PICAXE

CODING instructs a computer to perform certain functions. This process now seen as an important skill that should be learnt by all students.

When programming students learn:
- Sequencing
- To break up big problems into smaller manageable steps
- Debugging - identify and correct errors in the code

INTRODUCING PICAXE

What is a Microcontroller?
A microcontroller is a computer that is part of a single integrated circuit. It contains memory, programmable input/output peripherals as well as a processor. They are used in controlled devices such as mobile phones, cameras, microwave ovens, etc.

There are various components that can be used for programming e.g. Arduino, and Raspberry pi. Scorpio projects use Picaxe due to the ease of use and affordability.

Picaxe chips are low cost and allow students to explore the world of coding (programming) and project design.

The manufacturer of Picaxe provides access to programming software and development tools provided for free from the Picaxe website. In addition there are a number of other free design tools to assist the student with their design and coding work.

Picaxe chips are ideal as powerful learning tools allowing students to make a wide range of projects with a minimal amount of components. This makes them an affordable alternative for schools looking to get into STEM.

Picaxes have input pins, output pins and some pins that can be configured to be either an input or an output.

INPUTS can be any of the following, an LDR, Thermistor, Ultrasonic Detector, IR TV Remote, Switch or Microphone. Some of these devices can be connected directly to an input (such as LDRs, switches and Thermistors) while others need extra circuitry to enable them to work (such as microphones and IR detectors).

OUTPUTS can include the LEDs, DC Motors, Servo Motors, Stepper Motors, Piezo Speaker, Relay, Solenoid, 7Segment Display, Dot Matrix Display, Globe, Liquid Crystal Display, loudspeakers and Globes. Some of these components can connect directly to the Picaxe outputs (LEDs, Piezo Speaker) while others need a Transistor or Mosfet driver to operate them (DC Motors, Solenoids, Loudspeakers).

Scorpio Technology's range includes a number of Picaxe controlled projects, including **Pat's 14M2 Microcontroller** and various Add-on projects, an **Electronic dice**, **Beepa** (an electronics project kit), **Dizzy**, **Beetle** and the **Controller** kit.

PAT'S 14M MICROCONTROLLER
Pat's Microcontroller is a Picaxe controlled microcontroller. It is designed to be assembled and then programmed by the students, who can then modify the programme to expand their knowledge of programming.
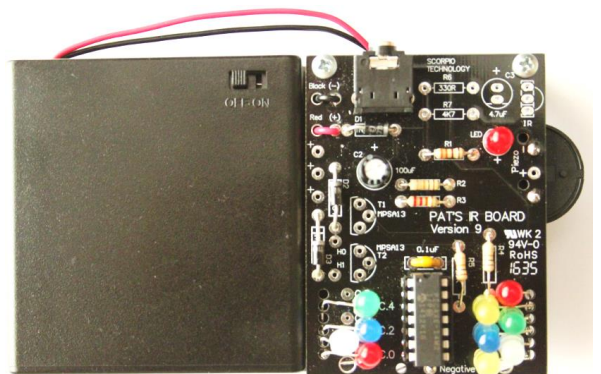
The base kit contains the components to make a "10 Lights and 12 Tunes" project:

- The Microcontroller PCB and components
- 10 LEDs and a Piezo sounder

NOTE: the basic kit does not include motor drivers or infra-red control, although the components required for these can be soldered onto the microcontroller if desired. The microcontroller can also be used – without the LEDs or Piezo sounder – to control a number of Add On projects, or to control a project of the students devising. However, if the students will be making the "10 Lights and 12 Tunes" project, and then re-using the microcontroller for another project, we suggest that:

- the 10 LEDs be mounted on a light tower or in a different way, but not on the PCB
- either pins or connector blocks and wires are used, to avoid having to unsolder components from the PCB.

PROGRAMMING PAT'S 14M MICROCONTROLLER

Before the students start making the project, you can (after going through the basics about electronics) cover the theory of how Microcontrollers work.

Picaxe also has the advantage that it can be programmed by coding (i.e. writing a programme), using a flow chart or by using BLOCKLY, so the students can see different ways of programming their project.

ADD ON PROJECTS

While the microcontroller on its own is an electronics project, some of the Add On projects provide a mechanical element, for example the Hexapod and the Robot Buggy.

The addition of these allows you introduce additional subjects that students can learn about and research. Some ideas are:

- The use of acrylic or plywood for the bodies, reason for use / preference, advantages / disadvantages, suitable adhesives etc.
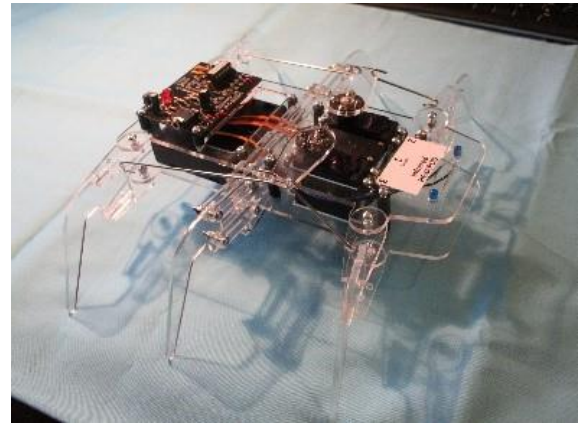
Hexapod

- The use of servo motors (used in the Hexapod), how they work, how they differ from normal (rotational) motors (as used in the Robot Buggy) etc.

- Why the servo motors do not require motor driver components, but the Robot Buggy's motors do.

Robot Buggy

REFERENCES:

- https://www.fractuslearning.com/2014/05/15/kids-should-learn-to-code/

Scorpio would like to hear about any projects you or your students develop using Pats IR Picaxe Board or any other Picaxe projects. Let your work stimulate others!

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