**Implementing UCard (RFID) scanning functionality:**

In order to confirm the correct individual is using the chair, the student will need to scan their UCard upon arrival. The UCard acts as an RFID (Radio Frequency Identification Device) and its unique identifier is compared with the ID sent from the web app. If the ID sent from the web app matches the ID scanned, then the student has been successfully authenticated and can begin using the desk.

Reading the ID within the UCard would be achieved using an external RFID reader. The module chosen to achieve this was the MFRC522. The MFRC522 is a highly integrated reader/writer IC for contactless communication at 13.56 MHz. This board is manufactured by NXP but can be purchased from the M5Stack store in an enclosure that connects to the stack’s 4-pin ‘GROVE’ connector. As the delivery times from the online store were large, the standalone MFRC522 board was purchased from eBay, this unit did not include a GROVE interface however. This module was therefore connected to the stack’s I/O bus via jump cables:

The MFRC522 supports two communication protocols to communicate with the stack, I2C (Inter-Integrated Circuit) and SPO (Serial Peripheral Interface). I2C is sometimes preferred over SPI because it allows for multiple ‘slave’ devices to communicate with multiple ‘masters’ (the stack in this case) using only two lines. One to transmit the data (SDA) and one to carry a synchronising clock signal (SCL). As there are only two lines, I2C requires each slave to be addressed and this is reflected in the MFRC522 object within the source code where the constructor requires an address to be provided when I2C mode is utilised:

*MFRC522(byte chipAddress);*

SPI offers faster data rates compared to I2C however needs at least 4 lines to be utilised, a Clock (SCK), a line to transfer data from the CPU to the peripheral MOSI, a line to transfer data from the peripheral back to the CPU (MISO) and a chip select line (CS) to select the peripheral in question (hence many more lines may be needed for multiple devices).

Unfortunately, we were unable to get the MFRC522 to interface with the stack, using either of these connection protocols. This may have been due to the fact that eBay bought MFRC522’s can often be faulty.

