# Arm Mega:Bit Client Meeting Tuesday 1st May

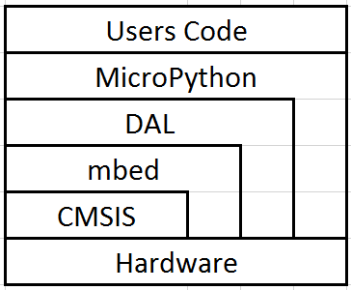
We went to the British Computing Society and met with Jonny Austin from Arm, a senior lecturer from Lancaster University and two other members of the micro:bit foundation.

## Problem

The project goal is to make a teaching aid for schools to help with incorporating micro:bits into computing lessons. The ideal scenario is that the students program their micro:bits individually and then in order to demonstrate their work, they plug their device into the teaching unit which then replicates the code on a larger scale for the whole class to see.

## The Micro:Bit

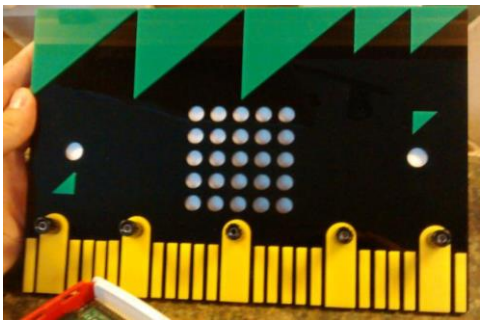
The micro:bit is a small microprocessor with on board peripherals. It uses a nRF51 processor and has a Bluetooth radio, RF radio, magnetometer, accelerometer, GPIO pins, 2 buttons and a 5x5 LED matrix.




The figure to the left shows the code structure graphically. There are several levels to translate the user code down to the hardware level. Each 'sits' on top of the next and is procedurally stepped down to the hardware control. However, in some cases mbed, DAL and MicroPython can access the hardware directly.

## Discussed Solutions

### Prototype



The picture to the left shows the prototype mega:bit in construction. It provides banana connectors at the bottom which are connected to the micro:bits edge connector, two buttons which work off the edge connector and an LED matrix. As this is a prototype the LED matrix is soldered directly to the micro:bit matrix. The micro:bit uses its own sensors and simply drives the extended peripherals on the simple mega:bit. The issue with this is the soldering, you cannot simply plug a micro:bit into it.

### Accessibility Pin

One of the GPIO pins is a 'reserved accessibility pin', we discussed possibly running the larger LED matrix from this pin however the details of this were not discussed.

### I2C

Like the accessibility pin, the larger LED matrix could be controlled via the I2C bus. There were concerns with this idea and whether the important timing requirements of the I2C communication would interfere with that of the Bluetooth and RF radios. A solution to this issue would be to remove functionality for interrupts and force the user to write code linearly. This is not ideal as interrupts are a foundation to more complex code and an important learning point for students.

## USB

We had a general discussion about the USB port and whether this could provide two way communication to control the Mega:bit or possibly to 'clone' the code onto the mega:bit. Further research on the viability of this needs to be done.

## Trade-offs

We then discussed that as with any engineering project, compromises must be made to make a working product. This is okay but if trade-offs are necessary they must be communicated to the teacher simply and easily.

## Discussion

Further points were raised on the project. The mega:bit would be useful for teachers to assist in their lessons, this means at least one mega:bit would go to each school involved in the project. This means mass production must be considered in our designs. Our initial target would be 5000 units but in reality, it would be many more. One solutions to this would be to produce the mega:bit simply from PCB material like the micro:bit. This means a large majority of the production is automated by the circuit board manufacturer.

If the mega:bit uses the plugged in micro:bit's sensors, the orientation of both must be aligned since otherwise the accelerometer and magnetometer data would be skewed.

An additional feature to help teachers would be to have a second LED matrix on the back of the mega:bit so when holding it up, the teacher can see what the students are seeing.

The client briefly mentioned adding haptic feedback for the visually impaired who cannot see the LED matrix. Further investigation must be done here into the demand for this.

If the mega:bit has Bluetooth or RF radios on it, further certification is required and this takes time and money so is ideally avoided.

## Conclusion

In conclusion the project is interesting in that there are both very simple and very complicated solutions. The primary points taken away from the meeting and to keep in mind are:

1. Certification
2. Manufacturing
3. Firmware complexity
4. Usability
5. Cost (not so bad)
6. Transparency
7. Existing accessibility API
8. Compass
9. Ease of use
10. Haptic feedback versions?

It was agreed we would have weekly check-in sessions so the client could monitor our progress. Help and information is available from the project slack channel which we will join.

Further details on the specifics of the hardware and software are available at: tech.microbit.org