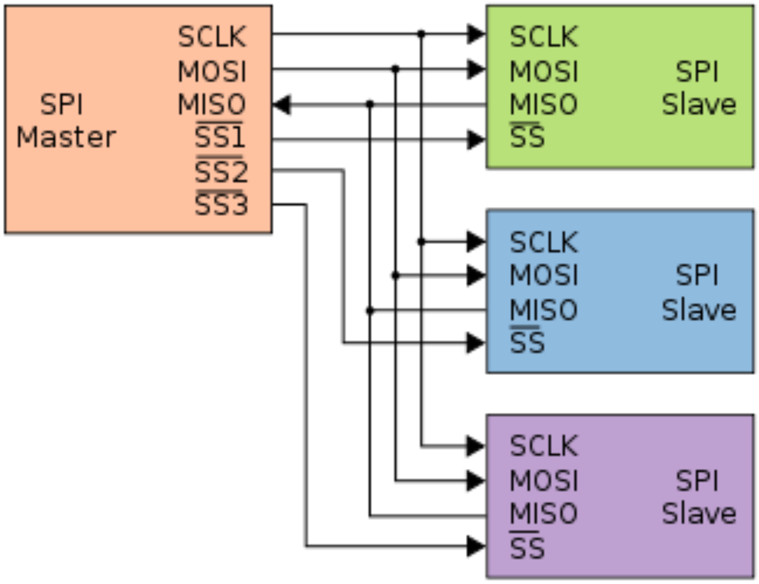
HARDWARE RESEARCH

ARDUINO AND RFID

An Arduino device, which is our current solution for a way to handle and process RFID inputs, cannot run a Unity application. We should still consider purchasing one to handle RFID processing.

It seems like Unity *could* build for a Raspberry Pi; a Raspberry Pi could also be used to handle the RFID input. However, I think it's best to have and use two separate devices for handling the RFID and running the Unity application. This would let us swap in and out the device running the Unity application. We would want this because there are a number of caveats that come with trying to build a Unity application for a Raspberry Pi—critically, Unity basically only supports x86 builds.

It seems like we should use an Arduino Mega due to its greater number of pins compared to the Arduino Uno. The RC522 RFID Reader appears to be the only/main/most popular option. I think that it uses the Serial Peripheral Interface (SPI) to connect to the Arduino, which uses 4 lines to connect. Each SPI device needs its own SS line, but I believe that the MOSI and MISO lines can be shared, and the clock definitely can. We should increase the number of RFID scanners in the device from 5 to 10; this will allow children the space to experiment with concepts such as verb tenses. RFID tags are cheap and easy to source; we can secure 80, which gives us enough for every letter and duplicates.



RASPBERRY PI/ALTERNATIVES AND DISPLAY

As I mentioned above, a Raspberry Pi could run a Unity application in theory. It's possible that our application does not require incredible performance and runs fine despite not being a native ARM build; it's also possible to try and build for Android or WebGL, or use Box64. In any case, we should consider the Raspberry Pi 4 or older, as the new Raspberry Pi 5 is more expensive and we would likely be leaving a lot of performance overhead.

There are some x86 single board computers as well, such as the UP 7000; however, these are not cheap. Buying and attempting to use a Raspberry Pi would be the best course of action; if we pursue this and fail, the application could also be built to run on an external x86 device (i.e. an x86 laptop) that outputs to the display in the table. Both boards, and obviously a computer, can connect to the internet—we will need this for our API calls.

I am not sure how to find a display that could be set into the desk (i.e. a display that isn’t a monitor). I am confident that this would not be particularly expensive relative to the rest of the materials.

TANGIBLE MATERIALS

Wooden alphabet blocks range in price; we should consider that we may need multiple sets due to repeating letters used in the creation of many words. It should also be easy to read the letter on the block (high visual contrast) and there should be as little other decoration or material on the other sides of the blocks as possible to prevent children from placing the blocks on the scanners incorrectly.

We also need a housing/assembly to make this a full standalone device. We are thinking that a wooden wedge-shaped desk would be the best design for SpellCraft, as it could house the two boards and provide a way for children to see the display without having to look too far down. It could be placed on top of a table or other surface, or be used on the ground. The area where the scanners are housed could be recessed to hold the blocks in place, with raised edges in between the scanners to prevent blocks from sliding left and right.

HARDWARE PROPOSAL/BILL OF MATERIALS

ARDUINO AND RFID

- Arduino Mega 2560 Rev3—$48.40
- RC522 RFID Scanners (5 Pack)—$15.99 * 2
- 13.56 MHz RFID Stickers (50 Pack)—$14.98 * 2

RASPBERRY PI & DISPLAY

- Raspberry Pi 4 Model B (2GB RAM)—$45.00
    - 64GB MicroSD Card—$9.98
    - USB-C Power Supply—$8.00
- 7-inch display—$62.99

TANGIBLE MATERIALS

- Wooden Alphabet Blocks—$15.19 * 3
- Wood for Desk
    - Unclear; I have a design that I would like to review. It’s less complicated than the ZenFLOW Desk, so I’m hoping that we can actually create it.