Laundry Machine Availability Tracker

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Introduction/High-Level Requirements

1.1 Objective

A popular amenity that apartments have is the addition of in unit laundry. Many apartments, however, do not come with in unit laundry and there is usually a communal laundry room that is shared by the apartment's tenants. This is similar to university dorm laundry in which students living in the same dorm share several dorm laundry rooms that they must bring their laundry to. The problem many people encounter with a communal laundry room is finding an available unit when they are sharing with so many others. This can lead to several trips to and from your unit to the laundry room waiting for an available washing unit to open. There is also not an efficient system to manage the who waited the longest other than physically waiting in the laundry room for someone's laundry to finish and claiming it on a first come first serve basis.

Our solution to this problem is an app that users can download which would be connected to each laundry machine unit in the room to track the laundry status. The app will include a queue system so that multiple users can sign up to use the laundry machines in turns. We will also implement a locking system that will lock the lid of the laundry machine until a code is input to an attached keypad. The code will be provided to the user that is currently using the machine and will be changed when the it is the next user's turn. A vibration sensor will be attached to each laundry machine to monitor the status of each machine. When the vibration sensor no longer senses vibrations for a period of time, that signifies that the machine has completed its cycle. The current user will be notified via the app to retrieve their clothes and after a set time the machine will be marked as available. Once a laundry machine is available, the next user will be notified via the app that a machine is available to use.

1.2 Background

Similar solutions have been implemented in universities, and even our own university has a system that tracks washing machine availability [1]. The university laundryview system has a timer for each individual machine in use and also tells the user which machine is available. This system is fine if multiple machines are available at once but the problem arises when only a few or no machines are available. The problem with this system is that it only tracks the status of the machines itself and still relies on a first come first serve basis for who uses the

available unit. From personal experiences living in the university dorms we have seen during busy laundry days in which students would be waiting in the dorm room for the next available unit to open. Impatient users would also take out the laundry if the previous user did not retrieve their clothes in time due to the locks on the machine unlocking automatically once the timer ran out. Our system is an upgrade to the university system since we will have a lock and queue subsystem that puts users in a line for the next available machine guaranteeing them a laundry machine for use once it is their turn.

1.3 High Level Requirements

1. Sensors must be able to tell a user when the washing machine has stopped and when the lid has been opened to remove clothes inside.
2. Locking mechanism must work together with the attached keypad to allow the lid to be opened only when the correct code is put in by the user.
3. Application accurately provides information given by the sensors and allows users to queue up for using the washing machine.

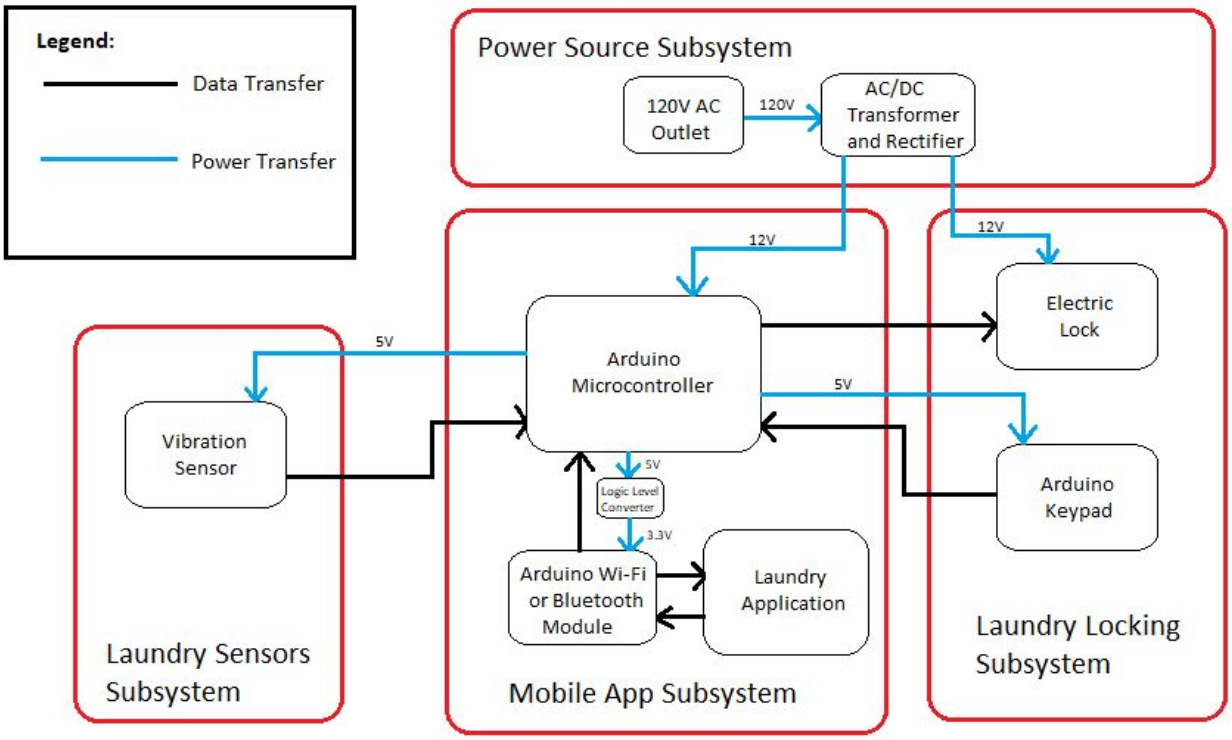

Fig. 1 Block Diagram

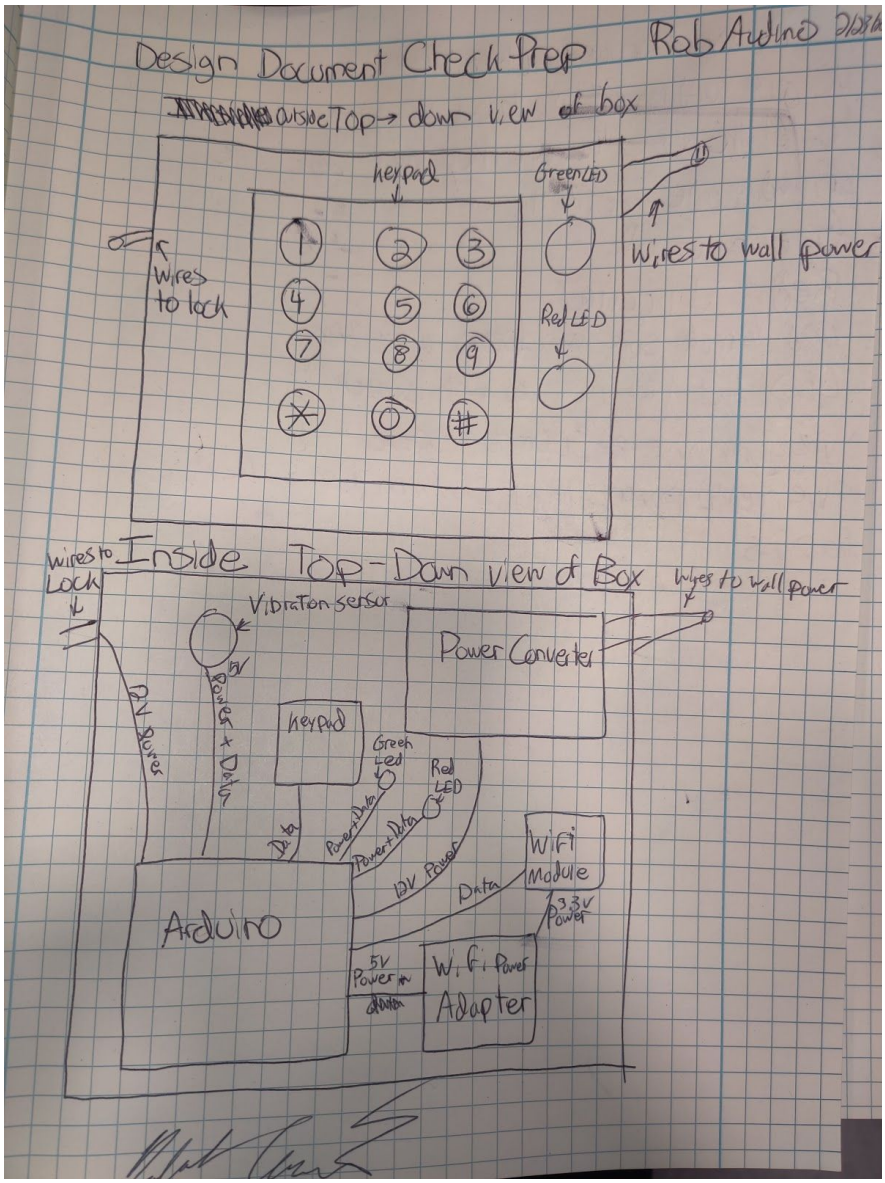
Design Document Check Prep
Rob Arduino
Outside Top → down view of box
keypad
Green LED
Wires to lock
Wires to wall power
Red LED
Inside Top-Down View of Box
wires to Lock
Vibration sensor
Power Converter
keypad
Green Led
Red LED
Power + Data
Data
12V Power
WiFi Module
3.3V Power
Arduino
5V Power in
W. F. Power Adapter

Fig. 2 Processor Box

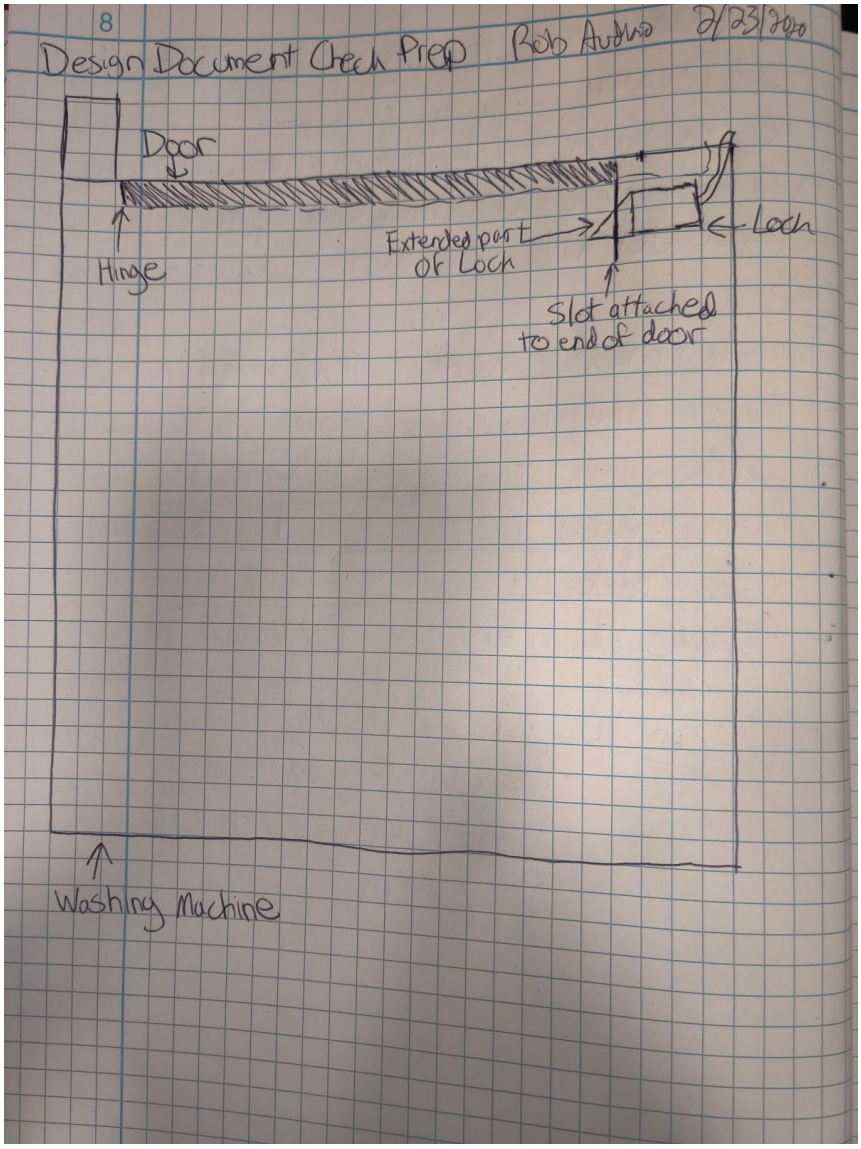

Fig. 3 Washing Machine Locking System

Requirements & Verification Tables

2.3.1 Electric Lock

Requirement	Verification
1. Electronic solenoid lock retracts when continuous 12V input voltage is applied	1. A. Provide 12V to the solenoid lock from power supply B. If lock retracts, part is working as intended.

2.3.2 Keypad

Requirement	Verification
1. Keypad input is correctly read by Arduino	1. A. Write code for Arduino to read the input provided by the keypad into a variable B. Print value of that variable to terminal C. If the value matches what was typed into keypad, keypad input is properly being read by Arduino

Circuit Schematics

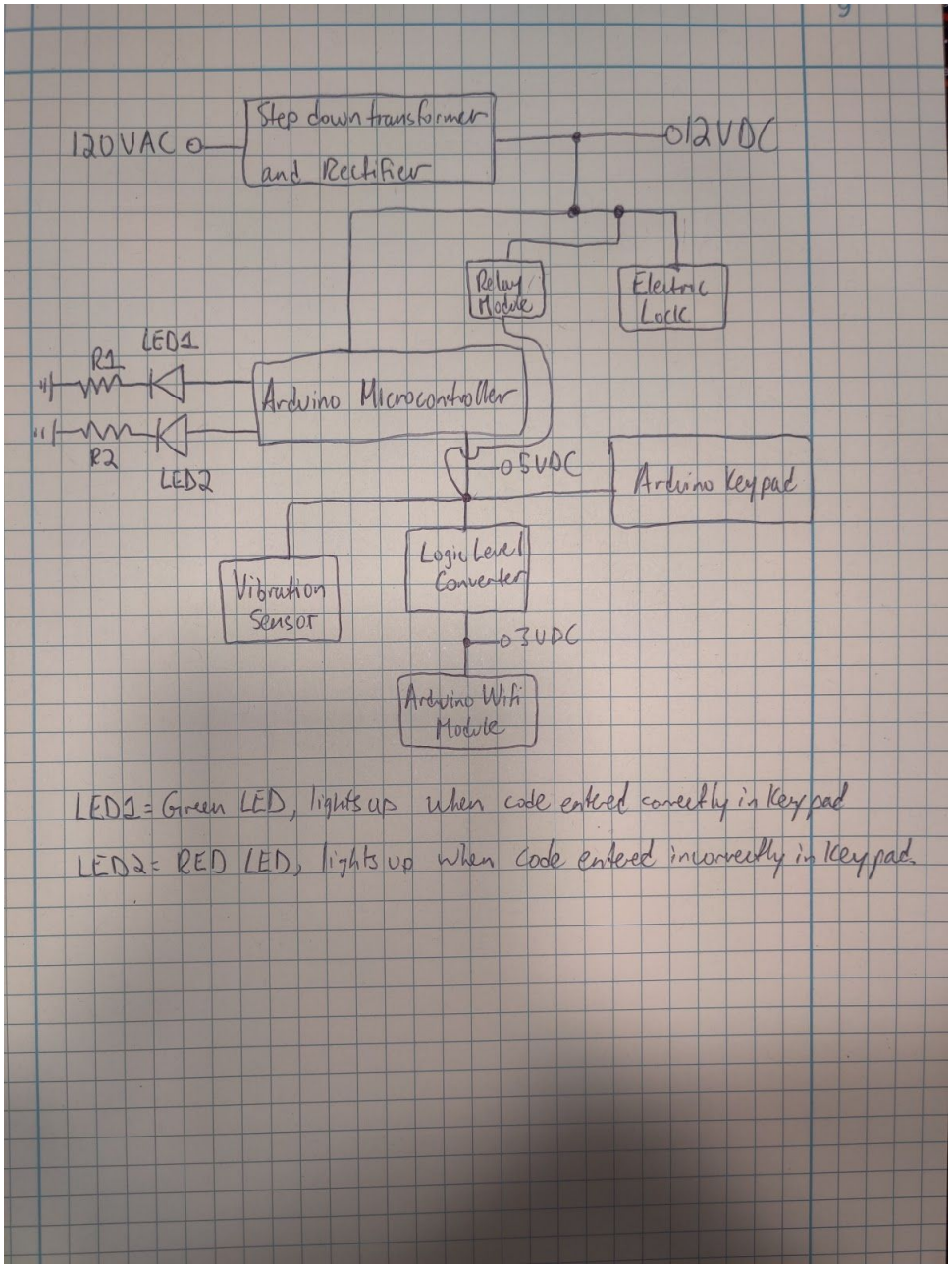

Fig. 4 Power Circuit Schematic

Calculations

Current Draw Calculations:

Transformer Current Provided: 1000 mA

- Arduino Operation Power: 25mA
- Lock Power: 430 mA
- Vibration Sensor Power: 1 mA
- Wifi Module Power: 200 mA

= Spare Current: 344 mA

This spare current will be used up by whatever programs and code we need to run on our arduino to accomplish our design. The spare current will also be consumed by the LED's, so we need to make sure we choose appropriate LED's and associated resistors to limit the current draw. These include interfacing with the keypad, generating new lock combinations, opening and closing the lock, and communication with the app through wifi.

3. Ethics and Safety

Thankfully, the fact that we are working with something as innocuous as laundry machines means that there are relatively few ethical concerns. However, there are still some aspects of our design that could be intentionally abused. First of all, one user could use a single device or multiple devices to reserve the laundry machines for extremely long durations of time, preventing others from moving up in the queue and thereby from using the laundry machines. This could have unintended consequences, such as someone not being able to have clean clothes available for important things like dates, work, interviews, and other important occasions. Someone could also abuse the queue system in order to charge for someone to use laundry, since only the person abusing the system would have the code for the next several hours. Someone with time constraints on doing their laundry would be forced to submit to this abuser, or else not be able to do their laundry.

Despite the lack of ethical concerns, there are some safety issues with our project. Firstly, the user could possibly get their finger lodged in between the washer/dryer door and the locking system. If the user isn't careful, they could also accidentally leave their phone or other valuable electronics or other item in the washer/dryer, and not be able to access the machine to pull it back out in time to save their valuables. In accordance with item 1 of the IEEE Code of Ethics [2], we will make certain that our design "holds paramount the safety, health, and welfare of the public". We will take all precautions to ensure that our 120V-12V step down transformer, perhaps the most dangerous part of our project, is both safe, well built, and lasts. In this way, we will protect the health of the consumer from any possible electrical shock from connecting or disconnecting power from our product.

References:

[1] *LaundryView*. [Online]. Available: https://www.laundryview.com/selectProperty. [Accessed: 09-Feb-2020].

[2:] "IEEE Code Of Ethics". *Ieee.Org*, 2020, https://www.ieee.org/about/corporate/governance/p7-8.html. Accessed 13 Feb 2020.