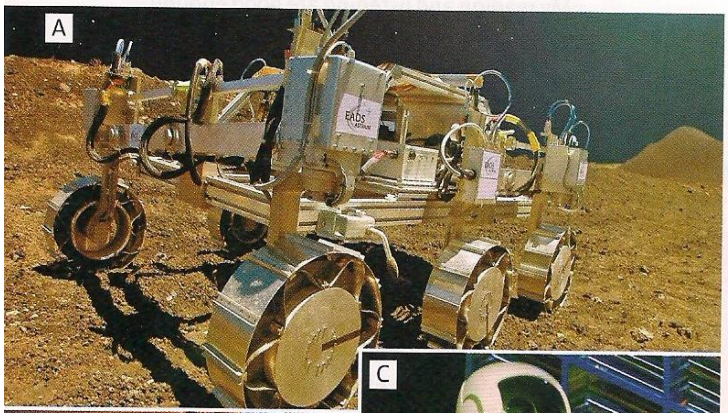
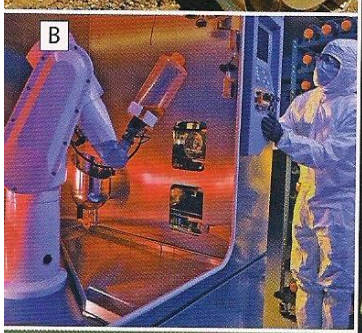
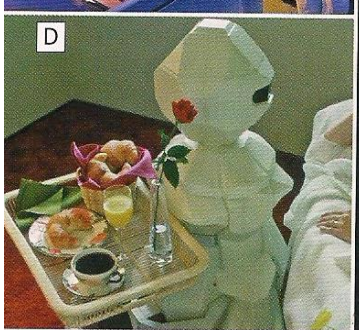
IFTS 14 – ROBOTICA – INGLES TECNICO 2
TASK 1

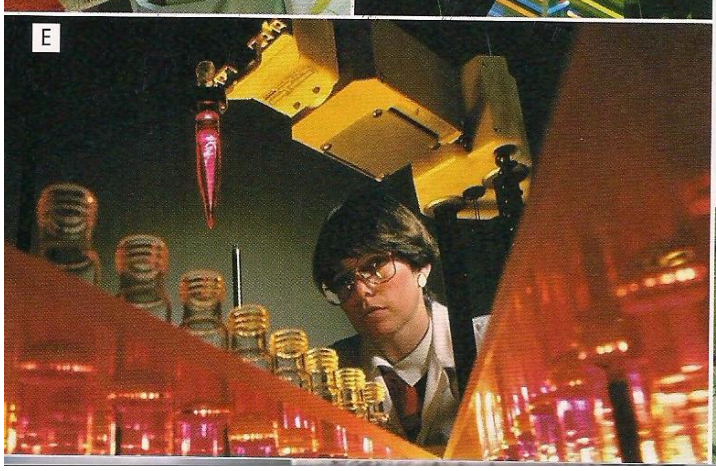
Switch on

Work in small groups. What could these robots be used for? Compare answers with others in your group and provide reasons to support your answers.









Reading

How robots work

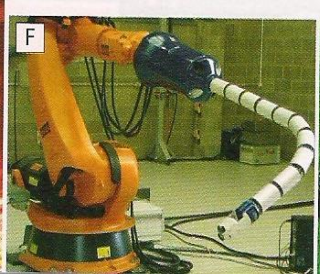
1 Study the opening sentences for each paragraph in this textbook extract. Predict the topics of each paragraph.

First sentence	Possible topics
1 Robots have five basic components: a movable structure, a motor, a power source, a sensory system, and a processor.	
2 The motor provides the physical power to move the structure.	
3 In the same way that humans depend on sight, hearing, taste, smell, and touch to make sense of the world, robots require a sensory system in order to function.	
4 Heat sensors may be important for robots working in extreme conditions.	
5 The brain of a robot is the processor.	

2 Try to answer these questions before you read. Compare answers with others in your group.

1 In what ways can robots move?
2 What kinds of motor can robots have?
3 What kinds of power source can robots have?
4 What does the sensory system do?
5 What does the processor do?

3 Now read the text to check your predictions in **1** and your answers in **2**.



Robots – moving, powering, feeling, and thinking

Robots have five basic components: a movable structure, a motor, a power source, a sensory system, and a processor. The entire robot may move, on legs in the case of Honda's Asimo, on wheels, or on caterpillar tracks in the case of Urbie, or only one part may move, such as the arm of an industrial robot.

The motor provides the physical power to move the structure. It may be electric, pneumatic, or some form of heat engine. All motors require a source of power. In the case of mobile robots, the usual source is a battery. The problem with batteries is that they are heavy and run down quite quickly. In future there may be robots which use biological fuel which they collect as they move. Compressed air, in tanks for mobile robots or directly from a compressor for fixed robots, is the power source for pneumatic systems.

In the same way that humans depend on sight, hearing, taste, smell, and touch to make sense of the world, robots require a sensory system in order to function. Sensors feed information to the processor. The information provided depends on the function of the robot. Location is important for most robots. Industrial robots must be capable of placing items or performing actions in exactly the right place. With some robots, location is controlled by placing electronic tracks for the robot to follow. Container handling in ports can be done by robotic vehicles following such tracks.

Heat sensors may be important for robots working in extreme conditions. Sensors which measure the pressure exerted by robot arms or pincers are important for robots which pick up or handle delicate items. For robots which walk or climb stairs, information on weight distribution and balance is important. Robots which look for some types of explosive need sensors which can detect chemical smells. Robots which have to navigate over unfamiliar ground, such as the Mars Rover, have digital cameras to help them identify obstacles and select navigable routes.

The brain of a robot is the processor. It controls the operation of the robot. It is programmed to allow the robot to carry out a series of actions and to respond to feedback from the sensory system. In the case of a simple robot, such as a domestic vacuum cleaner, the program may instruct the robot to turn 90 degrees when it collides with an obstacle.

Problem-solving

1 Robotic vacuum cleaners which can clean floor surfaces by themselves are becoming more common. Work with a partner to list the kinds of sensors they need.

2 Read this short talk by a Sales Rep at a trade fair about how a robotic vacuum cleaner works. Note down information about one of the types of sensor it uses.

3 Now exchange information with others in your class to complete the table.

4 Read again and check your answers.

Sensors	Notes
dimension sensors	
object sensors	
cliff sensors	
wall sensors	
dirt sensors	

Problem-solving

I am going to tell you about the five sensors that our domestic robotic vacuum cleaner contains. These sensors help it to navigate safely and to clean surfaces effectively.

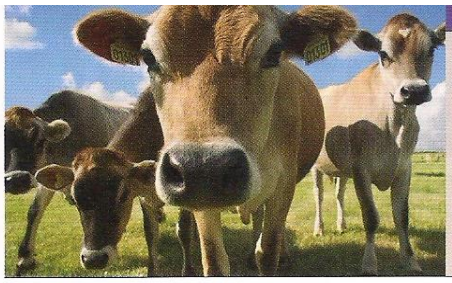
The dimension sensors determine the size of the room. The robot cleaner sends an infrared signal in each direction in turn. These reflect from the walls and return to an infrared receiver. The processor calculates the dimensions of the room from the time taken for the signal to return.

Then there are object sensors – when the cleaner hits an object, such as a chair, the bumper, which goes right round the cleaner, is pressed in. This activates mechanical object sensors. These send signals to the processor which cause the cleaner to change direction to avoid the object.

There are also cliff sensors – under the cleaner there are infrared sensors directed downwards. If the time taken for the return infrared signal increases suddenly, the processor detects a 'cliff', for example, stairs or other sudden drops which the robot could fall down. This causes the robot to reverse away from the cliff.

The wall sensors let the cleaner follow walls and go round objects closely but without touching them.

And finally, and most importantly, dirt sensors – these are acoustic impact sensors. When the cleaner raises a lot of dirt from a carpet or other surface, some of the dirt hits the metal plates of the acoustic impact sensors. This causes vibration which the sensors detect. They pass a signal to the processor which causes the robot to clean the area again until there are no more vibrations – in other words, until the area is clean.



Gadget box

The DeLaval Voluntary Milking System can milk 60 cows three times a day. Cows decide when they wish to be milked. The robot checks if the cow is ready, milks the cow, compares its production with previous yields, and cleans itself before the next cow enters.

What would be the main advantage for dairy farmers?

Language spot

Causing, preventing, and enabling links: *cause to, make, prevent, stop, allow to, enable to, let*

In technology we often have to describe the relationship between actions. Study these pairs of actions about robots. What is the relationship between each pair?

1 a *The object sensor detects an obstacle.*
  b *The robot changes direction.*
2 a *The cliff sensor reports a sudden drop ahead.*
  b *The robot does not move in that direction.*
3 a *Caterpillar tracks are fitted to the robot.*
  b *It can move quickly on rough surfaces.*

In pair 1, one action *causes* another action. In pair 2, one action *prevents* another action. In pair 3, one action *enables* another action.

Note how we can link each pair to show the relationship between them.

1 *The object sensor detects an obstacle, which **causes** the robot **to** change direction.*
  *The object sensor detects an obstacle, which **makes** the robot change direction.*
2 *The cliff sensor reports a sudden drop ahead, which **prevents** the robot (from) moving in that direction.*
  *The cliff sensor reports a sudden drop ahead, which **stops** the robot moving in that direction.*
3 *Caterpillar tracks are fitted to the robot, which **allows / enables** it **to** move quickly on rough surfaces.*
  *Caterpillar tracks are fitted to the robot, which **lets** it move quickly on rough surfaces.*

In the examples, *which* refers to the preceding action. In these cases *which* + the active verb can be replaced by the *-ing* form of the verb. For example:
*The cliff sensor reports a sudden drop ahead, **preventing** the robot (from) moving in that direction.*

2 Decide on the relationship between each of these pairs of actions. Then link them using an appropriate verb.

1 The power sensor reports low battery current to the processor.
  The robot cannot move.
2 The bumper is pressed in.
  The object sensor reports an obstacle to the processor.
3 The sensors detect a 'cliff'.
  The robot reverses.
4 Infrared signals from the robot are reflected by a wall.
  The robot changes direction and moves parallel to the wall.
5 Dirt hits the acoustic impact sensor plates.
  The plates vibrate.
6 The sensors detect the vibration and pass a signal to the processor.
  The robot cleans the area again.

1 Complete the gaps in this text with the correct form of the appropriate verbs.

allow (to) cause (to) enable (to) let make prevent stop

Land mines kill 800 people every month and _____[1] people returning to their homes after a conflict is over. Comet III is an experimental mine-clearing robot developed at Chiba University in Japan. It is fitted with caterpillar tracks, _____[2] it move quickly over rough ground. For mine-hunting it has six legs, _____[3] it to walk delicately through mine fields. It takes 20 seconds to calculate each step. Slow processing speeds _____[4] Comet III from moving more quickly, but faster processing chips should _____[5] Comet III to reach human walking speeds in future.

Comet III has stereo vision provided by two digital cameras. This _____[6] it navigate by itself without the help of remote control. Comet III has metal detectors and ground-penetrating radar, _____[7] it to detect different types of mine. A reflected signal from a mine _____[8] Comet III to probe gently to uncover the mine. Vibration or pressure can _____[9] a mine explode, so the work must be done with care.

Sometimes the ground is very hard, which _____[10] the probe uncovering mines. Newer models fitted with drills and an air hose will _____[11] the robot do this safely. A robotic hand will _____[12] the robot to pick up rocks.

Causing, preventing, and enabling links: *cause to, make, prevent, stop, allow to, enable to, let*

There are several ways to describe the relationship between actions.

Causing

cause + object + *to* + infinitive

make + object + infinitive

*Vibration or pressure can **cause a mine to explode**.*
*Vibration or pressure can **make a mine explode**.*

Preventing

prevent + object + *from* + *-ing* form

stop + object + *-ing* form

*The hard ground often **prevents the robot from uncovering** mines.*
*The hard ground often **stops the robot uncovering** mines.*

Enabling

allow / enable + object + *to* + infinitive

let + object + infinitive

*Digital cameras **allow / enable** the robot to navigate by itself.*
*Digital cameras **let** the robot navigate by itself.*

Sentence structure

There are two ways we can structure these ideas.

- Relative clause, using *which* + verb of causing / preventing / enabling

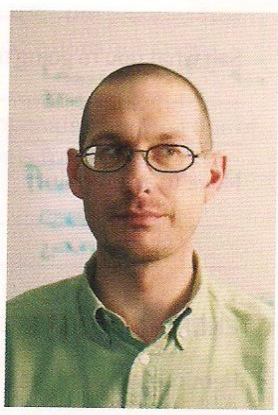
*Batteries run down quite quickly, **which** causes the robot to stop moving.*
*The Mars Rover is fitted with digital cameras, **which** prevents it from colliding with obstacles.*
*The robot is equipped with sensors that measure pressure, **which** enables it to handle delicate items.*

Note that the verb following *which* is in the third person singular, as it refers to the preceding action rather than to a singular or plural noun.

- Omitting *which* and using the *-ing* form of the verb that follows it. Compare:

*The robot has six legs, **which enables** it to walk delicately through mine fields.*
*The robot has six legs, **enabling** it to walk delicately through mine fields.*

It's my job



1 Before you read about Ikonen, Senior Manufacturing Systems Engineer, answer these questions with a partner.

1 What do you think Jaako's responsibility is?
2 One of his products involves biosensors. What do you think a biosensor is?
3 What do you think is the difference between mechanization and automation?

2 Read and check your answers.

3 Read again to find the answers to the questions.

1 What did he study at college?
2 Why did the mobile phone company need to automate?
3 What does a blood glucose monitor do?
4 Why must the process of manufacturing the monitors be automated?

It's my job

I = Interviewer, J = Jaako Ikonen

I How did you get interested in technology?
J I started making radio-controlled model boats at the age of 13.
I That's how you got started?
J That's how I got started, yeah. I loved playing around with the electronics.
I Did you go on to college at the end of school?
J Yes, I went to college and did Mechanical engineering with one year of Electrical and electronic engineering.
I What was your first job?
J Designing and building automated manufacturing systems for a mobile phone company. They needed to automate because production was going through the roof. Their old system simply could not produce enough phones.
I I'm not clear about the distinction between mechanization and automation.
J Big difference. Mechanization is the old world of machines with no brains, they could do only one thing – like Henry Ford's assembly lines. Automation means you are using a combination of software, of mechanical engineering, electronics, electrical engineering – that's the mechatronics side of things. There's intelligence built in. That's why it's called automation.

I You then moved to your current job?
J Yes. I'm Senior Manufacturing Systems Engineer for a large health care company. That means I'm responsible for developing all new processes and process automation for manufacturing our products.
I What do you make?
J One of the main products is blood glucose monitors for diabetics. It uses biosensors, which are coated in enzymes to measure the blood glucose levels in a drop of blood. Basically how much sugar there is in the blood.
I Where does automation come in?
J You can't make these machines by hand. There can't be any contamination, they have to be perfectly clean, and there can't be any defects in the production. Peoples' lives are involved so you cannot afford to be wrong. Also the volume is huge so only machines can achieve this.
I Is it done by robots?
J We use incredibly fast, vision-driven robots. They don't simply pick up and place components blindly. They can see what they're doing, they can teach themselves, and they check every move they make to ensure there are no errors.
I What qualities do you need to be successful in your field?
J You must be innovative. You must be able to work across functions and be able to communicate with non-technical people.
I Can you give me any examples of communicating with non-technical people?
J I work in R&D and we have to constantly communicate with Marketing – they know what the customers want. We just have the ideas.

Speaking

Assessing explanations

1 Work in groups of three, A, B, and C.

Student A Go to p. 110.
Student B Go to p.113.
Student C Read text C below.

2 A plays the role of Speaker first, telling the others about their text using only notes to help. B plays the role of Reporter, taking notes from A's talk and reporting it briefly. C plays the role of Assessor, listening carefully to both talks and judging how accurately B has reported. If there is disagreement, you can refer to the texts.

3 Continue until each member of the group has played the part of Speaker, Reporter, and Assessor once.

C

FIRST – For Inspiration and Recognition of Science and Technology – is a US organization founded by Dean Kamen, inventor of the Segway. FIRST has run an annual Robotics Competition since 1992 for teams of high-school students. Teams have six weeks to design and construct a robot to solve a particular task, which differs each year.

Teams usually consist of about 25 students with three or so professional Engineers who volunteer to assist them. They often include subteams who look after different aspects of the design of the robot, such as pneumatics, control systems, mechanics, and electrics.

Each team is supplied with a standard set of components including a remote control receiver and transmitter, a microprocessor and software, motors, sensors, a power pack, and mechanical parts.

More than 1,300 teams from seven countries, although mainly from the US, took part in 2007. FIRST also organizes robotics competitions for younger students.

A

HeartLander is an experimental miniature robot designed to allow surgeons to treat damaged hearts without major surgery. It has been developed at Carnegie Mellon University in Pittsburgh. The robot is two centimetres long. It can be inserted into the body by a small incision in the chest. It moves by a combination of suction and push-pull movements provided by wires driven by motors outside the body. The movement resembles the way a caterpillar moves. It can travel at speeds of up to 18 cm per minute.

A computer monitors its position and controls its movements.

HeartLander can be directed to crawl over the surface of the heart while the heart is beating. Its inventors hope to use it to attach leads for pacemakers, to inject drugs straight to the heart, and to take samples from the surface of the heart for analysis.

To do this without major surgery would be an important advance in the treatment of heart problems.

B

Geminoid is a humanoid robot which looks and sounds just like its creator, Hiroshi Ishiguro of Osaka University in Japan. Its features are made from silicon moulds of his own body. It has the same hair colouring and style, and wears the same glasses and clothes.

Dr Ishiguro demonstrates his robot by using it to teach his classes. What makes this robot so convincing is that it appears to breathe, its eyes blink, and it fidgets just like a human. It also speaks with his voice. These effects are achieved by technology which includes 50 sensors and motors under Geminoid's skin to give expression to its face and to replicate human movements. The breathing effect is caused by compressed air forced into the chest. A motion capture system tracks the real Dr Ishiguro's mouth movements which are then copied by the robot. His voice is relayed through a speaker in the robot.

Dr Ishiguro believes that in future, humanoid robots will stand in for people who cannot be present at an event. We may have not only robot teachers, but robot politicians and singers.

We should have – in rather cheap machines – human level intelligence in well under fifty years.

Hans Moravec

Research Professor in the Robotics Institute of Carnegie Mellon University, 1990

Webquest

FIRST is not the only robot competition available. Work in small groups to research some others and report back to the class what you have found out. You should get information about what the rules are, where the competition is held, and what type of competition it is. Is it based on a competitive sport, such as football, or is it a race or a challenge?

These sites may help:

www.dcs.shef.ac.uk/~noel/competitions.html

www.ecsel.psu.edu/~avanzato/robots/contests/

http://robots.net/rcfaq.html#LNK077

http://cswww.essex.ac.uk/staff/hhu/competition.html

http://robogames.net/index.php