

Laundry Machine Availability Tracker

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ECE 445 Project Proposal - Spring 2020
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1. Introduction:

1.1 Objective

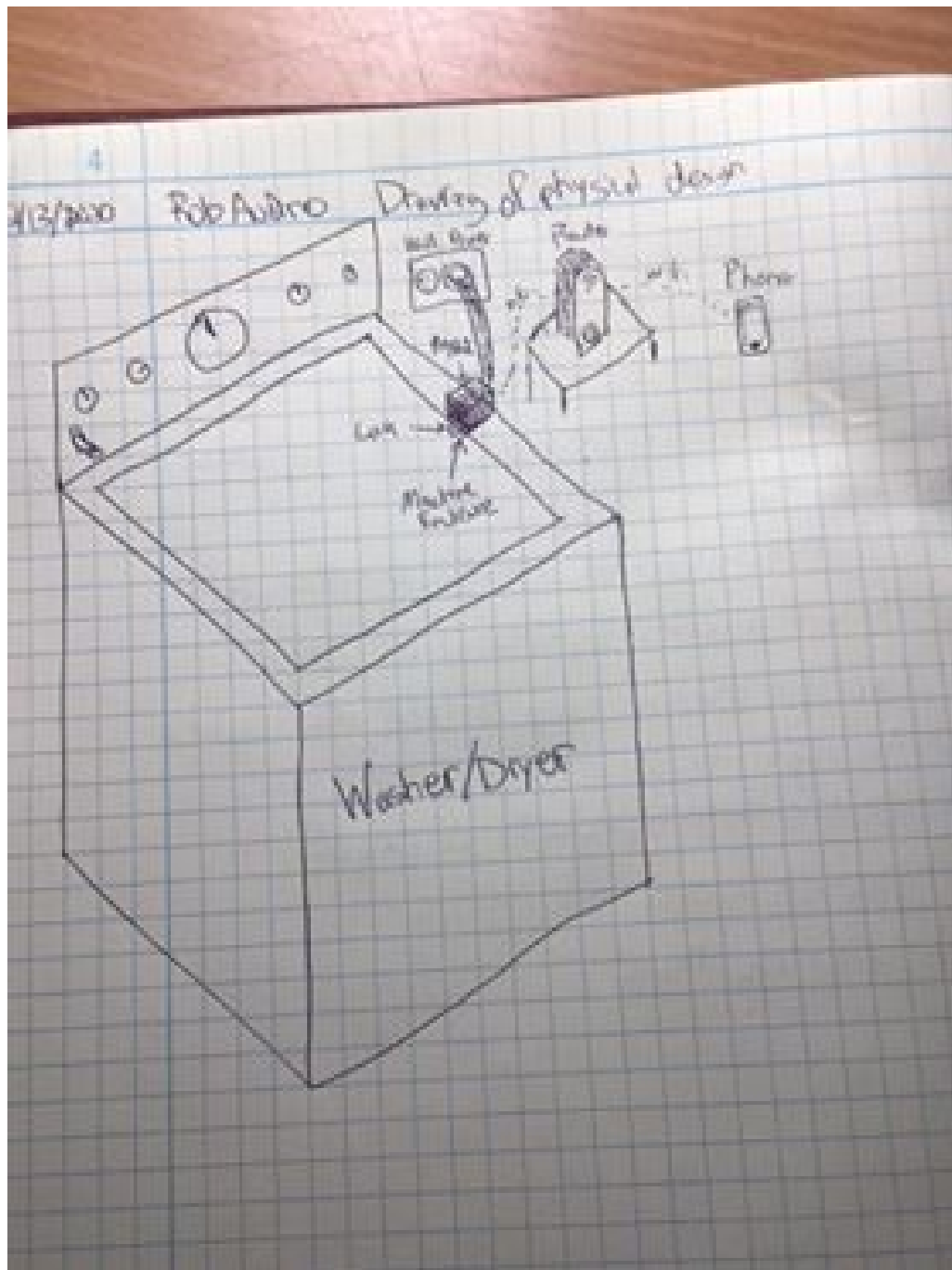
A popular amenity that apartments have is the addition of in unit laundry. Many apartments, however, do not come with in unit laundry and there is usually a communal laundry room that is shared by the apartment's tenants. This is similar to university dorm laundry in which students living in the same 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. Once a laundry machine is available, the user would be notified via the app and would have a guaranteed machine that they can 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 problem with this system is that it only tracks the status of the machine itself and still relies on a first come first serve basis for who uses the available unit. Our system is an upgrade to the university system since we will have a 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.

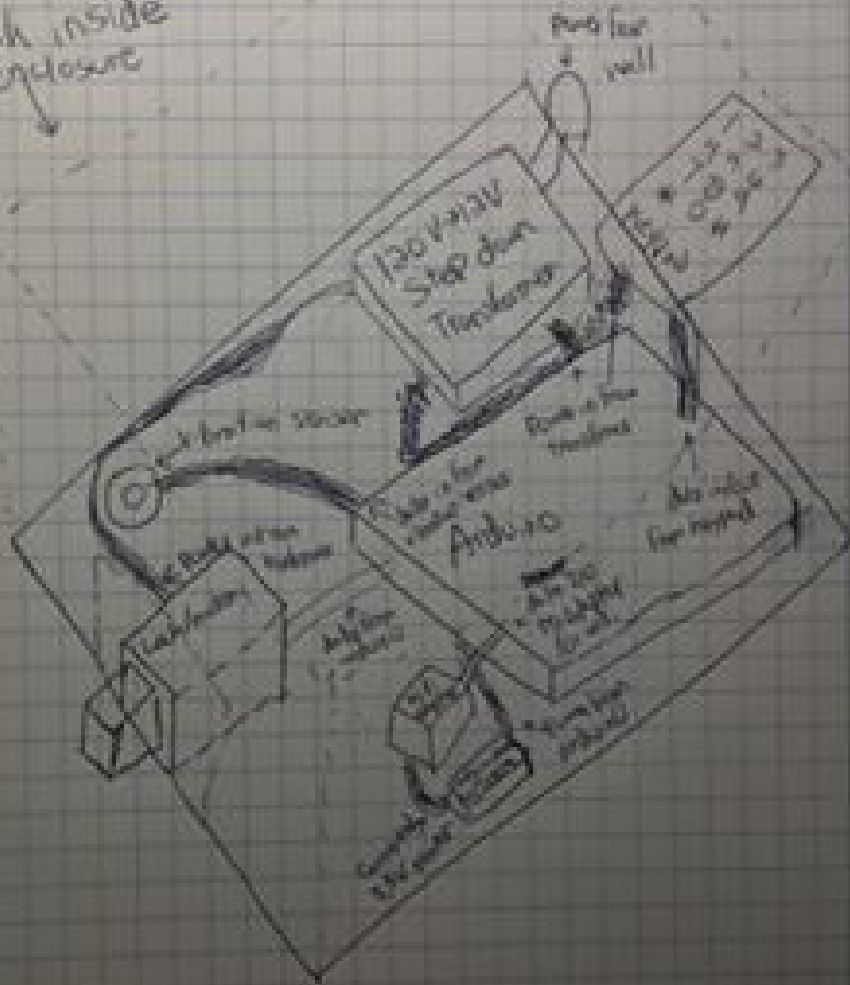
Physical Design



Detailed Drawing

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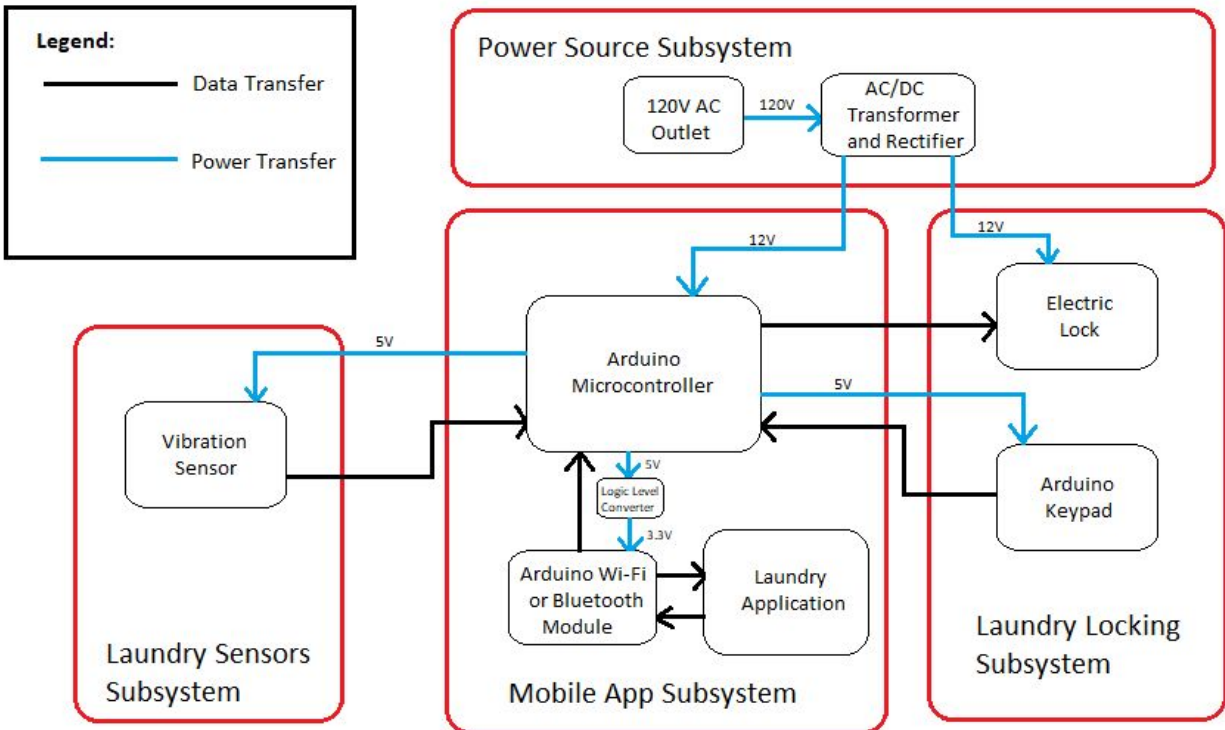
A Look inside the enclosure



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.

2 Design



2.1 Power Source Subsystem

2.1.1 Step-Down Transformer

The step-down transformer will take in the input voltage of 120V AC from the power outlet and convert it to 12V DC.

Requirements:

- Must step down the voltage from 120V AC to 12V DC
- Must output 12V DC

2.2 Laundry Sensors Subsystem

2.2.1 Vibration Sensor

The vibration sensor detects the vibration of the laundry machines and generates an output voltage change proportional to the strength of the vibration.

Requirements:

- Must detect change in vibration to determine if machine is running and in use

2.3 Laundry Locking Subsystem

2.3.1 Electric Lock

The electric lock is used to keep the lid of the washing machine unit shut while in use and also stays shut until the user inputs a specific code generated into the keypad. The electric lock is also used to signal when the machine is available for use. Once the electric lock is unlocked, the next person in the queue is notified that the machine is available and the the lock is locked and can only be opened once the next user in the queue enters their generated code into the keypad

Requirements:

- Locks once the laundry machine begins to run and stays locked
- Unlocks only when the laundry owner enters a generated code into the keypad
- Locks automatically after previous unlock

2.3.2 Arduino Keypad

The arduino keypad is connected to the electric lock and the arduino microcontroller and takes in a input code which, if matched with the randomly generated code, will unlock the washing machine lid.

Requirements:

- Sends input code to arduino microcontroller to determine if the input code is a match with the generated code

2.4 Mobile App Subsystem

2.4.1 Arduino Microcontroller

The microcontroller receives data from the vibration sensor, keypad, and the arduino wifi module and outputs signal to the electric lock and arduino wifi module after processing the information. How the arduino processes the information is determined by code that we will implement into the arduino.

Requirements:

- Receives and transmits sensor information
- Provides power to sensors and keypad

2.4.2 Arduino Wi-Fi Module

The Arduino Wi-Fi module allows the Arduino to connect to a Wi-Fi network. This will allow our Arduino to send information over a Wi-Fi network to a mobile application we develop.

Requirements:

- Allows Arduino to connect to a Wi-Fi network

2.4.3 Washing Machine App

The app will use the sensor information given to it by the Arduino to tell a user whether or not a washing machine is available for use. The user can queue up to use the washing machine from the app. The user will also receive the password for unlocking the washing machine lid from the app when it is their turn to use the washing machine.

Requirements:

- Accurately tells user the status of the washing machine based on sensor data
- Allows users to queue up to use the washing machine
- Provides password to unlock lid of washing machine when the user's turn comes

2.4.4 Logic Level Converter

Converts 5V output from Arduino to a 3.3V output to power the Arduino Wi-Fi module. Module will not work if given greater than 3.3V and this part is necessary as an inbetween for the Arduino and Wi-Fi module.

Requirements:

- Able to connect Wi-Fi module and Arduino board
- Properly supplies 3.3V to Arduino Wi-Fi module

Physical Enclosure:

All of the electronic components of the project will be encased inside a metal enclosure, leaving only the lock, keypad, and the power cable for the step down transformer exposed. This leaves only the most necessary components for the user to interact with, minimizing any risk of damage to the product by the user or the environment.

Requirements:

- Tightly fits all of the components in our design without damage
- Has appropriately sized holes to allow lock, keypad, and power cable to be accessed from the outside
- Attaches securely to the face of the washer/dryer

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, 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.