# Unit 3 - The Exploration of Robotics and Artificial Intelligence

## Overview

The overall focus for learning in this unit is to to investigate some of the ways robots and robotics are used around us, including industrial and private use. Learners are encouraged to explore and control robots to see how and why they work in order to understand what else they could be used for. There is also an ethical dimension where many studies believe that automation will replace most people's jobs in the coming years. Is this a good or bad thing? Does it matter?

**A work activity will typically be 'straightforward or routine' because:**

The task or context will be familiar and involve few variable aspects. The techniques used will be familiar or commonly undertaken.

**Example of context** – assembling and testing a simple robot

## Assessor's guide to interpreting the criteria

## *General Information*

**RQF general description for Level 1 qualifications**

- Achievement at RQF level 1 (EQF Level 2) reflects the ability to use relevant knowledge, skills and procedures to complete routine tasks. It includes responsibility for completing tasks and procedures subject to direction or guidance.
- Use knowledge of facts, procedures and ideas to complete well-defined, routine tasks. Be aware of information relevant to the area of study or work
- Complete well-defined routine tasks. Use relevant skills and procedures. Select and use relevant information. Identify whether actions have been effective.
- Take responsibility for completing tasks and procedures subject to direction or guidance as needed

***Requirements***

- Standards must be confirmed by a trained Gold Level Assessor or higher.
- Assessors must at a minimum record assessment judgements as entries in the on-line mark book on the INGOTs.org certification site.
- The work in the unit is recommended in order for candidates to have covered enough depth and breadth in the topic to successfully carry out their controlled assessment and take the external exam.

- When the candidate has covered as much of ths material as necessary to complete the controlled assessment element, they may be introduced to the topic

- This unit should take an average level 1 learner 30 hours of work to complete.

***Assessment Method***

Understanding of these learning objectives will be demonstrated through answering questions related to key ideas and concepts in the terminal examination as well as practical application of their understanding through the controlled assessment.

***Expansion of the assessment criteria***

**1. Understanding the different uses for robots and AI**

**1.1 I can list the different types of robot used by sector**

Learners will be able to list some robots by sector

**Additional information and guidance**

Most people assume that robots are used in heavy industries like car production, but they are used quite widely in a range of industries. Having said that, it depends on what you define as a robot. A robot is probably most associated with humanoid types of device, but in manufacturing, most robots replicate one function or activity of humans. Using the car industry, a robotic arm may be used to lift and move certain heavy parts like body components or engines, another robotic arm may be used to spray the shells of the cars etc. Some robots turn up in distribution centres to find and pack items for delivery to customers. Recently, a robot was able to prepare burgers for a well known fast food chain. Robot arms, due to their mechanical precision, are used in microsurgery in order to enhance the technical skill of surgeons.

Learners can research other uses of robots and list the sectors they operate in.

**1.2 I can list the way AI is used in different sectors**

Learners will list a number of examples of AI use by sector

**Additional information and guidance**

Learners who are keen on sports have probably already experienced AI without knowing it. A number of sports reports on websites are written by AI algorithms and the majority of people are unaware as the reports are as good as reporters. In the US, AI is being used to make simple legal decisions as the rules based decisions are perfectly suited to a rule driven mechanism such as AI. At a number of airports across the world and in busy cities, some AI systems are being used for face recognition as the machines can quickly identify specific features and hopefully find terrorists or other known criminals in transit. The stock exchange uses AI to make predictions on stocks and can therefore control trillions of pounds of investment money. AI is also used in medicine as it can quickly scan through 1,000s of images and detect cancer patterns. This type of AI is as accurate as trained doctors, but significantly faster.

There are many other examples that learners can research and comment on.

**1.3 I can explain some different ways robots are controlled**

Learners will show a basic understanding of robot control processes

**Additional information and guidance**

The type of control used on robot devices may depend on the particular type of device, but in most instances it will be based on some computer based system. Learners can download and explore something like ROS (Robot Operating System) to look at how it works in practice. There is also a visualization version to explore, though it is probably a class based project.

https://en.wikipedia.org/wiki/Robot_Operating_System [1]

http://wiki.ros.org/rviz/UserGuide [2]

In addition to the computer based control, learners should be able to explore other aspects such as motors, servos and other mechanical devices that make robots move. The large industrial robots will use hydraulic systems to give them enough power.

Learners just need to have a basic understanding of these components.

**1.4 I can comment on some of the issues for society posed by robots and AI**

Learners will offer some of their own views on robotics and AI

**Additional information and guidance**

There is no right or wrong answer here as it is really down to the learner's own views on these developments. If they are enthusiastic about the technologies, then they will offer some positive views on what the future will hold, especially if they are interested in a career in the industry. If, however, they are concerned about the inevitable replacement of many people with robots and AI, they may have some concerns about the future.

Some of the issues they can explore will be:

- Loss of jobs - people no longer needed
- Loss of control - leave robots and AI to make important decisions
- Possible takeover - the Terminator scenario
- Overproduction - too much stuff so waste
- Freedom - no need to work so can use it for leisure
- Safety - no more industrial accidents
- Accuracy - no more wrong decisions
- Companionship - support and comfort always there (for elderly etc)

**1.5 I can explain my feelings about robots and AI**

Learners can explain why they have chosen their comments in 1.4

**Additional information and guidance**

If learners feel good or bad about robotics and AI, why do they feel that way? Is it a concern for their own future or others? What are some of the decisions that inform the way they feel? For example, people in Japan are aging with not enough young people coming along to replace them, as a result, the country is relying on robots for some of the social care and interaction for elderly people that their children would normally perform or care workers. Is this a good thing? What happens when you care more about your robot helper than your own neighbours or friends and does it really matter? If your life is easier and by using robotics and AI you are free to do more of the things you like, surely that is a good thing?

**2. Testing different robot devices and AI systems**

**2.1 I can explain with an industry example how robots are controlled**

Learners will explain a control mechanism used in robotics

**Additional information and guidance**

In most cases it may be difficult to get some hands on experience of robot controlled devices in a manufacturing setting, though this would clearly be useful. There are numerous videos available which can be used instead and they will give enough detail for learners to comment on the controls. They need to explore how the mechanisms work and give some examples, for example the servos are used to move an arm in three directions and all of this is controlled with a computer program. More simple robotic arms may be controlled by joysticks or similar mechanical devices.

**2.2 I can investigate some of the materials used in robot manufacture**

Learners will be introduced to some robot devices and materials

**Additional information and guidance**

The amount and type of robots that learners can have experience of will vary, but the key here is for them to see what they are made of and to discuss as a group the nature of these materials. Clearly the material will depend on the use, so a large industrial robot used to lift car engines weighing 100s of kilograms will need a strong material, probably steel, whereas a small robot used for toys or similar functions will need to be made of light and durable plastics. Other materials will be similar perhaps to the material investigated in other units in this qualification, so metal alloys and rare earth minerals.

Perhaps some simple tests can be carried out as a class to investigate the materials against each other to see their suitability.

**2.3 I can practice controlling a robot**

Learners will try to control a robot

**Additional information and guidance**

The robot used will vary here so the type of controls investigated will also vary, the key thing is that learners can have a hands on experience of what various robots can do and how hard or easy they are to control. At one extreme, students can see some of the programming required in something like ROS and see how complex this is. On the other end, the simple controls of commercial toy robots should give an indication of functionality. There are also simulation programme that can be used to give a sense of control and other variables.

**2.4 I can list how AI is used in key industries**

Learners will list a number of industrial uses of AI

**Additional information and guidance**

As AI evolves and becomes more understood, it is increasingly being used by more industries. The list from the following web page increases over time.

https://en.wikipedia.org/wiki/Applications_of_artificial_intelligence [3]

Learners can choose a number of applications that interest them in terms of their own career or subject interests.

**2.5 I can test the AI functions of a common system**

Learners will test simple AI systems and comment on their functions

**Additional information and guidance**

Many learners will have “tested” AI if they have used a web browser and have done any online shopping. Using an online shopping system, especially if you create an account, will present you with a list of “items of interest” based on your previous shopping. Many websites that are commercially oriented will also look at your browser record through your cookie trail and then pop up related items of interest for you to look at.

Many more automated systems will be appearing to deal with customer services and marketing aspects of a business.

Learners may have other examples they have come across which they can share for discussion.

**3. Exploring the future uses of robotics and AI and the impact on my world**

**3.1 I can make a prediction about the uses of robots in the future**

Learners will use their knowledge and understanding to make some predictions

**Additional information and guidance**

Most of the major advances in robotics and AI have happened relatively recently and probably only in the short lifetime of the learners on this course. The advances though are now increasing rapidly and it is hard to predict what will be around in a year or two, but there is no reason not to try. Using their understanding of what they have investigated, what might there be in the future of robotics. TLM are working with Consequential Robotics on their MiRO project which is designed to be a companion for people and has multi-sensory devices to make it interact in many different ways. The devices is in early stages of development, but is already very easy to interact with and give human like values. One application they have for the robt is for elderly people as a live in monitor device. If the person falls over, MiRO would spot this change with its cameras (eyes) and be able to communicate to a pre-set number to call for a doctor or ambulance. Robot devices are already patrolling some shopping centres in the US to help people find their way around or report any problems.

Learners can come up with their own novel way to use a robot. There is probably no wrong answer.

**3.2 I can make a prediction about the use of AI in the future**

Learners will make their own predictions about AI use

**Additional information and guidance**

Many homes now are equipped with a multitude of IoT (Internet of Things) devices. These devices use AI to interact with their environment, including you, to answer questions or carry out instructions. How far can these devices go? What devices do the learners want in their home in the future to help them with their busy lives?

### 3.3 I can explain how robots and AI might affect my future

Learners will explain their ideas about the impact of these technologies

### Additional information and guidance

This criterion is something of an extension on the earlier criterion as learners will identify the impact on their lives and made some predictions about the possible future. Depending on the predictions they make and their overall feelings about these technologies will determine their explanations about any impacts. Thy could perhaps select a number of industries they investigated from 2.4 and explain how these will affect them, for example the possibility of planes flying completely autonomously. They do this already with military aircraft and devices used for exploration, but how would they feel if their plane flying them to their holiday had no pilot?

### 3.4 I can discuss ways that robots and AI will help the world

Learners will discuss the positives of these technologies

### Additional information and guidance

AI is being developed heavily for social good, For example, satellite images are being analysed by AI to look for obvious areas of poverty and social deprivation so that governments can better target resources. As mentioned earlier, medical images of cancers are being analysed by complex AI systems to find early signs of cancer as if people are treated early enough there is a much better chance of recovery. Intelligent Tutoring Systems (ITS) are being used widely to teach people who do not have access to classrooms or teachers but do have online access. This makes education far more accessible around the world. AI engines are widely used now to work out translation so that people from different countries can communicate. There are many other ways they can assist people.

### 3.5 I can discuss the ways robots and AI might harm the world

Learners will discuss the negatives of these technologies

### Additional information and guidance

At the end of the day, robots are AI, however sophisticated, are still basic instruction boxes and if the instructions are wrong, then serious consequences can happen. Some home based AI devices are now believed to be used for spying on us and being used to transmit secret details about us for fraud or other crime. In the news recently (February 2018) there have been AI systems used to hijack people’s home computers to mine cryptocurrencies. Other harms, perhaps discussed earlier as well, are more social in nature. Some analysts believe that robots and AI will replace up to 50% of current occupations. There will be other careers created in maths and engineering, but that means most jobs are not safe. Many of these are skilled jobs in law, journalism or accountancy. What will happen to those of us who are no longer required?



**Links**
[1] https://en.wikipedia.org/wiki/Robot_Operating_System
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[3] https://en.wikipedia.org/wiki/Applications_of_artificial_intelligence