Automated Locker

Final Presentation

The Problem

The lockers at Alden High School are prone to jamming and the reassignment process is tedious

Priorities

- Minimal modification to existing lockers for easy mass installment
- Keep the existing combination lock/master key system
- Maintain a high level of security
- Simple and quick access to each lockers contents

Our Findings

Jamming:

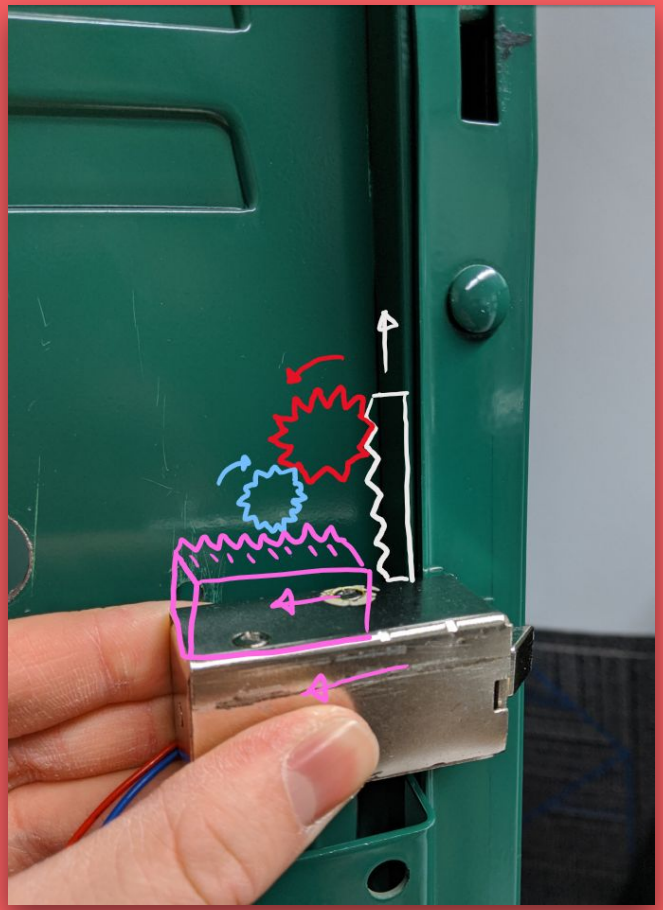
- The lockers jammed due to a vertical shifting latch
- When contents were piled into the locker, they would rest on the latch causing it to be unable to move
- Some shelvings students put into their lockers also collided with the latch

Reassignment:

- Students keep the same locker for all four years of high school
- Incoming freshman must be assigned new lockers with the combination
- Issues arise when students forget combinations or have trouble entering them

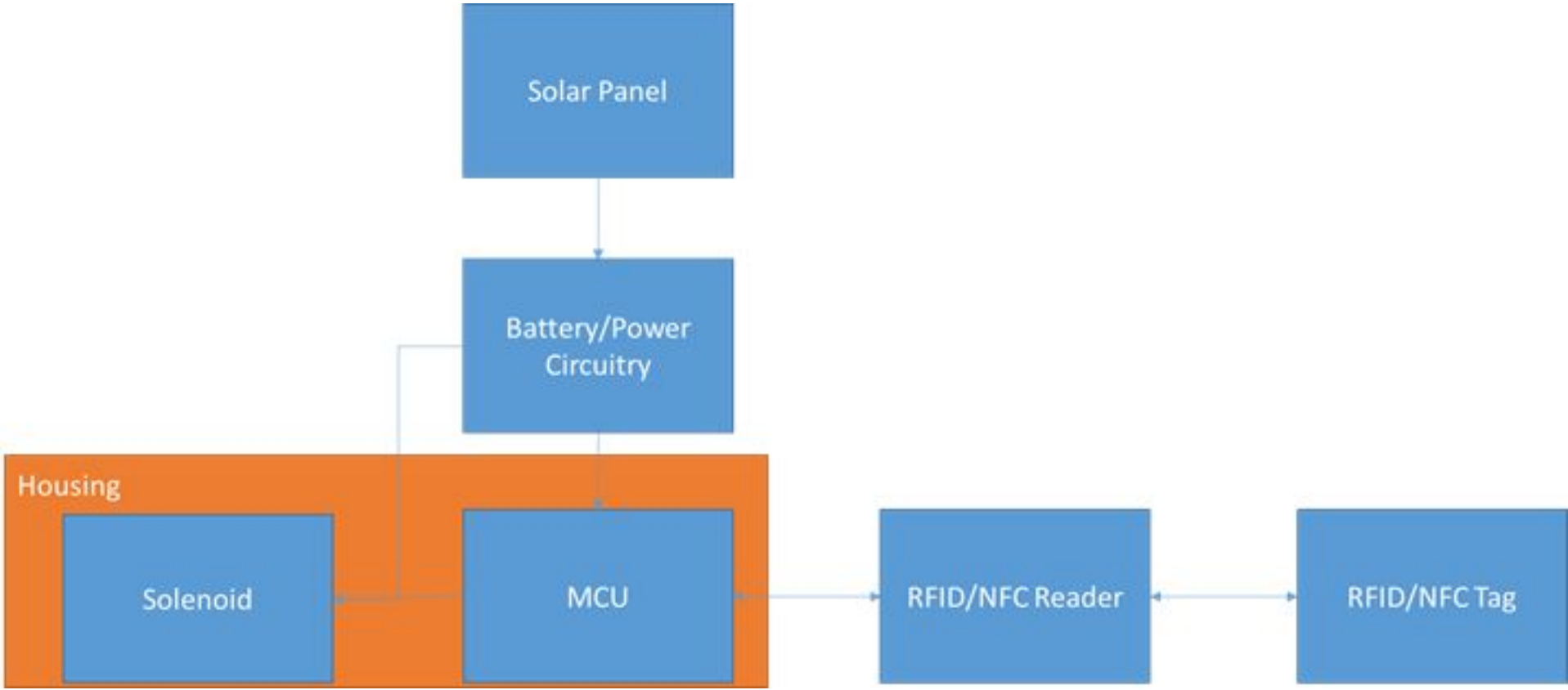
Initial Concept Design

- Arduino Uno Controller
- NFC Reader
- Horizontally Shifting Solenoid



Our Solution

- Arduino Controlled
- NFC Tag Reader
- Electrical Solenoid Latch
- Administrative tags for emergency access and reassignment
- Solar panel to slowly recharge internal power supply


Solar Panel
Battery/Power Circuitry
Housing
Solenoid
MCU
RFID/NFC Reader
RFID/NFC Tag

Why We Chose this Design...

- NFC
  - Highly secure and reliable
- Arduino
  - Fast to develop for and cheap to manufacture
- Solenoid Latch
  - Low power and will not jam
- Solar Panel
  - Lockers do not have access to power

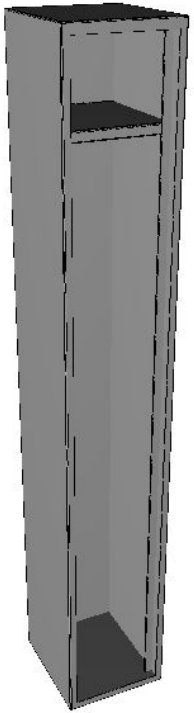
How It Works Everyday

1. The student scans their assigned tag
2. If the key was valid, the locker opens and its contents are available

How It Works For Reassignment

1. The faculty member scans a clear tag to wipe all previously registered tags
2. The faculty member scans a registrar tag
3. The LED indicates the locker is in ‘Registration Mode’
4. The student scans their new tag
5. The new tags ID is saved in the Arduino’s memory as a registered tag
6. The student can now scan their tag to access their locker

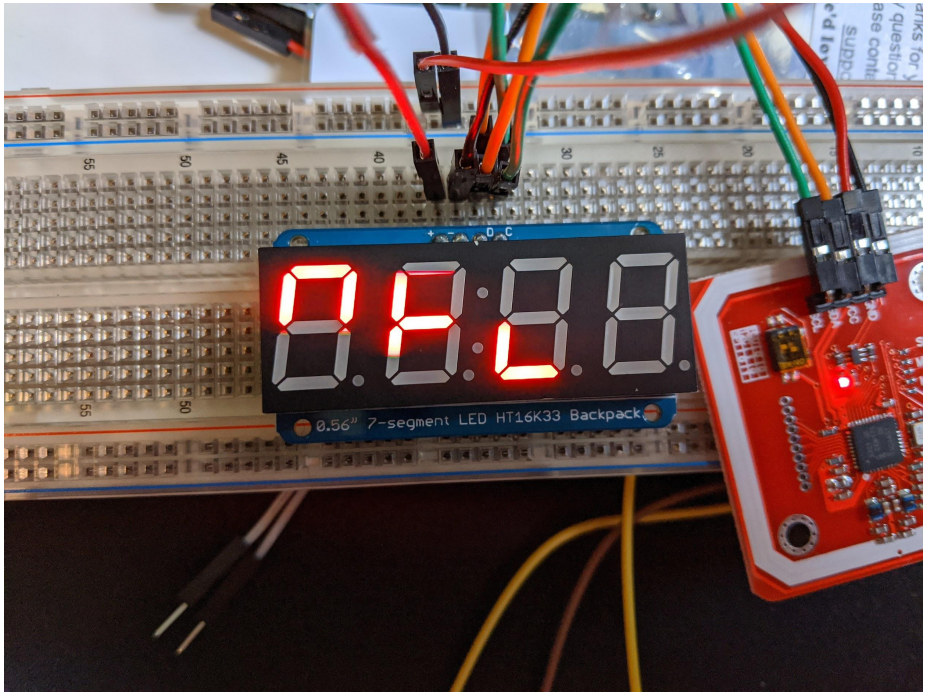
Locker Models



STL files provided by Matthew Derenda, a student at Alden High School

Testing

- The NFC Locker Module
- The NFC Batch Tag Writer



Results

- Authentication with NFC UID is an efficient and robust way of accessing lockers
- Registering new tags was simple and quick with the reassignment tag method
- Smart devices created new UID for each scan, making it difficult for authentication

Problems Encountered

- Smart Phones have a different unique identifier(UID) every time it’s tapped on the NFC reader.
- Apps for iPhones have very limited access to NFC capabilities
- Losing the Admin Tag will lead to the whole system being compromised.
- Solar panels will not gather the same amount of power in different hallways
- Power efficiency to maximize the time in between battery swaps

Looking Forward

- We can look into handling payloads or handling dynamic UIDs to allow the use of smartphones for authentication using nfc.
- Look into other power delivery system that can support our system.

Questions?