ROBOT DUCK

TEACHER/TUTOR NOTES & WORKSHEETS

The project will take probably two or three sessions for assembly and test.

BACKGROUND

The following are suggested topics for introduction and discussion:

- **Walking movement**
- **Motors** – DC type using battery and permanent magnet field
  - movement can be reversed by changing connections (polarity)
- **Worm and wheel**
  - large reduction in speed from input to output – input speed from motor, output seed from gear wheel and shaft.
  - ratio of number of teeth on gearwheel to number of threads or 'starts' on worm, in this case 42 teeth to 1 start, reduction ratio 42:1 but large increase in turning force (torque).
  - try stopping the motor by hand, then try the gear wheel shaft.
- **Conversion of rotary motion to linear motion by use of a crank.**
  - the crank was invented in early days of steam engines to convert piston in cylinder movement to wheel/shaft rotation via a connecting rod.
  - for our duck the rotation of the shaft is converted to "up and down" motion of the duck`s legs with cranks. The duck legs or connecting rods go through and pivot about the base-plate making the feet swing forward and back as well as up and down
  - this movement provides the walking action. It can walk "forwards" or "backwards" by changing the direction of rotation of the shaft.

Getting the best walking

- Experiment with the position of the feet on the leg.
- The walking surface is important – too slippery a surface does not help, try sticking Blutak or Plasticene to the feet to get a better grip. Velcro might be good for getting a better unidirectional grip.
- The plastic tube provides a third support for the duck and also helps or hinders with the walking depending on whether it is bent back or forward.
- Adjustment of the feet and plastic tube position will ensure that the duck walks in a straight line. Changing the angle between the opposite cranks can have this effect too.
- For fun a thick paper picture of a duck or local celebrity such as the teacher or a footballer can be attached to the base.

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Session 1:

Blackboard

Mechanised walking – why is it important ?

Joint movements in walking – see internet links below for skeleton walking

http://svs.gsfc.nasa.gov/vis/a000000/a000000/a000093/

http://www.senteacher.org/FileDetails/22/Skeleton.xhtml

Practical

Check the parts – illustrated list in instructions

Note – step 1 is putting the plastic spacer on the gear wheel shaft before snapping it into the clunk-click motor bracket.

Session 2:

Blackboard

Mechanisms – shaft direction (swopping battery connections)

- gears/worm reduction
    - motor alone – high speed, low torque – easy to stop
    - motor with gear wheel shaft – low speed, high torque— cranks
    - Converting circular motion into linear motion (and vice versa)

Practical

Complete assembly of the model and test

Extended activities

Duck races

Making from card a duck silhouette or duck body from papier maché

Investigate Walking Robots on the internet

ROBOT DUCK

WORKSHEET

1. What is a robot? .....

   ……

   ……

2 Give two ways to power and control a robot

   a) …… ……

   b) …… ……

3. How do you change the direction of rotation of the electric motor

   .....

   .....

4. Give three examples of rotation being converted to up and down movement

   a) ……

   b) ……

   c) ……

5. Give three examples of up and down movement being converted to rotation

   .a) .....

   b) .....

   c) ……

6. Give two examples of robots being used at home

   a) .....

   b) ……

7. Write a story on the other side of this page about a robot which went out of control.