

Automated Locker

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1 Introduction

A locker from Depew High School/Middle School was modified in order to suit student's needs. We came up with an electronic mechanism, which will unlock and lock when the correct key is scanned by a RFID, a radio based frequency identifier. This system will allow the user to unlock the locker in a way which minimum effort is needed. We also included a mechanical override key just in case if something goes wrong

2 Disclaimer

This design document solely emphasizes on design. For troubleshooting and any other inquiries, refer to the user manual, or the required documentations.

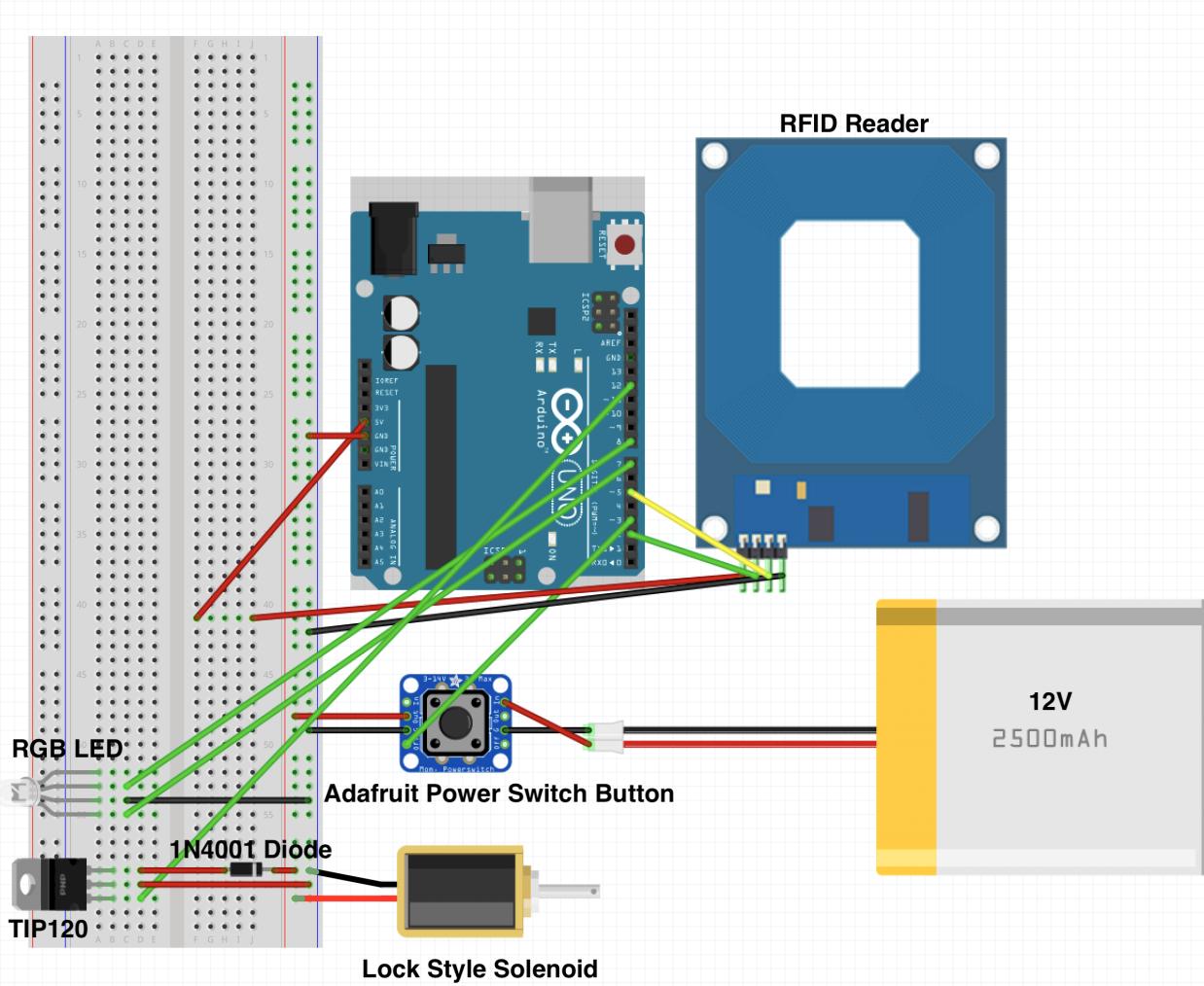
3 Complete Parts List

- Lock Style Solenoid 12VDC
- Arduino UNO R3
- RFID Card Reader - Serial
- RFID 50mm Round Tag x5
- Push Button Power Switch Breakout
- Diode Rectifier 1N4001
- TIP102 or TIP120 Transistor
- LED RGB Diffused
- Dewalt 12V Lithium Ion Battery
- Dewalt 12v to 20v Lithium Ion Battery charger
- 220 Ohm Resistors
- Some double sided 3M adhesive tape, super glue, and hot glue.
- Door handle

NOTE: ONLY DEWALT BATTERIES ARE SUPPORTED

4 Electronic Bits

4.1 The Circuitry



Circuitry for routing the lock style solenoid is on Adafruit's website [1].

4.2 Wire Color Designations

- RED: 12V (Active) and Arduino 5V
- GREEN: Signal (0 or 1)
- BLACK: Ground GND
- YELLOW: RFID Serial Read

4.3 Circuit Description

There are 4 components that are connected to the Arduino.

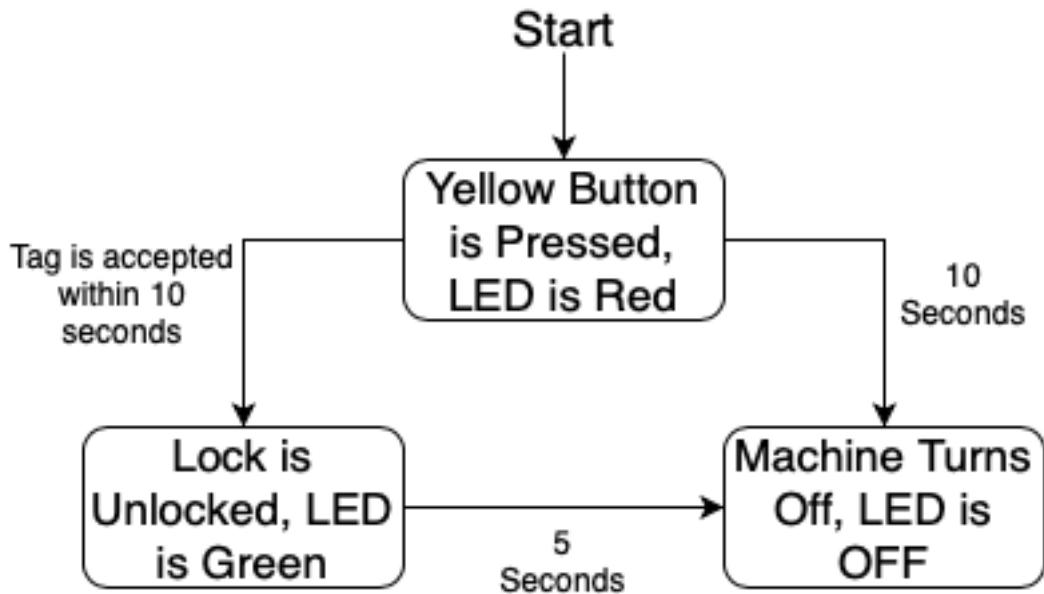
- Adafruit Momentary Power Switch: 12V from battery goes to IN and (-) goes to G. Then goes out to power the circuit with G and OUT. OFF is a signal send from the Arduino to turn it off.
- RGB LED: Shines RED signaling ON, but locked. GREEN means unlocked.
- TIP120: PNP transistor that controls the operation of the solenoid, with the BASE of the transistor connected to PIN 12 on the Arduino.
- RFID Reader: Having the ENABLE pin connected to 2 and SERIAL pin to 5, it sends out signals to ready the RFID reader to read tags.

5 Software

Our clients wanted fix keys. So we have 5 set keys for each Arduino. The source code can be found here: LockerCode in [2]. All coding was done in the Arduino IDE. LockerCode.ino is our main code. The other one, addKeys.ino has the sole purpose of reading keys and printing out the RFID tag value on the serial monitor. To add or delete keys, go into the main code, and in the section of defining key values, you add or delete keys there. This is not user accessible.

5.1 Architecture Overview

In our main code, it is very simple.

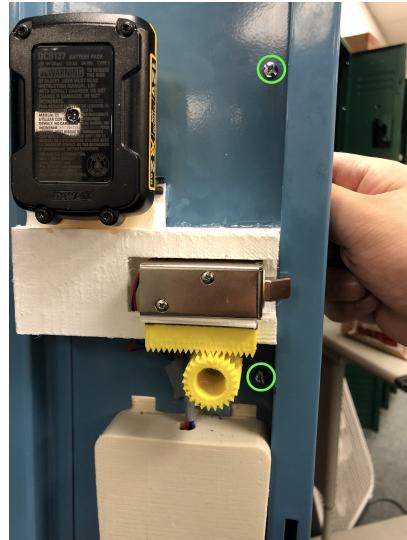


6 Mechanical Design

6.1 The Locker Door

The 3D designs are on the Github folder Locker STL Files in linked referenced [2]. The only modifications we made to the locker was:

- We cut off the older locker interface, as well as deleted the plate
- Drilled 2 holes for the locker handle:



- Drilled a hole for mechanical override key:



The 3D printer hardware design are all shown in the above pictures and are included in the folder Locker STL Files on Github. Everything is held in by super glue and very strong adhesive. The mechanical override key is done by a gear set, which when turned will slide the physical lock. A 90 degree clockwise turn by the key will be enough to unlock it. All the circuitry is held inside the interface box. The lid is held in by friction. To pop open the front lid, use a very sharp and thin knife to pry open in case of some kind of failure.

6.2 3D Printed Parts

In the Github link, there will be a Locker STL Files, which are the 3D models.

- Opening Mechanism: This folder contains the override mechanism, the gear for the locker solenoid and the gear for the mechanical cylindrical key. Also includes the yellow plate for the front of the interface.
- SelfMade Button: This folder only contains the button and the button holder for which if the user or producer wants to use a self made button, or a store bought button.
- LockerSolenoidHolder: This piece is the most important piece where the lock style solenoid is housed, as well as the battery. Mounts inside the locker.
- LockerInterface: This is where all the circuitry lies. Can fit directly into the old locker interface.
- LockerInterfaceLid: This encloses the package, giving it a sleek look. The button and front plate is mounted on this, and closes directly on top of the LockerInterface piece.

7 References

1 : <https://www.adafruit.com/product/1512>

2 : <https://github.com/alexkim1218/CSE453-Automated-Locker/tree/master/>