RM® MechRC™ suggestion sheet 01

Pupils can easy relate to a humanoid robot and create real life actions using the software and on screen robot. There is a host of ready made movements that pupils can try out or adapt. Or they could be inspired to create their own. This can then be downloaded to ED-E to see the action in 'real' life. RM MechRC gives a perfect balance to remote control, computer control, programming and modelling.

Physics

The RM MechRC has applications for teaching the concepts of centre of gravity, inertia and the physics of complex movement through modelling and experimentation. Modelling complex movement, such as the mechanics of walking and other general body movements is difficult without the use of a computer due to the many variables.

In addition to the location of pivots in a complex system, stability under the force of gravity and the inertia due to the mass of the individual moving parts need to be considered.

The alternative to using Newton's laws and inserting all the variables into differential equations and trying to solve them, is to use a virtual environment to simulate the motion and then execute the same motion via ED-E in the real world.

Suggested investigations:

- Get ED-E to stand on one leg
- Observation of delay times for actual and virtual movement – can they synchronise?
- The physics of walking – how does ED-E balance in between strides? What is the optimum stride? How fast can it walk?
- Investigating forces at work in complex movement

Biology

The RM MechRC provides a stimulating way to introduce the topics of joints, body movements and the skeleton in a fun and engaging way.

Suggested investigations:

- Run the ready made dance routine and simple moves to compare the servo motors to our joints. What are the similarities and what can ED-E do that we cannot?
- Run the handstand move and crane to show some complex moves. How does our body movements compare? What similarities are there between ED-E and us? Discuss the area of 'feedback' and that ED-E and humans both feedback to our brains / programs.

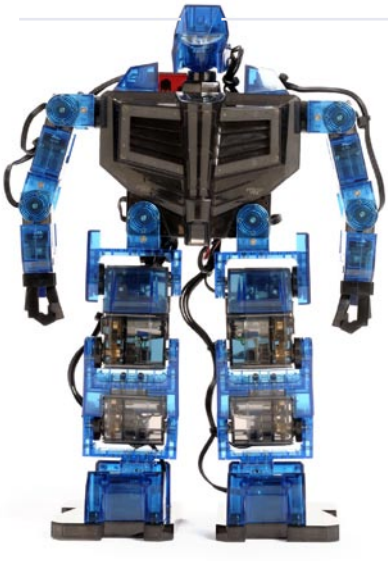
RM® MechRC™ suggestion sheet 02

Programming

With 17 servo motors there is plenty of opportunity to introduce outputs and provide numerous extension activities. The key to progressing in this area is to keep the movements and activities simple. Pupils first learn that devices can be controlled through direct instructions and, in the case of the RM MechRC, the remote control. Pupils then develop their experiences by learning to program a servo and then several servos using the RM MechRC Animator software.

Suggested investigations:

- Get ED-E to lift one arm. Now try that with one leg. Does it work, discuss why?
- Try standing on one leg. What do you have to do to stop falling over? Explain that we move our trunk above the standing leg to compensate.
- Point out that two servos are needed to make ED-E balance. Which two? Discuss how the centre of gravity needs to change.
- Get ED-E to bow. Compare the bow to real life. What happened on screen compared with the real robot? Did the pupils program cause ED-E to fall over? Why did this happen? Discuss with pupils the difference between modelling on screen and real actions
- Put together a short routine where ED-E uses more than 3 servos at any one time



Media Studies / Story Telling

As part of Media Studies pupils have to story board their productions. This is ideal for the RM MechRC with it's storyboard animator software. With the advent of 'Chroma Key' filming pupils can place their props in any location and gives an excellent opportunity to use the RM MechRC creatively within different contexts.

Suggested Projects:

- Create a moonwalk dance using the RM MechRC Animator software and film using 'Chroma Key'. Take 3 edits and combine these in a multi-camera approach
- Create a dance video similar to Peter Gabriel's Sledgehammer. Using different back drops with the robot centred

Engineering / Robotics

RM MechRC provides pupils with an opportunity to investigate pre-built robotic applications especially looking at accurate servo motors. Robotics forms an increasingly important part of manufacturing assembly processes. Robots are also used in hazardous working environments and the RM MechRC can be used to demonstrate such systems in action.

Suggested investigations:

- Investigate how servo motors work. Are they accurate? Where are they used in industry?
- Use the RM MechRC Animator software to move ED-E live. How responsive is the connection? Explain that factory floor robots are programmed this way
- Get ED-E to pick up a box off the floor and lift it up onto a small table. The box will need to be open and lying sideways in order for ED-E to pick it up
- What issues were there using the software to program the ED-E? How could it be improved?

RM® MechRC™ suggestion sheet

03

Dance

The RM MechRC is ideally suited for investigating the area of Dance, especially choreography. With 17 servo motors ED-E can mimic the human form more effectively than any other robot currently in the education market. Discussion points will arise from the movement of joints, transfer of weight to gravity and timings. Pupils can even download 90 seconds of their favourite music onto ED-E to use within their dance.

Suggested investigations:

- Learn how to move ED-E
- Learn how gravity is important in movement
- Perform a dance using the pre-made dancemoves supplied in the software
- Create user's own dance moves using the software and controller
- Upload and use custom music to perform a dance

Design Technology / Electronics

While ED-E comes pre-assembled, there are opportunities for pupils to develop their own hardware add-ons and to expand their knowledge and understanding of systems and control.

By adding additional components pupils can increase the DT capability of the RM MechRC. Students can add extra servos (sold separately) as well as simple sensors that they build themselves. That opens the RM MechRC up to final projects or after school clubs and competitions.

Suggested projects:

- Build a robot gripper
- Build sensors to detect when ED-E has fallen over (and automatically right itself)
- Build an infrared "laser gun" system
- Build a gorilla (extra servo in each arm with hook hands)

Mathematics:

Every joint in ED-E is controlled by angles creating opportunities in mathematics in the areas of geometry and shape and space. The following geometrical problems can make mathematic sessions much more engaging:

- Forces and angles
- ED-E's legs form a parallelogram when the robot shifts it weight over each foot allowing some complex investigations of the relationships of joint angles
- Forward kinematics. If the servos are set to specific angles, where will the hand be?
- Inverse kinematics. If I want the hand to be in a particular place, what angles do the servos need to be at?