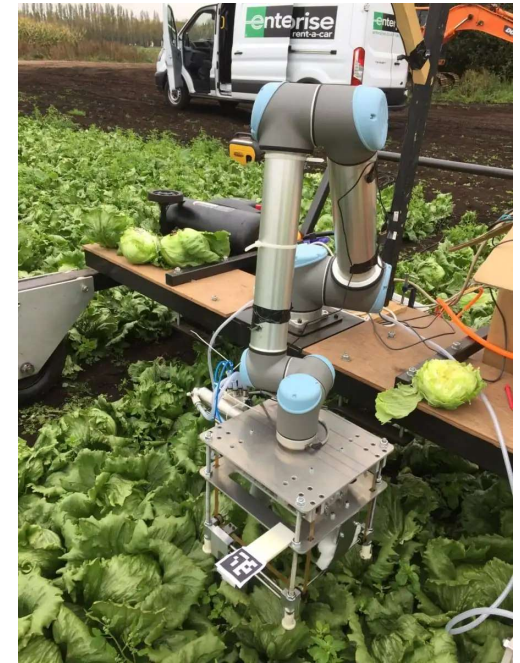


6.2.3 THE ROLE OF ROBOTS AND THEIR ADVANTAGES AND DISADVANTAGES

- Agriculture
 - Harvesting and picking
 - robots have been designed to do this labor-intensive work; they are more accurate (only pick ripe fruit, for example) and much faster at harvesting
 - for the reasons above, this leads to higher yields and reduces waste (for example, Vegebot (Cambridge University) uses cameras to scan, for example, a lettuce and decide whether or not it is ready to be harvested. A second camera in Vegebot (near the cutting blades) guides an arm to remove the lettuce from its stalk with no damage.
 - <https://www.youtube.com/watch?v=JNdQ-QEpYbQ>



6.2.3 THE ROLE OF ROBOTS AND THEIR ADVANTAGES AND DISADVANTAGES

- Agriculture
 - Weed control
 - weed management robots can distinguish between a weed and crop using AI
 - Labor cost saving, less farmers need for removing weed
 - weed control robots use GPS tracking to stay on course to move along the rows of the farm and remove the weeds
 - Weed is removed by laser or chemical weed control which is operated by an actuator under the control of the microprocessor in the robot. Less waste than using farmers.
 - <https://www.youtube.com/watch?v=krec6kyBzjE>



6.2.3 THE ROLE OF ROBOTS AND THEIR ADVANTAGES AND DISADVANTAGES

- Agriculture
 - Phenotyping
 - phenotyping is the process of observing physical characteristics of a plant in order to assess its health and growth
 - robots designed to do phenotyping are equipped with sensors that can create a 3D image/model of the plant, thus allowing it to be monitored for health and growth
 - machine learning is used to recognise any issues with leaves (for example, if they have a blight or have the wrong colour) so that the robot can convey this back to the farmer
 - these robots are much more accurate and faster at predicting problems than when done manually
 - <https://www.youtube.com/watch?v=fFxzWG-KGGU>



6.2.3 THE ROLE OF ROBOTS AND THEIR ADVANTAGES AND DISADVANTAGES

- Agriculture

- Seed-planting drones and fertiliser distribution
 - drones (flying robots) can produce an aerial image of a farm sending back a 'bird's eye view' of the crops and land
 - they allow seed-planting to be done far more accurately
 - they also allow for more efficient fertiliser-spreading to reduce waste and improve coverage (this is much more efficient than conventional crop spraying)
 - the drones use a very complex camera system to target seeding and allow fertiliser spraying.
- <https://youtu.be/U7nJBFjKqAY?t=221>



6.2.3 THE ROLE OF ROBOTS AND THEIR ADVANTAGES AND DISADVANTAGES

- Agriculture
 - Autonomous agriculture devices
 - Several of the devices described above could be referred to as autonomous. The following list summarises some of the devices that can work independently of humans:
 - grass mowers/cutters
 - weeding, pruning and harvesting robots
 - seeding robots
 - fertiliser spraying
 - all of these devices use sensors and cameras to go around obstacles, or they can even be programmed to 'go to sleep' if the weather turns bad.

6.2.3 THE ROLE OF ROBOTS AND THEIR ADVANTAGES AND DISADVANTAGES

- **Medicine**

- robots are used in surgical procedures, which makes the operation safer and also makes the procedures quicker and less costly
- robots can be used from monitoring patients to doing actual minor surgery
- the disinfecting of rooms and operating theatres can all be done by autonomous robots



6.2.3 THE ROLE OF ROBOTS AND THEIR ADVANTAGES AND DISADVANTAGES

- Medicine
 - robots can take blood samples from patients:
 - less painful to patients since the robot is better at determining a 'good vein'
 - safer to doctors and nurses if the patient has an infectious disease
 - doctors and nurses can be freed up to do more skilled work
 - prosthetic limbs are now mini robots
 - bionic skins and neural implants that interface with the human nervous system (of the damaged limb) giving feedback to allow for better control of the prosthetic limb (again sensors and actuators are used to give human- like responses, such as grip).



6.2.3 THE ROLE OF ROBOTS AND THEIR ADVANTAGES AND DISADVANTAGES

- Domestic robots

- Robots used around the house vary from devices to carry out household chores through to devices used to entertain people. For example:

- autonomous vacuum cleaners:

- these use proximity sensors and cameras to avoid bumping into obstacles and allows them to cover a whole room automatically
- these robots have a microprocessor to control the overall operation of the device; this also allows the user to program the device
- actuators are used to control motors which allow movement forward backward and from side to side

- autonomous grass cutters (mowers):

- these use the same type of sensor, camera, microprocessor and actuator set up as vacuum cleaners



6.2.3 THE ROLE OF ROBOTS AND THEIR ADVANTAGES AND DISADVANTAGES

- Domestic robots
 - personal assistants
 - this is a robot controlled by a micro-processor that also uses cloud connectivity to connect to the internet
 - it understands voice commands (using a microphone) and will answer any questions it is asked
 - Amazon Alexa, Google home assistant



QUESTIONS

- Robots are used in a factory to build cars. One characteristic of a robot is its mechanical structure.
 - State two other characteristics of a robot

- Suggest two advantages and two disadvantages of using robots, instead of humans, to build cars in the factory