# Educational robots for teaching programming

## Aims and Objectives

The aim of this project is to produce the software to integrate the popular robotics platform the Thymio II with the open source scratch environment. One objective of this project is to make use of the scratch API so scratch can be used to program robotic platforms. Another objective is to create a simple, quick and user friendly way for robots to programmed so that people new to programming will be able to learn with it. Finally an objective is to make use of the Thymio II robot to show users the result of their programming.

## Background

Programming and computer skills are becoming increasingly important as the influence of the internet and the power of computers grow, programming has even been called the 'second literacy'. Despite this there are still significant barriers to education in this field and few attempts to integrate it in to other computer related topics. This project will use the language Scratch and the Thymio II as they have both been shown to be good at introducing people to the topic of programming and robots as well as maintaining interest and creating enthusiasm.

Scratch is a language developed at MIT which has been used in education with broad success. Scratch allows for the use of most programming concept without requiring the user to be aware of syntax through the use of blocks. As well as being easy to use it is also free to use and has a large community with a wide range of users from 4 year olds to 60 meaning support can be found relating to the most basic of tasks to complex ones. One study found that during a Harvard Summer School for Computer Science course that 76% of students felt that using scratch as an introduction help them when they later moved on to java, students also found it was more rewarding to have visual feedback on what they had programmed than just having a text window (Malan and Leitner, 2007).

Amongst the reasons why teachers don't accept technology in to the class as readily as they do other tool are stress and fear of failure. Trying to teach something with which you have little experience in can be daunting and trying to learn a new topic can cause stress. Introducing people to scratch has both caused people to be more likely to include programming in lessons and to worry about failing less when they consider education in programming. A study of students learning to become preschool teachers were given a introductory lesson in computer programming and found that interest in using technology in the classroom increased from 80% to 92%. As well as this they found that 65% found scratch easy to use and 85% found it simple and understandable (Fesakis and Kiriaki, 2009).

One challenge facing robotics in education is the price of the platforms and how easy they are to use. The Thymio II can be bought for around £100 which is cheaper than alternatives such as the LEGO Mindstorm while still having most of the feature. Besides the LEGO robot there are few available robotics platforms that are simple enough that they can be used for an introduction to the topic while also being in depth enough that they can perform complex programs. The Thymio II is a capable system and with scratch would mean that it can be easily picked up while still being able to perform some complicated programs. Scratch can create object orientate programs and is seen to have one major limitation which is recursion which has been purposely left out so that beginners would not feel threatened (Harvey, B. and Mönig, J. 2010).

Robots have been used before with other aspects of programming to create courses that have proven to create very enthusiastic students. For example, at the University of Lincoln robotics was taught alongside computer vision, this lead to positive results in practical and some students going far beyond the brief of their assignments. (Cielniak, Bellotto and Duckett, 2013), this suggests that enthusiasm can be created with practical assignments using robots.

The Thymio II is a programmable robot with a wide variety of sensors and methods for feedback. It has 2 wheels for movement, a speaker for audio output and several light, some of which are programmable and others which indicate the feedback from the distance sensors. There are 9 distance sensors to prevent it from falling off objects and to detect thing in front or behind it. It also has a 3 axis accelerometer, a microphone and an infrared sensor for remote input. With all these feature the Thymio II is well suited to education as it can be applied to a lot of situations. The Thymio II is the result of testing amongst children with the Thymio I. After running courses with the Thymio 89.2% of parents thought the session was educational and 78.5% thought that it had increased their child's interest in robotics (Riedo, F., Rétornaz, P., Bergeron, L., Nyffeler, N., and Mondada, F. 2012)

## References

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