Golden Phoenicks

Locker Automation System

Jan Stanley Go, Yohaan Anthraper, Jeremy Rende

# 1.1 Declaration of Joint Authorship

We, Jan Stanley Go, Yohaan Anthraper, and Jeremy Rende, hereby verify that this document submitted for assessment is a collaborative effort amongst ourselves, and is written in our own wording. Usages of works of other authors, in any way (whether it be core concepts, diagrams and figures, previous technologies, programs and source code, or text from their works) are cited properly at the point in which they were used. Included in this document is a list of references used. Stanley handled the LCD display device and the mobile application’s display feature, Yohaan handled the door opener device and its corresponding feature in the mobile application and Jeremy managed the database and the door lock device, along with the corresponding feature in the mobile application.

# 1.2 Proposal

***Proposal for the development of Golden Phoenicks Locker Automation***

Prepared by Jan Stanley Go, Yohaan Anthraper, and Jeremy Rende  
*Computer Engineering Technology Students*https://github.com/stango25/lockerautomationsystem

**Executive Summary**

As a student in the Computer Engineering Technology program, I will be integrating the knowledge and skills I have learned from our program into this Internet of Things themed capstone project. This proposal requests the approval to build the hardware portion that will connect to a database as well as to a mobile device application. The internet connected hardware will include a custom PCB with the following sensors and actuators 16x2 LCD Display, DC Gear Motor, Lock Solenoid. The database will store User and Product info along with signals for products. The mobile device functionality will include Lock, Unlock, Open, Close, Display statuses. and will be further detailed in the mobile application proposal. I will be collaborating with the following company/department N/A. In the winter semester I plan to form a group with the following students, who are also building similar hardware this term and working on the mobile application with me This is winter semester?. The hardware will be completed in CENG 317 Hardware Production Techniques independently and the application will be completed in CENG 319 Software Project. These will be integrated together in the subsequent term in CENG 355 Computer Systems Project as a member of a 2 or 3 student group.

**Background**

The problem solved by this project is During a busy day of study, students are often burdened with handfuls of learning materials that may impede their ability to open and shut their locker. This compounded with potential disabilities makes the manual unlocking and opening of a locker a day-to-day issue. Our product will solve this issue.. A bit of background about this topic is The problem solved by this project is ease of access to a locker. Access to lockers can be difficult for student with many items to carry, or those with disabilities. Currently almost all lockers are manually operated and therefore not accessible by anyone with a severe physical disability..

Existing products on the market include [1]. I have searched for prior art via Humber’s IEEE subscription selecting “My Subscribed Content”[2] and have found and read [3] which provides insight into similar efforts.

In the Computer Engineering Technology program we have learned about the following topics from the respective relevant courses:

* Java Docs from CENG 212 Programming Techniques In Java,
* Construction of circuits from CENG 215 Digital And Interfacing Systems,
* Rapid application development and Gantt charts from CENG 216 Intro to Software Engineering,
* Micro computing from CENG 252 Embedded Systems,
* SQL from CENG 254 Database With Java,
* Web access of databases from CENG 256 Internet Scripting; and,
* Wireless protocols such as 802.11 from TECH152 Telecom Networks.

This knowledge and skill set will enable me to build the subsystems and integrate them together as my capstone project.

**Methodology**

This proposal is assigned in the first week of class and is due at the beginning of class in the second week of the fall semester. My coursework will focus on the first two of the 3 phases of this project:  
 Phase 1 Hardware build.  
 Phase 2 System integration.  
 Phase 3 Demonstration to future employers.

*Phase 1 Hardware build*

The hardware build will be completed in the fall term. It will fit within the CENG Project maximum dimensions of 12 13/16" x 6" x 2 7/8" (32.5cm x 15.25cm x 7.25cm) which represents the space below the tray in the parts kit. The highest AC voltage that will be used is 16Vrms from a wall adaptor from which +/- 15V or as high as 45 VDC can be obtained. Maximum power consumption will be 20 Watts.

*Phase 2 System integration*

The system integration will be completed in the fall term.

*Phase 3 Demonstration to future employers*

This project will showcase the knowledge and skills that we have learned to potential employers.

The brief description below provides rough effort and non-labour estimates respectively for each phase. A Gantt chart will be added by week 3 to provide more project schedule details and a more complete budget will be added by week 4. It is important to start tasks as soon as possible to be able to meet deadlines.

Already purchased for previous course. We might get some supplies under 20 dollars for connecting devices.

**Concluding remarks**

This proposal presents a plan for providing an IoT solution for Our product is a culmination of our past three products (Lock, Display, and DC Motor). This will be used to create an automated locker system that will solve any underlying issue that prevents a student from controlling the locker manually.. This is an opportunity to integrate the knowledge and skills developed in our program to create a collaborative IoT capstone project demonstrating my ability to learn how to support projects such as the initiative described by [3]. I request approval of this project.

**References**

[1] Electronic Lockers. (n.d.). Retrieved February 01, 2018, from http://www.tiburonlockers.com/storage-solutions/electronic-lockers.php

[2] Institute of Electrical and Electronics Engineers. (2015, August 28). IEEE Xplore Digital Library [Online]. Available: https://ieeexplore.ieee.org/search/advsearch.jsp

[3] V. Stangaciu, V. Opârlescu, P. Csereoka, R. D. Cioargă and M. V. Micea, "Scalable interconnected home automation system," 2017 21st International Conference on System Theory, Control and Computing (ICSTCC), Sinaia, 2017, pp. 169-174.

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# 1.3 Abstract

In today’s day and age, consumer products revolve around the transition from physical/manual system to automated electronic systems. Despite this, every workplace has an installation that has yet to be automated. In this case, that installation is *the Locker*. To assist those who are either physically impaired or occupied with bulky or heavy items, a system should be made to enable locker users to unlock and open their lockers from afar and at a simple tap of a button. The system’s main feature would be a door opening mechanism and a smart lock mechanism. If necessary, a display with buttons would be placed to facilitate manual unlocking. The door opening mechanism and the smart lock mechanism would both rely on information from an offsite database to perform tasks, which would be updated using either an Android application or through the display and its buttons. Both the application and the display would have security features implemented through the use of an account with a password and through this account, the user would have their own devices attached to it. The database will contain user account information and user device information, as well as the statuses of the devices. This system has the potential to be used in all sorts of workplaces, including schools, to simplify the user’s locker experience and monitor their lockers anywhere and anytime, so long as they are connected to the internet. This report contains the documentation of this idea becoming a reality.

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# 1.5 List of Illustrations/Diagrams

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# 1.6 Introduction

Currently, hundreds of secondary and post-secondary institutions make use of conventional manual lockers for student and faculty use. Over the years as institutions have made strides to become more accessible and secure, the locker has not evolved. The Locker Automation System outlined in this report is a proposed solution to improve on: accessibility, usability, and security of existing locker installations.

Using a modular, Internet of Things (IoT) connected system the Locker Automation System will allow a user (student, faculty) to unlock, lock, open, close and check the status of their locker. These functions will be accessible via a mobile app and by a physical input and LCD display affixed to the front of the locker. Data will be centralized on an IBM Bluemix Cloud mySQL server. At launch, the mobile app will be available to Android users who possess a device running on API level 21 or higher, with an active Google Play Store account.

Throughout the following report different hardware and software interfaces, as well as product dimensions and physical requirements will be discussed. Also included will be data on the proposed cost of a unit conversion and the learning curve that will be faced by an average user following the transition. Additionally, and particular localization adaptation issues as well as accommodations that may be possible for those who are differently-able will be discussed, as well as security improvements and possible concerns.

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# 2 Project Description

## 2.1 Technical Problem

The technical problem addressed in this report is the conversion of a manual locker, into an automated “smart” locker system.

## 2.2 Reason for Project

The reason for the undertaking of this project is to facilitate increased accessibility and security over a conventional manual locker system.

## 2.3 Scope

## 2.4 Objective

## 2.5 Unique Problems

## 2.6 Unique Approaches

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# 3.1 Project Description

## 3.1.1 Software Requirements Specifications

### 3.1.1.1 Introduction

#### 3.1.1.1.1 Purpose

The Golden Phoenicks Locker Automation App is intended to be used simultaneously with all three devices. Ideally, the students/customers should be able to control all aspects of the Locker Automation Device from anywhere using their mobile devices.

#### 3.1.1.1.2 Intended Audience and Reading Suggestions

This document is intended to be read by the Computer Systems Project teachers, any students who would like to duplicate the project, and any users who would like to learn more information on the utilities.

#### 3.1.1.1.3 Product Scope

The software includes database and Java integration that work hand in hand to make the user’s experience as efficient and comfortable as possible. The user will be able to control each device in the hardware at will.

### 3.1.1.2 Overall Description

#### 3.1.1.2.1 Product Perspective

This software product came to be as a result of a need to integrate our hardware devices to modern standards and to allow users to access their devices easily.

#### 3.1.1.2.2 Product Functions

With this software, the user is intended to be able to perform the following:

* Lock or unlock their locker doors. Jeremy will be responsible for this feature.
* Open or close their locker doors. Yohaan will be responsible for this feature.
* Display the status of their devices. Stanley will be responsible for this feature.
* Create an account to register these devices to. The handling of the database will be Jeremy’s task as well.

#### 3.1.1.2.3 User Classes and Characteristics

Users include:

* Students
* Teachers
* And the general public

The three user classes can use the product so long as their workplaces or schools have lockers beforehand. The users need to be capable of operating Android devices to download the software from the App Store.

#### 3.1.1.2.4 Operating Environment

The software is to be run on any Android devices with an Operating System of 5.0 and above. The Locker Automation System hardware devices will also be needed to use the system in its full potential.

#### 3.1.1.2.5 Design and Implementation Constraints

The developers will be limited in that they will only be producing the software on the Android platform, with a specific Operating System, and MySQL will be used for database. PHP scripts are used to communicate with the MySQL.

#### 3.1.1.2.6 User Documentation

The software will be distributed with an online video tutorial.

#### 3.1.1.2.7 Assumptions and Dependencies

It is assumed that the MySQL database, to be hosted on IBM Cloud in Texas, is still active. Presumably the user either has a mobile data connection or a WiFi connection as well. The Google Play Store also needs to be up and running just fine. Any updates to the software will need to be done in Android Studio.

### 3.1.1.3 External Interface Requirements

#### 3.1.1.3.1 User Interfaces

The Android application must follow the Google Android specifications for proper UI design.

#### 3.1.1.3.2 Hardware Interfaces

The Raspberry Pi will be used to establish a connection to the database which the Android application will then connect to. The Android phone needs to run with an Operating System version of 5.0.

#### 3.1.1.3.3 Software Interfaces

The product will be using the following software libraries and components:

* Python
* Raspbian
* Android
  + Java
  + XML
* PHP
* MySQL
* HTML
* GitHub

#### 3.1.1.3.4 Communications Interfaces

The software will be using WiFi or mobile data technology to connect to the Internet and the database as a result.

### 3.1.1.4 System Features

#### 3.1.1.4.1 Lock Control

##### 3.1.1.4.1.1 Description and Priority

This feature is a high priority item, and it’s intended to be used to control the lock hardware system. Ideally it needs to be ready as it is one of two main features of the software.

##### 3.1.1.4.1.2 Stimulus/Response Sequences

If the user taps on the button that says “Lock”, the Lock System should arm itself and update the database accordingly. If the user taps on the button that says “Unlock”, the Lock System would disarm and update the database accordingly.

#### 3.1.1.4.2 Door Control System

##### 3.1.1.4.2.1 Description and Priority

This feature is a high priority item, and it’s intended to be used to control the door control hardware system. Ideally it needs to be ready as it is one of two main features of the software.

##### 3.1.1.4.2.2 Stimulus/Response Sequences

If the user taps on the button that says “Open”, the Door System should open and update the database accordingly. If the user taps on the button that says “Close”, the Door System would close the door and update the database accordingly

### 3.1.1.5 Other Nonfunctional Requirements

#### 3.1.1.5.1 Security Requirements

Software includes:

* Secure Login Screen
* Secure database connection
* Secure Information Retrieval

# 4.1 Conclusions

# 4.2 Recommendations:

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# 6 Appendices

## 6.1 Definition of Terms

Android – refers to the operating system developed by Google, based on Linux Architecture.

Locker - a small lockable closet or compartment.

Automation – act or process of automation

Lock - a contrivance for fastening or securing something.

Door - a movable, usually solid, barrier for opening and closing an entranceway.

Display - to show or exhibit; make visible.

Database - a comprehensive collection of related data organized for convenient access, generally in a computer.

Dallas – a city located in Texas, United States of America, North America, Planet Earth.

IBM – Our database and cloud services provider.

Phone – a portable electronic telephone device.

Application – software used by Android applications.