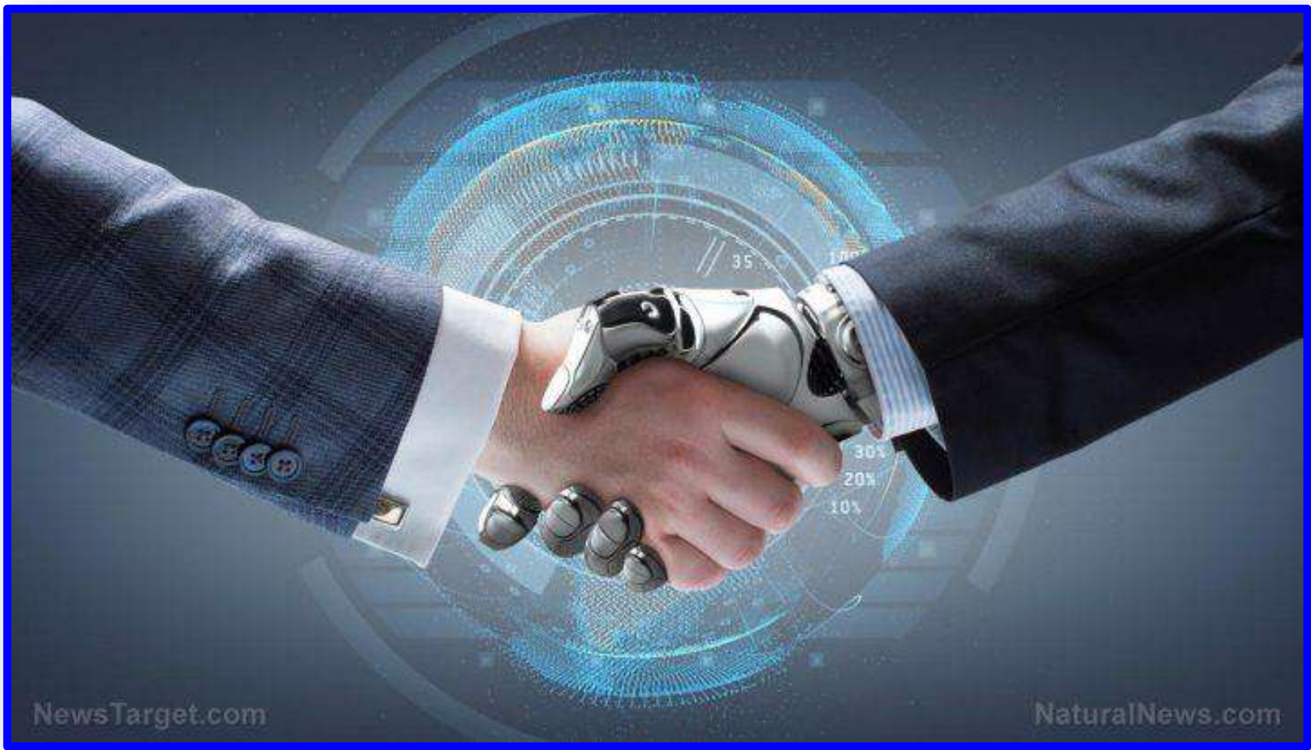
8. Match the phrases to make sentences

1 Quantum processor chips could be	**a** applied to enable robots to identify much smaller, even nanoscale, particles and aberrances.
2 Onboard quantum computers in robots would	**b** lead – alongside machine learning – to new opportunities developing in robotics which researchers are currently unable to imagine.

3 A quantum-computing powered rapid prototyping process could	**c** reliable and more powerful processing ability to computers, has the potential to rapidly advance all of these applications and more.
4 In input sensing and data acquisition, quantum computers could be	**d** vastly smaller than classical chips with the same computing ability.
5 Quantum supremacy, by bringing exponentially faster, more	**e** much better identify and process the data they gather.

9. Supplementary Reading

Russian robot put to working hiring humans



How would you feel if, after applying for a job, you learned that the recruiter who will be interviewing you is a robot? Would you feel comfortable with interacting with a bot for a job that you'd like to get hired for? One Russian startup has made such a robot possible, and in fact, it has already been in operation for the past two years.

Stafory, a Russian startup that is currently based in St. Petersburg and employs a total of 50 people, successfully created Robot Vera, artificial intelligence (AI) software that is meant to do one thing first and foremost: Help a number of high-level clients such as Ikea, L'Oréal, and Pepsi in filling their vacant jobs. It's a robot that was meant to do human resources or recruitment work, basically, and it has been quite adept at it so far.

Based on reports about Robot Vera, its main benefits include the ability to speed up the process of hiring clerks, construction workers, and waiters – blue-collar and high-turnover service positions – and cut the time and costs required for their recruitment by up to one-third, according to the people who made it. That would be the duo of Vladimir Sveshnikov and Alexander Uraksin, who worked together as co-founders of Stafory.

The co-founders first thought of creating Robot Vera after experiencing a problem with recruitment first-hand. With their shared background in human resources, the two found themselves calling up hundreds of candidates before realizing that they could probably automate the process. Talking about their revelation two years ago, Uraksin said, “We felt like robots ourselves, so we figured it was better to automate the task.” (Related: Rise of the machines: A.I. technology could soon be taking over the jobs of supermarket managers.)

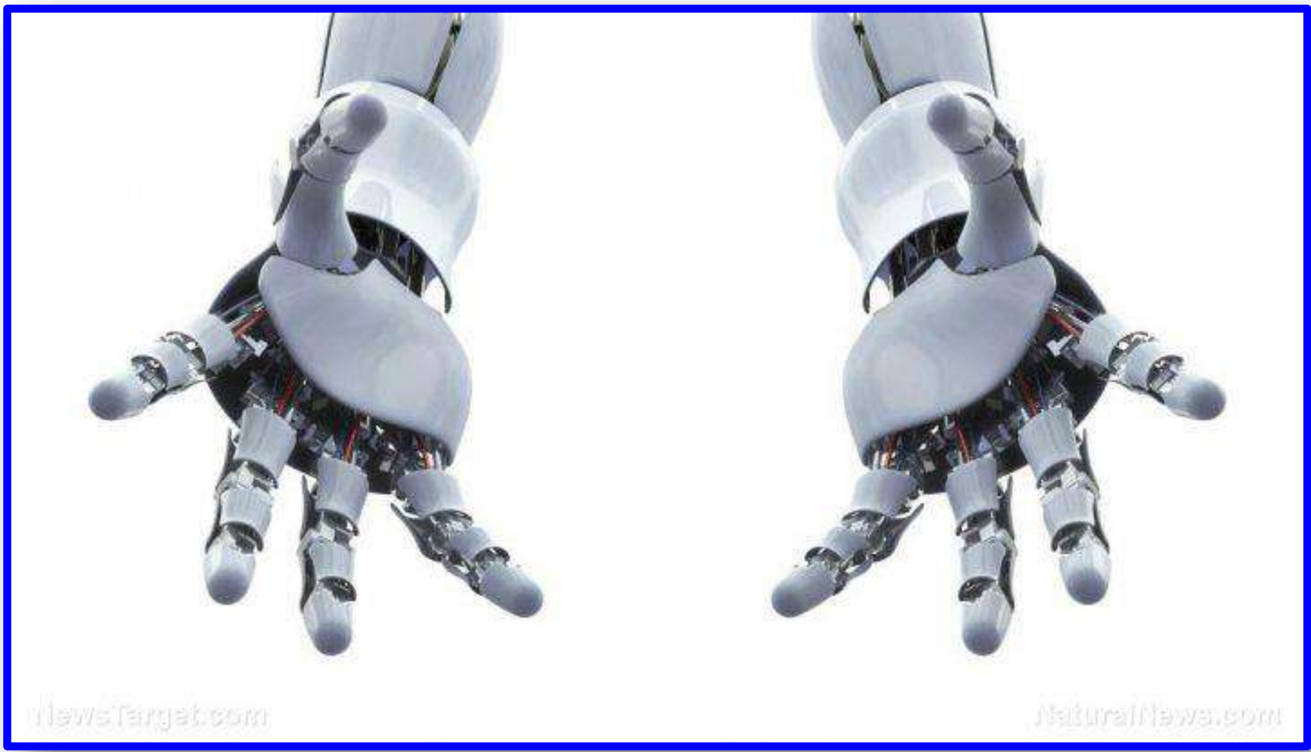
Vera, which is said to be named after Sveshnikov’s own mother, was created by combining speech recognition technologies from the likes of *Amazon.com*, Google, Microsoft, and even Russia’s Yandex. Stafory’s in-house programmers also took 13 billion examples of syntax and speech from a wide assortment of sources such as job listings, TV, and Wikipedia, in an effort to expand Vera’s vocabulary and allow it to speak more naturally and also understand candidate responses.

So far, Vera is said to be capable of interviewing several hundred applications simultaneously through either video or voice calls, which helps cut down the time necessary to identify the most worthy candidates. Vera’s work involves her narrowing the field of candidates down to just the most suitable 10 percent, after which, the work gets turned over to human recruiters.

As of this writing, Vera has been working in Russia for about two years already. Stafory has since added clients in the Middle East, and with pilot projects based in the U.S. and Europe, it’s set to earn $1 million in revenues this year.

Is Vera perfect and capable of taking over recruitment jobs completely? Not at all. As Mikhail Chernomordikov, a Microsoft strategist in Dubai states, it shouldn’t be viewed as a full-on substitute to traditional HR offices. “Final decisions on hiring are reserved for humans,” he said. But with the way that technology is advancing, it’s unclear how long things will remain this way.

3D printable robot arm created that could be used for sign language, making communication easier for hearing-impaired



Sign language interpreters aren't always available, making communication between the hearing and deaf communities all the more difficult. Closing this gap through technology is an option that continues to see numerous attempts. The latest of these is a robotic sign language interpreter that takes the form of an arm.

The creation of researchers at the *University of Antwerp*, this handy gadget has been dubbed Project Aslan, which stands for "Antwerp's Sign Language Actuating Node." It works by translating and signing text messages that are sent into it by the computer it's hooked up to. Project Aslan communicates via fingerspelling, an alphabet system in which unique gestures correspond to specific letters.

Stijn Huys, who spearheaded Project Aslan, explained that his team's endeavor was born out of deficiency. "I was talking to friends about the shortage of sign language interpreters in Belgium, especially in Flanders for Flemish sign language. We wanted to do something about it, I also wanted to work on robotics for my masters, the two were combined," said Huys.

Putting it together was no easy feat. According to *NewAtlas.com*, the hand is made up of electronic components and plastic parts. The electronic components included an Arduino Due microcomputer, three motor controllers, and 16 servo motors, to name a few. About 25 plastic parts were 3D-printed using a simple desktop printer over the course of 139 hours. Putting all the parts together took another 10 hours.

Being little more than a single arm, signing more complex messages will be of great difficulty for the robot. Huys and his colleagues, Guy Fierens and Jasper Slaets, have said that they plan on adding another arm in the future to make it easier to motion two-handed gestures. Another possible addition to this set-up is an emotive robot face to convey facial expressions. Furthermore, the team may also delve into including a translation option for spoken words.

Of course, a robot sign language interpreter can't take the place of a human, but it is a stellar alternative, especially in circumstances where human help isn't immediately available to hearing-impaired people. "A deaf person who needs to appear in court, a deaf person following a lesson in a classroom somewhere. These are all circumstances where a deaf person needs a sign language interpreter, but where often such an interpreter is not readily available," explained robotics teacher Erwin Smet. "This is where a low-cost option like Aslan can offer a solution."

Moreover, Huys believes that the applications of Project Aslan could even extend into hospital settings. Not all people who work in medical fields have the time to learn sign language, which only adds to the challenge of caring for patients with hearing disorders. Written text won't completely solve the problem either since a number of people who've been deaf from birth are unable to couple letters with sounds to make sense of what's before them. Having the robot on hand will help facilitate communication between patients and hospital staff. (Related: Taking orders from the cat: Scientists have created an

AI cat robot to keep the elderly company and remind them to take their medication.)

Currently, Project Aslan is still in its prototype form. Though once the soft mechanical design and software have been finalized, they will all be made open source and hopefully people of all ages the world over will create their own versions of Project Aslan. That's what Huys is hoping for. "It would be nice for the children to put the robot arm together themselves. We've developed it as a collection of pieces that are 3D printable and that click together," he mused.

Robo-bees are the reimagined rover: NASA plans to send them to Mars

NASA has got an inspiring bee stuck in its bonnet. The agency recently announced plans for a robotic bee that will be able to buzz through the thin air of Mars. If it pans out, swarms of these tiny robot drones might one day replace traditional rovers, according to a*LiveScience* article.

Rovers are big, expensive, take time to crawl across the ground, and can get stuck in soft ground. The still-active Curiosity rover and its deactivated sister Spirit are as big as small cars. In comparison, a swarm of "flapping-wing robots" would take up much less room aboard transport spacecraft, move at a faster clip, and cover a large area in less time.

The planned drones are unimaginatively named Marsbees. According to the NASA announcement, they are the size of a bumblebee – which can grow anywhere from 0.4 to 1.6 inches long – with big flapping wings. (Related: Walmart just filed six patents for robot bees – and it sounds like an episode straight out of Black Mirror.)

Each Marsbee will carry sensors and wireless communications. They will use a conventional rover as a mobile base and communications hub, in much the same way real bees live in a hive and serve a queen.

Sad robot: Expert says that robots could become so life-like that they will develop mental illnesses too

It's fair to say that our world has reached a point where technology is so advanced that robots are almost*expected* to be lifelike – but what about robots thatdevelop mental illnesses, hallucinations and depressionlike human beings do? Is this just science fiction, or can we really expect artificial intelligence to grow even *more*similar to humans in the not-so-distant future?

Back in March, *New York University* hosted a symposium in New York City called Canonical Computations in Brains and Machines, where a group of neuroscientists and experts in the field of artificial intelligence spoke about overlaps in the ways in which human beings and machines think and process information. According to one of these neuroscientists – Zachary Mainen of the Champalimaud Centre for the Unknown – we might expect advanced machines to soon be able to experience some of the same mental problems that people do.

"I'm drawing on the field of computational psychiatry, which assumes we can learn about a patient who's depressed or hallucinating from studying AI algorithms like reinforcement learning. If you reverse the arrow, why wouldn't an AI be subject to the sort of things that go wrong with patients?" Mainen said.

The neuroscientist went on to explain that mental illnesses like depression and hallucinations depend on a chemical in the brain called serotonin, and if serotonin is being used to help intelligence systems solve a more general problem, “then machines might implement a similar function.” In other words, if serotonin can go wrong in humans, it could also go wrong inside of a machine.

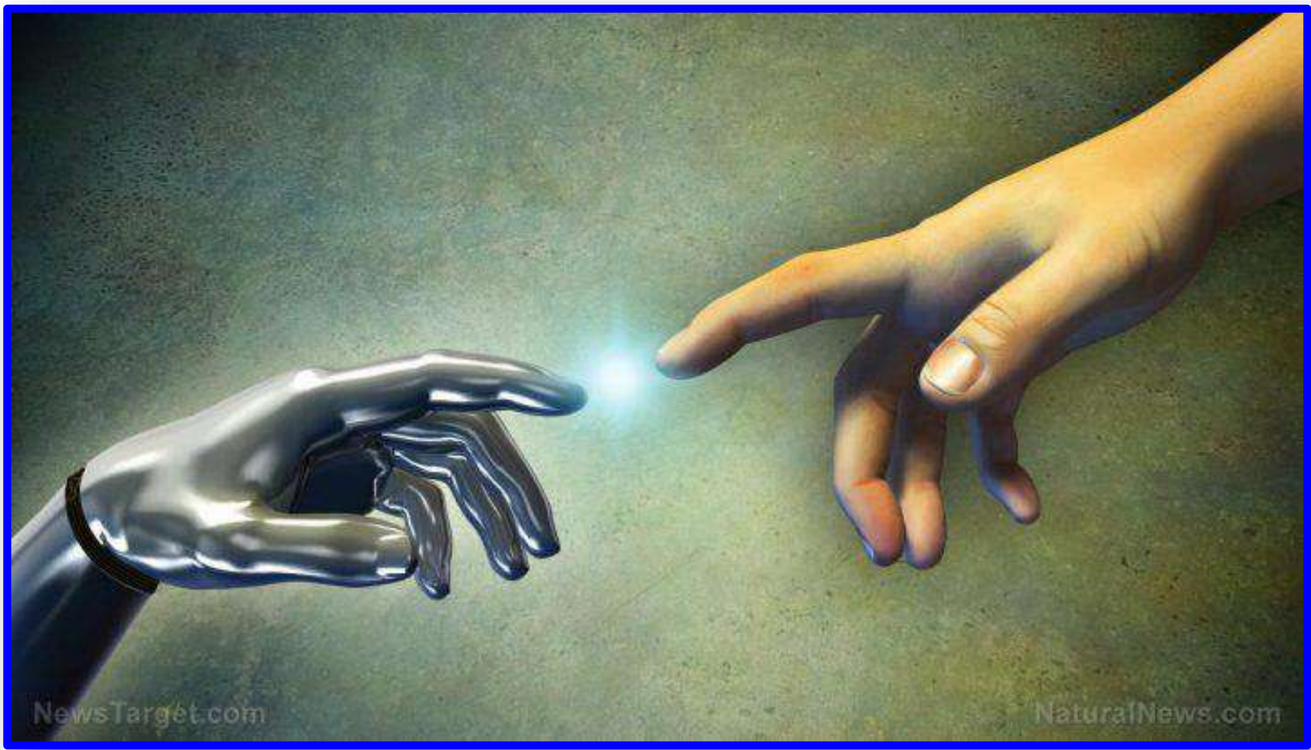
To most, the idea of artificial intelligence advancing to a point where it actually suffers from many of the same emotional problems and mental illnesses as human beings do is unnerving at the very least. They are right to feel this way, frankly, because the more artificial intelligence advances, the more difficult it will be for human beings to control them. It sounds like something straight out of a science fiction film, but this is quickly becoming a very real concern that society needs to take seriously. (Related: A new AI has the ability to teach itself with a reinforcement learning algorithm that results in superhuman abilities within hours.)

According to Katja Grace of the Future of Humanity Institute at the University of Oxford, artificial intelligence will begin to exceed human performance within the next few decades as machines continue to expand their capabilities. In order to arrive at this conclusion, Grace surveyed a number of leading researchers in artificial intelligence (a total of 1,634 to be exact) and asked them when they expect artificial intelligence to start outperforming human beings. The findings indicate that this may happen much sooner than we think.

The experts that responded to the survey predict that AI will outperform humans within the next ten years in tasks that include translating languages (by the year 2024), writing high school essays (by the year 2026) and driving trucks (by the year 2027). However, other tasks, such as working in retail (2031), writing a bestselling book (2049) and working as a surgeon (2053) are expected to take significantly longer for machines with artificial intelligence to master. (Related: Here are eight professions that are expected to see human beings replaced with artificial intelligence technology in the years ahead.)

Furthermore, the experts predicted that there’s a fifty percent chance that artificial intelligence will be better than human beings at mostly everything in just four and a half decades. Relatively speaking, that’s not a very long time, and human beings had better make plans to adapt to this inevitable technology-driven world or risk becoming obsolete. See Robots.news for more coverage of robotics and AI.

[Robots and humans working harmoniously together? FedEx executives say that automation will not affect employment]



Could it be possible to have robots in the workplace that don't affect the jobs of actual humans that are also in it? Delivery services company FedEx seems to think so, and now it's about to go all-out on this particular idea. This is based on information contained in an official announcement, as well as some online reports that cover the firm's current autonomous robot-related projects that are said to be scheduled for expansion.

It is said that FedEx successfully wrapped up a trial of automated "tuggers" in one of their U.S. shipping hubs, and now it's considering adding even more robots as part of its workforce as a result. To be more specific, the company's North Carolina shipping hub – the Kernersville facility – was where the trial of five robots named Dusty, El Guapo, Jefe, Lucky, and Ned took place. All five of them used digital maps and a number of sensors to make their way around, and judging by the success of their trials, it appears that their technology works just fine.

According to Galen Steele, the FedEx senior manager who is in charge of the depot, it's clear that there is room for both robots and humans in the workplace after all. "I understand people thinking this will take their jobs," he said. "But over time, they realize that is not the case at all." (Related: Study: Robots could soon replace most government workers.)

Helping, not taking over…yet

The autonomous robots, which were designed to take over the jobs of human tuggers, have an official name: Robotic Tugger RT4500. They were built by a Massachusetts-based robotics company called Vecna Technologies, which became part of FedEx last year. Over time, they are expected to replace around 25 jobs in total, which is a small fraction of the total number of employees in the facility — there are 1,300 people in it at the moment, and 100 new positions are said to be created every year.

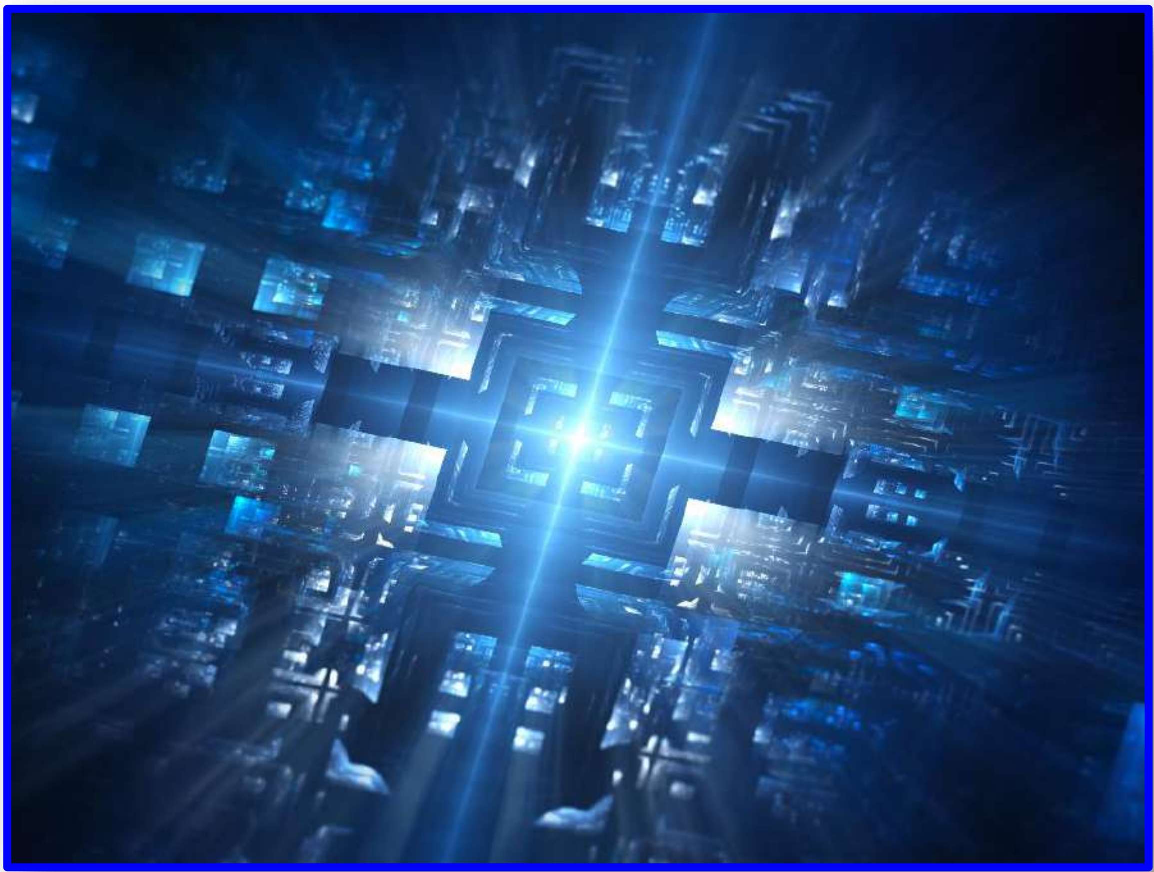
The autonomous tuggers are described as being "built to maximize productivity by automating point-to-point transport" of large payloads with the use of flatbed carts or trains of carts. Vecna uses an OEM tugger equipped with its own proprietary autonomy package, which seems to work just fine for FedEx's needs so far. If it can take care of the work of one huge delivery service's company in one of its biggest facilities, then you can be sure that it would work for other companies as well.

The use of these types of robots is fairly smart on the company's part, considering that more and more people are now using online shopping over going to actual stores, and they need to deal with large, irregular items more often that take a lot of work to handle. Non-robotic tuggers currently exist and are driven by actual human drivers, but if the autonomous ones become standard, then they would only be required to pack the items to be transported instead.

Just like most other autonomous robots, robotic tuggers have simple mechanisms for operation. After a single button press, they can go on their way and navigate locations through the use of laser-based sensors, built-in cameras, and other navigation tools that are designed to help them "see" the environment and avoid obstacles.

It may be a while before these tuggers and other kinds of robots do fully replace humans, but it's clear that it will only be a matter of time. FedEx has the right idea in simply integrating them with the jobs of their current workers, but it will be interesting to see what really happens down the line.

Part 2 Artificial Intelligence



Reading

1. What is Artificial Intelligence?

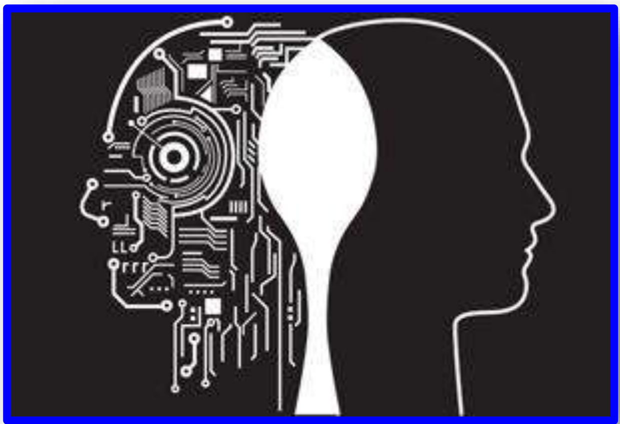
1.Read the text «Robotics» carefully paying attention to the words and word combinations in bold type and do the tasks on it:

Artificial intelligence (AI) is wide-ranging branch of computer science concerned with building **smart machines capable of performing tasks** the typically **require human intelligence**. AI is **an interdisciplinary science** with **multiple approaches**, but **advancements in machine learning** and deep learning are **creating a paradigm shift in virtually every sector of the tech industry**.

HOW DOES ARTIFICIAL INTELLIGENCE WORK?

Less than a decade after breaking **the Nazi encryption machine Enigma** and helping the Allied Forces win World War II, mathematician Alan Turing changed history a second time with a simple question: "Can machines think?"

Turing's paper "Computing Machinery and Intelligence" (1950), and it's **subsequent Turing Test, established the fundamental goal** and **vision of artificial intelligence**.



At it's core, AI is the branch of computer science that aims to answer Turing's question in the affirmative. It is the **endeavor to replicate or simulate human intelligence in machines**.

The expansive goal of artificial intelligence has given rise to many questions and debates. So much so, that no singular definition of the field is universally accepted.

The major **limitation** in defining AI as simply "building machines that are intelligent" is that it doesn't actually explain *what artificial intelligence is? What makes a machine intelligent?*

In their **groundbreaking textbook** *Artificial Intelligence: A Modern Approach*, authors Stuart Russell and Peter Norvig approach the question by **unifying their work** around the theme of intelligent agents in machines. With this in mind, AI is "the study of agents that receive **percepts** from the environment and perform actions." (Russel and Norvig viii)

Norvig and Russell go on to explore four different approaches that have historically defined the field of AI:

1. **Thinking humanly**
2. **Thinking rationally**
3. **Acting humanly**
4. **Acting rationally**

The first two ideas concern thought processes and reasoning, while the others deal with behavior. Norvig and Russell focus particularly on rational agents that act to achieve the best outcome, noting "all the skills needed for the Turing Test also allow an agent to act rationally." (Russel and Norvig 4).

Patrick Winston, the Ford professor of artificial intelligence and computer science at MIT, defines AI as "algorithms enabled by **constraints**, exposed by representations that support models targeted at loops that tie thinking, **perception** and action together."

While these definitions may seem abstract to the average person, they help focus the field as an area of computer science and provide a **blueprint for infusing machines** and programs with machine learning and other **subsets of artificial intelligence**.

While addressing a crowd at the Japan AI Experience in 2017, DataRobot CEO Jeremy Achin began his speech by offering the following definition of how AI is used today:

"AI is a computer system able to perform tasks that ordinarily require human intelligence... Many of these artificial intelligence systems are powered by machine learning, some of them are powered by deep learning and some of them are powered by very boring things like rules."

HOW IS AI USED?

Artificial intelligence generally false under two broad categories:

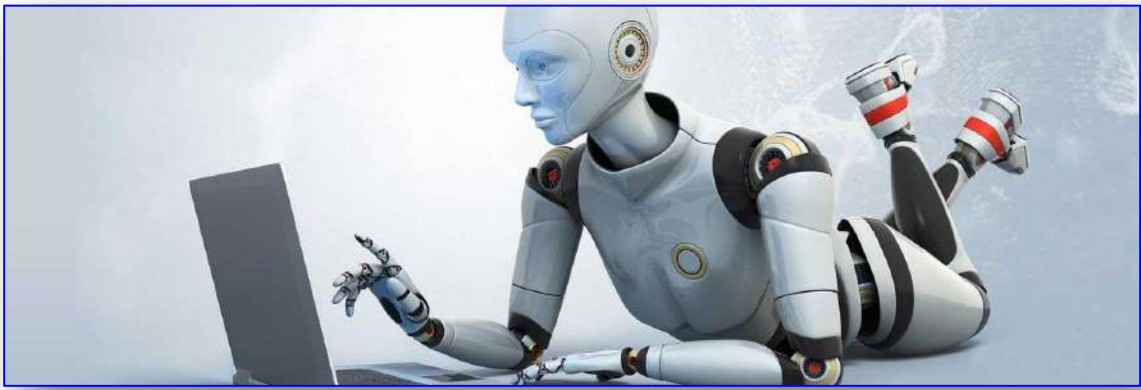
• **Narrow AI:** Sometimes referred to as "Weak AI," this kind of artificial intelligence operates within a limited context and is a **simulation of human intelligence**. Narrow AI is often focused on performing a single task extremely well and while these machines may seem intelligent, they are operating under far more **constraints** and limitations than even the most basic human intelligence.
• **Artificial General Intelligence (AGI)**: AGI, sometimes referred to as "Strong AI," is the kind of artificial intelligence we see in the movies, like the robots from *Westworld* or Data from *Star Trek: The Next Generation*. AGI is a machine with general intelligence and, much like a human being, it can apply that intelligence to solve any problem.

Exercises

Vocabulary Development

2.Practice the pronunciation of the following words and word combinations. Study these words and word combinations. Find and translate the sentences where they are used.

3. Prepare to write a dictation.



Artificial intelligence (AI)	|ɑːtɪˈfɪʃ(ə)l| |ɪnˈtɛlɪdʒ(ə)ns| искусственный интеллект	**humanly**	|ˈhjuːmənli| по-человечески
smart machines capable of performing tasks	умные машины, способные выполнять задачи	**thinking rationally**	рационально мыслящие
human intelligence	человеческий интеллект, человеческий разум, человеческий ум	**to require**	|rɪˈkwʌɪə| требовать, нуждаться, затребовать, приказывать
an interdisciplinary science	|ɪntəˈdɪsɪplɪn(ə)ri| смежные науки	**constraint**	|kənˈstreɪnt| принуждение, принужденность, скованность, стеснение, напряженность
multiple approache	многосторонний подход; множественный подход	**perception**	|pəˈsɛpʃ(ə)n| восприятие, ощущение, понимание, осознание
advancement in machine learning	|ədˈvɑːnsm(ə)nt| достижение в области машинного обучения	**blueprint**	|ˈbluːprɪnt| план, проект, программа; намётки
the Nazi encryption machine Enigma	|ɪŋˈkrɪpʃ(ə)n| нацистская шифровальная машина Энигма	**subsets of artificial intelligence**	|ˈsʌbsɛt| подмножества искусственного интеллекта
subsequent Turing Test	последующий тест Тьюринга	**simulation of human intelligence**	|ˌsɪmjʊˈleɪʃən| моделирования человеческого интеллекта
vision of artificial intelligence	видение искусственного интеллекта	**constraint**	|kənˈstreɪnt| принуждение, принужденность, скованность, стеснение, напряженность

to endeavor	|enˈdevə| стараться, прилагать усилия, пытаться, стремление, попытка, старание	**Artificial General Intelligence (AGI)**	Искусственный общий интеллект
to replicate or simulate human intelligence in machines	воспроизводить или имитировать (моделировать) человеческий интеллект в машинах	**limitation**	|lɪmɪˈteɪʃ(ə)n| ограничение, ограниченность, срок давности
groundbreaking textbook	|ˈɡraʊn(d)breɪkɪŋ| новаторский учебник		

4. Write the following words in their normal spelling

|ˌsɪmjʊˈleɪʃən|	**|ɪntəˈdɪsɪplɪn(ə)ri|**	**|lɪmɪˈteɪʃ(ə)n|**
|ədˈvɑːnsm(ə)nt|	**|ˈbluːprɪnt|**	**|ɑːtɪˈfɪʃ(ə)l|** **|ɪnˈtɛlɪdʒ(ə)ns|**

5. Find the following words or phrases in the text which have these meanings.

strategy	**individual**	**electronic brain**	**impression**

6. Find in the text the English equivalents for the following Russian.

1)отрасль компьютерных наук	2)искусственный интеллект породил множество вопросов и споров	3)тема интеллектуальных агентов в машинах
4)изучить четыре различных подхода	5)касаются мыслительных процессов и рассуждений	6)рациональные агенты, которые действуют для достижения наилучшего результата
7)профессор	8)служат основой для	9)для выполнения задач,

кафедры искусственного интеллекта и информатики	введения машины	которые обычно требуют человеческого интеллекта

7. Find in the text sentences containing the words given below. Consult the dictionary to pick out all their meanings. Illustrate these meanings with your own examples.

perception	**smart**	**intelligence**
limitation	**constraint**	**blueprint**

8. Match the terms with the definitions. Write their English and Russian equivalents.

definition	**simulation**	**encryption**
limitation	**representation**	**perception**

Definition	**English term**	**Russian term**
1)The activity of converting data or information into code		
2) Limitation or representation, as of a potential situation or in experimental testing.		
3)A shortcoming or defect		
4)The expression or designation by som e term, character, symbol, or the like.		
5)A statement of the meaning of a word, phrase, or term, as in a dictionary entry.		
6)The process of perceiving something		

with the senses.		

Writing

9. Punctuate the text and add capitals. Prepare a written translation of the following passage.

artificial intelligence is wide ranging branch of computer science concerned with building smart machines capable of performing tasks the typically require human intelligence ai is an interdisciplinary science with multiple approaches but advancements in machine learning and deep learning are creating a paradigm shift in virtually every sector of the tech industry less than a decade after breaking the nazi encryption machine enigma and helping the allied forces win world war II mathematician alan turing changed history a second time with a simple question can machines think turing's paper computing machinery and intelligence 1950 and it's subsequent turing test established the fundamental goal and vision of artificial intelligence

10. Match the phrases to make sentences

1 AI is often focused	a of computer science that aims to answer Turing's question in the affirmative.
2 AI is wide-ranging branch	b able to perform tasks that ordinarily require human intelligence…
3 AI is the branch	c with multiple approaches, but advancements in machine learning and deep learning are creating a paradigm shift in virtually every sector of

	the tech industry.
4 AI is a computer system	d on performing a single task extremely well and while these machines may seem intelligent, they are operating under far more constraints and limitations than even the most basic human intelligence.
5 AI is an interdisciplinary science	e of computer science concerned with building smart machines capable of performing tasks the typically require human intelligence.

Reading

2. ARTIFICIAL INTELLIGENCE EXAMPLES

- Smart assistants (like Siri and Alexa)
- Disease mapping and prediction tools
- Manufacturing and drone robots
- Optimized, personalized healthcare treatment recommendations
- Conversational bots for marketing and customer service
- Robo-advisors for stock trading
- Spam filters on email
- Social media monitoring tools for dangerous content or false news
- Song or TV show recommendations from Spotify and Netflix

Narrow Artificial Intelligence

Narrow AI is all around us and is easily the most successful realization of artificial intelligence to date. With its focus on performing specific tasks, Narrow AI has experienced numerous breakthroughs in the last decade that have had "significant societal benefits and have contributed to the economic vitality of the nation," according to "Preparing for the Future of Artificial Intelligence," a 2016 report released by the Obama Administration. A few examples of Narrow AI include:

- Google search
- Image recognition software
- Siri, Alexa and other personal assistants
- Self-driving cars
- IBM's Watson

Machine Learning & Deep Learning

Much of Narrow AI is powered by breakthroughs in machine learning and deep learning. Understanding the difference between artificial intelligence, machine learning and deep learning can be confusing. Venture capitalist Frank Chen provides a good overview of how to distinguish between them, noting:

"Artificial intelligence is a set of algorithms and intelligence to try to mimic human intelligence. Machine learning is one of them, and deep learning is one of those machine learning techniques."

Simply put, machine learning feeds a computer data and uses statistical techniques to help it "learn" how to get progressively better at a task, without having been specifically programmed for that task, eliminating the need for millions of lines of written code. Machine learning consists of both supervised learning (using labeled data sets) and unsupervised learning (using unlabeled data sets).

Deep learning is a type of machine learning that runs inputs through a biologically-inspired neural network architecture. The neural networks contain a number of hidden layers through which the data is processed, allowing the machine to go "deep" in its learning, making connections and weighting input for the best results.

Artificial General Intelligence

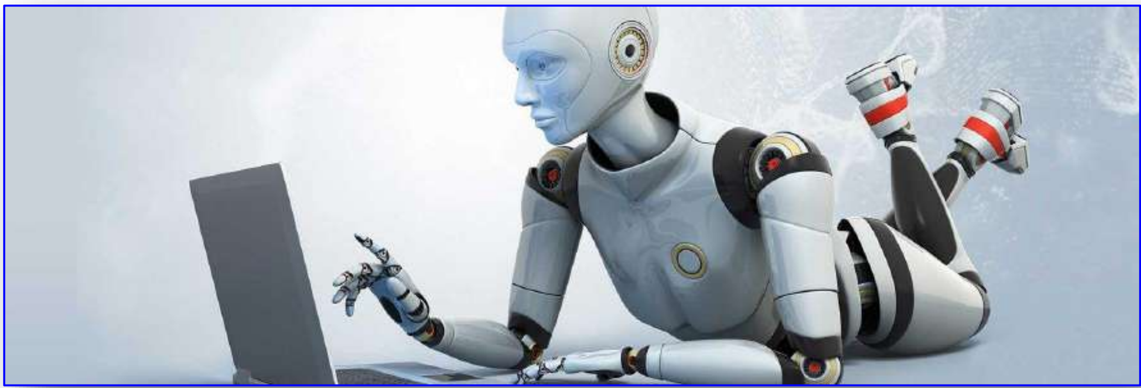
The creation of a machine with human-level intelligence that can be applied to any task is the Holy Grail for many AI researchers, but the quest for AGI has been fraught with difficulty.

The search for a "universal algorithm for learning and acting in any environment," (Russel and Norvig 27) isn't new, but time hasn't eased the difficulty of essentially creating a machine with a full set of cognitive abilities.

AGI has long been the muse of dystopian science fiction, in which super-intelligent robots overrun humanity, but experts agree it's not something we need to worry about anytime soon.

Exercises

Vocabulary Development



1.Create a thematic dictionary.

English term	Russian term

Writing

2.Read and translate the text in written form.

Speaking and Creative work

3.Make a summary of the entire text.

4.Prepare a presentation using information from the text "Artificial Intelligence example".

Reading

3. THE FUTURE OF ARTIFICIAL INTELLIGENCE

7 ways AI can change the world for better … or worse

"[AI] is going to change the world more than anything in the history of mankind. More than electricity."— AI oracle and venture capitalist Dr. Kai-Fu Lee, 2018

Artificial intelligence is impacting the future of virtually every industry and every human being. Artificial intelligence has acted as the main driver of emerging technologies like big data, robotics and IoT, and it will continue to act as a technological innovator for the foreseeable future.

THE FUTURE IS NOW: AI'S IMPACT IS EVERYWHERE

There's virtually no major industry modern AI — more specifically, "narrow AI," which performs objective functions using data-trained models and often falls into the categories of deep learning or machine learning — hasn't already affected. That's especially true in the past few years, as data collection and analysis has ramped up considerably thanks to robust IoT connectivity, the proliferation of connected devices and ever-speedier computer processing.

Some sectors are at the start of their AI journey, others are veteran travelers. Both have a long way to go. Regardless, the impact artificial intelligence is having on our present day lives is hard to ignore:

- **Transportation:** Although it could take a decade or more to perfect them, autonomous cars will one day ferry us from place to place.
- **Manufacturing:** AI powered robots work alongside humans to perform a limited range of tasks like assembly and stacking, and predictive analysis sensors keep equipment running smoothly.
- **Healthcare:** In the comparatively AI-nascent field of healthcare, diseases are more quickly and accurately diagnosed, drug discovery is sped up and streamlined, virtual nursing assistants monitor patients

and big data analysis helps to create a more personalized patient experience.

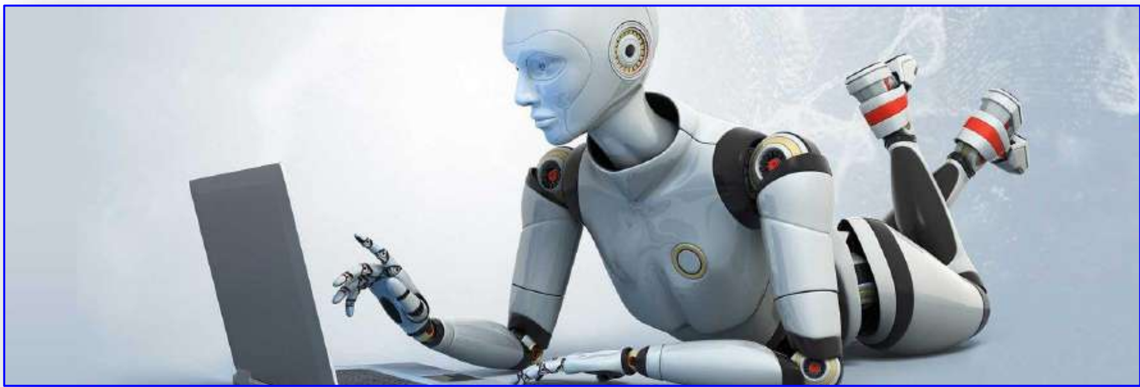
- **Education:** Textbooks are digitized with the help of AI, early-stage virtual tutors assist human instructors and facial analysis gauges the emotions of students to help determine who's struggling or bored and better tailor the experience to their individual needs.
- **Media:** Journalism is harnessing AI, too, and will continue to benefit from it. Bloomberg uses Cyborg technology to help make quick sense of complex financial reports. The Associated Press employs the natural language abilities of Automated Insights to produce 3,700 earning reports stories per year — nearly four times more than in the recent past.
- **Customer Service:** Last but hardly least, Google is working on an AI assistant that can place human-like calls to make appointments at, say, your neighborhood hair salon. In addition to words, the system understands context and nuance.

But those advances (and numerous others, including this crop of new ones) are only the beginning; there's much more to come — more than anyone, even the most prescient prognosticators, can fathom.

With companies spending nearly $20 billion collective dollars on AI products and services annually, tech giants like Google, Apple, Microsoft and Amazon spending billions to create those products and services, universities making AI a more prominent part of their respective curricula (MIT alone is dropping $1 billion on a new college devoted solely to computing, with an AI focus), and the U.S. Department of Defense upping its AI game, big things are bound to happen. Some of those developments are well on their way to being fully realized; some are merely theoretical and might remain so. All are disruptive, for better and potentially worse, and there's no downturn in sight.

Exercises

Vocabulary Development



1.Create a thematic dictionary.

English term	Russian term

Writing

2.Read and translate the text in written form.

Speaking and Creative work

3.Make a summary of the entire text.

4.Prepare a presentation using information from the text "The future of Artificial Intelligence".

4. Supplementary Reading

WHY RESEARCH AI SAFETY?

In the near term, the goal of keeping AI's impact on society beneficial motivates research in many areas, from economics and law to technical topics such as verification, validity, security and control. Whereas it may be little more than a minor nuisance if your laptop crashes or gets hacked, it becomes all the more important that an AI system does what you want it to do if it controls your car, your airplane, your pacemaker, your automated trading system or your power grid. Another short-term challenge is preventing a devastating arms race in lethal autonomous weapons.

In the long term, an important question is what will happen if the quest for strong AI succeeds and an AI system becomes better than humans at all cognitive tasks. As pointed out by I.J. Good in 1965, designing smarter AI systems is itself a cognitive task. Such a system could potentially undergo recursive self-improvement, triggering an intelligence explosion leaving human intellect far behind. By inventing revolutionary new technologies, such a superintelligence might help us eradicate war, disease, and poverty, and so the creation of strong AI might be the biggest event in human history. Some experts have expressed concern, though, that it might also be the last, unless we learn to align the goals of the AI with ours before it becomes superintelligent.

There are some who question whether strong AI will ever be achieved, and others who insist that the creation of superintelligent AI is guaranteed to be beneficial. At FLI we recognize both of these possibilities, but also recognize the potential for an artificial intelligence system to intentionally or unintentionally cause great harm. We believe research today will help us better prepare for and prevent such potentially negative consequences in the future, thus enjoying the benefits of AI while avoiding pitfalls.

HOW CAN AI BE DANGEROUS?

Most researchers agree that a superintelligent AI is unlikely to exhibit human emotions like love or hate, and that there is no reason to expect AI to become intentionally benevolent or malevolent. Instead, when considering how AI might become a risk, experts think two scenarios most likely:

1. **The AI is programmed to do something devastating:** Autonomous weapons are artificial intelligence systems that are programmed to kill. In the hands of the wrong person, these weapons could easily cause mass casualties. Moreover, an AI arms race could inadvertently lead to an AI war that also results in mass casualties. To avoid being thwarted by the enemy, these weapons would be designed to be extremely difficult to simply "turn off," so humans could plausibly lose control of such a situation. This risk is one that's present even with narrow AI, but grows as levels of AI intelligence and autonomy increase.
2. **The AI is programmed to do something beneficial, but it develops a destructive method for achieving its goal:** This can happen whenever we fail to fully align the AI's goals with ours, which is strikingly difficult. If you ask an obedient intelligent car to take you to the airport as fast as possible, it might get you there chased by helicopters and covered in vomit, doing not what you wanted but literally what you asked for. If a superintelligent system is tasked with an ambitious geoengineering project, it might wreak havoc with our ecosystem as a side effect, and view human attempts to stop it as a threat to be met.

As these examples illustrate, the concern about advanced AI isn't malevolence but competence. A super-intelligent AI will be extremely good at accomplishing its goals, and if those goals aren't aligned with ours, we have a problem. You're probably not an evil ant-hater who steps on ants out of malice, but if you're in charge of a hydroelectric green energy project and there's an anthill in the region to be flooded, too bad for the ants. A key goal of AI safety research is to never place humanity in the position of those ants.

WHY THE RECENT INTEREST IN AI SAFETY?

Stephen Hawking, Elon Musk, Steve Wozniak, Bill Gates, and many other big names in science and technology have recently expressed concern in the media and via open letters about the risks posed by AI, joined by many leading AI researchers. Why is the subject suddenly in the headlines?

The idea that the quest for strong AI would ultimately succeed was long thought of as science fiction, centuries or more away. However, thanks to recent breakthroughs, many AI milestones, which experts viewed as decades away merely five years ago, have now been reached, making many experts take seriously the possibility of superintelligence in our lifetime. While some experts still guess that human-level AI is centuries away, most AI researches at the 2015 Puerto Rico Conference guessed that it would happen before 2060. Since it may take decades to complete the required safety research, it is prudent to start it now.

Because AI has the potential to become more intelligent than any human, we have no surefire way of predicting how it will behave. We can't use past technological developments as much of a basis because we've never created anything that has the ability to, wittingly or unwittingly, outsmart us. The best example of what we could face may be our own evolution. People now control the planet, not because we're the strongest, fastest or biggest, but because we're the smartest. If we're no longer the smartest, are we assured to remain in control?

FLI's position is that our civilization will flourish as long as we win the race between the growing power of technology and the wisdom with which we manage it. In the case of AI technology, FLI's position is that the best way to win that race is not to impede the former, but to accelerate the latter, by supporting AI safety research.

Список литературы:

интернет-источники:

1. http://www.worldskills.ru.
2. Robotics (https://curlie.org/Computers/Robotics) at Curlie IEEE Robotics and Automation Society (http://www.ieee-ras.org/).
3. Investigation of social robots (http://www.ai.mit.edu/projects/humanoid-robotics group/index.html) – Robots that mimic human behaviors and gestures.
4. Wired's guide (https://www.wired.com/wired/archive/14.01/robots.html) to the '50 best robots ever', a mix of robots in fiction (Hal, R2D2, K9) to real robots (Roomba, Mobot, Aibo).
5. http://robotics.sciencemag.org.