

# Reprise of Locker Access System

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# Project plan

## **1. Problem Overview**

### **1.1 Problem Statement**

We are doing this project in order to solve problem regarding storage and lockers assignment in senior design lab in Coover 1301. Currently, the lockers are secured with standard combination padlocks. The disadvantage of using this type of lock is that the previous users may still know the combination number. Besides, some students might forget the combination number for their team's locker. Other than that, the padlock is not intuitive or not easy to use especially for first time users. Furthermore, administrators are not able to assign and update lockers easily and efficiently.

In order to solve these problems, we are creating a control system that allows locker access to authorized users by using their ISU card. The locker access system has to be easy to use while maintaining a basic amount of security. We are designing one user panel that communicates wirelessly with locker modules. The entire system will be comprised of two basic elements: a control box, and the locker module. Besides, this control system also allows administrators to access list updates and locker overrides. With this control system, it will be easier and safer for students to store their project and access their lockers.

## 1.2 Market and literature survey

### Penco Smart Locker

This smart locker is sold by Penco. The basic operation of this smart locker is almost similar with our project in which users will use their card to open the respective locker. However, this locker does not have any keypad for manual entry. The big difference is that Penco Smart Locker does not use wireless communication unlike our project. The card module is attached to each locker. Administrators will be able to open the locker if user forgot or lost their card. Besides, administrators also have access to each locker by using password protected administration software. Figure 2 shows the picture of Penco Smart Locker.



**Figure 1: Penco Smart Locker**

## **2. System Overview**

### **2.1 System Description**

The entire system will be comprised of two basic elements: a control box and locker module. The control box will integrate a user interface with an LCD screen to give directions to users, a card reader for scanning student ID cards and keypad for manual entry as well as administrative functions. The control box will receive input from the user in two ways: swipe ID card or keypad entry. The LCD screen will then give options to the user to which function they would like to perform and then transmit a data signal to the respected locker to be opened.

Each locker has one locker module. The locker module will be mounted on the door of the locker. Each module will receive the data signal sent from the terminal but will only respond if it matches the module indicated by the signal. The module will then trigger an electromechanical device in order to open the lock of the locker.

For administrative functions, they can either swipe their ID card or use keypad entry. They will be able to open all lockers simultaneously and individually. There is an SD card inside the control box that will store the information about lockers holder. Administrators will update the information on it by using computer. If they wish to update lockers assignments in the middle of semester, they can use the keypad entry.

## 2.2 Concept sketch

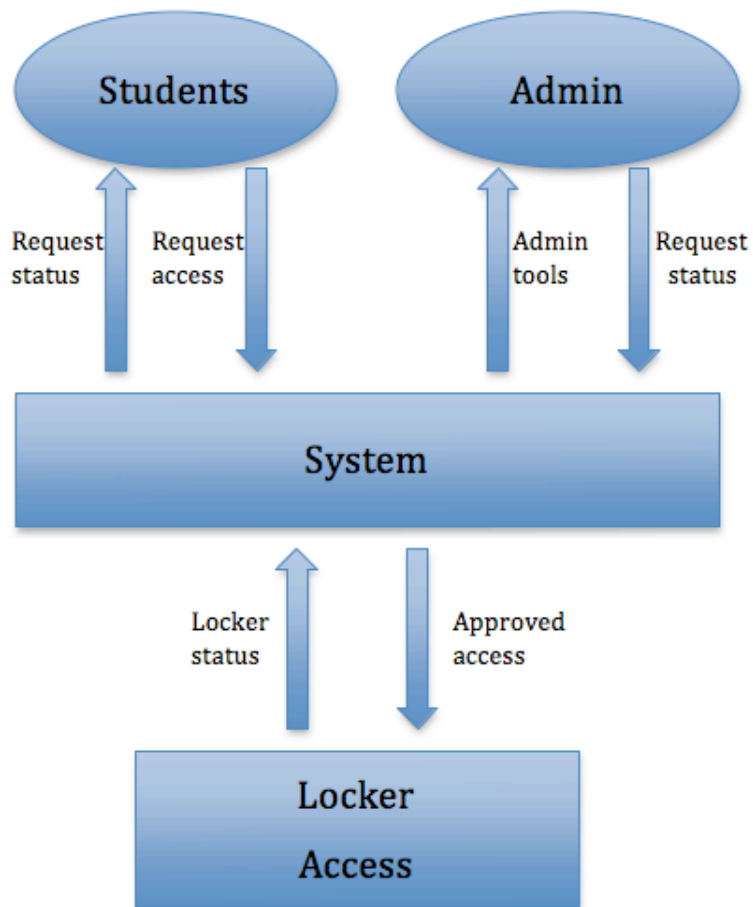


Figure 2: Concept Sketch

## 2.3 System block diagrams

### i. Block Diagram (FIGURE 3)

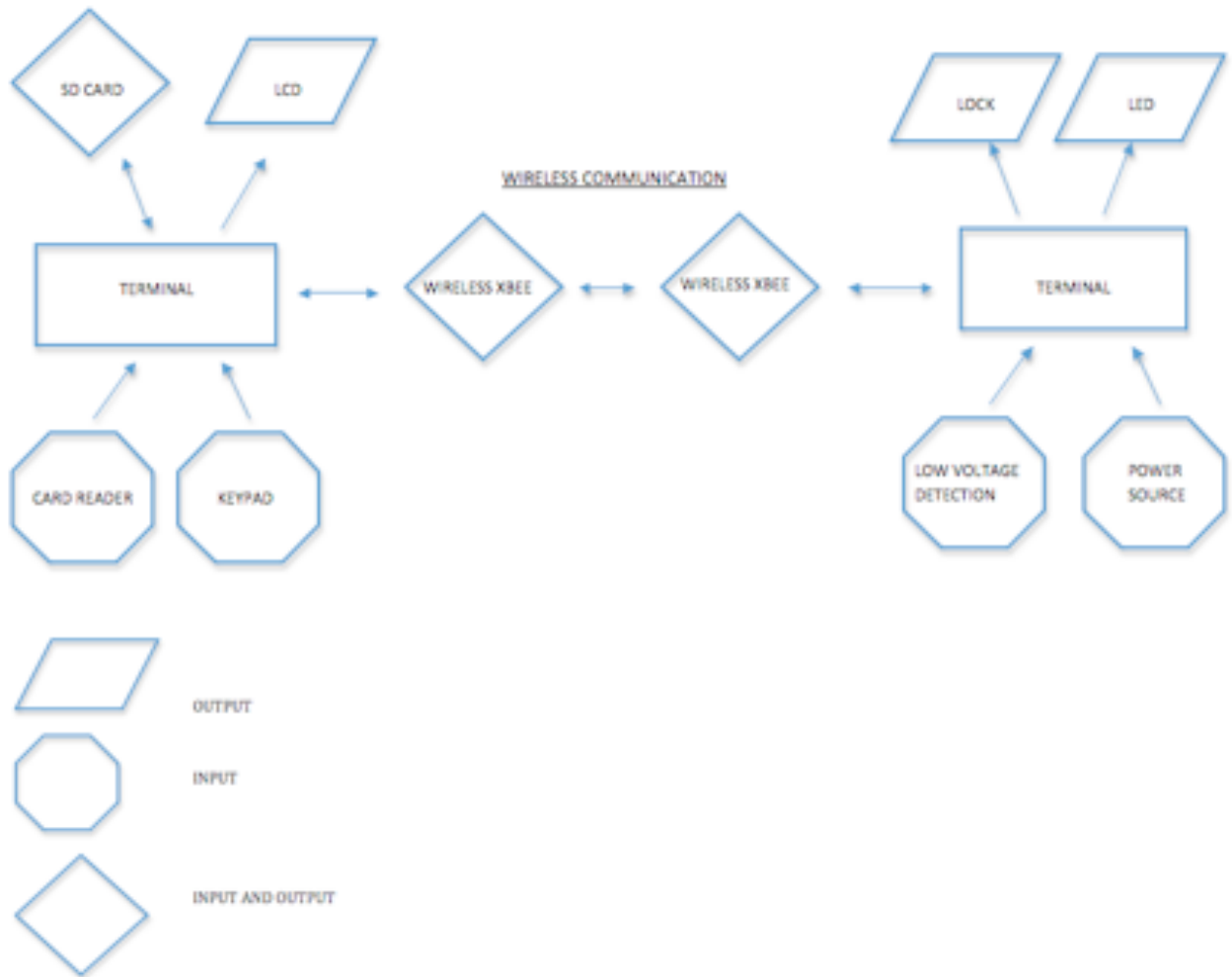


FIGURE 3: Block Diagram and reference

## **2.4 Operating Environment**

The control box and the locker module will always be located inside senior design room in Coover 1301. The temperature inside this room is approximately 69 to 74 degrees Fahrenheit. The dimension of the room is 44' x 28'. It has a lot of things inside such as tables, desktop, chairs and so on. These can be the obstacle for the communication between the control box and locker module if they are situated far from each other.



## 2.5 User Interface

The user interface will operate in different situation for the two intended users which are students and administrative.

### I. Students:

Students will have two ways to open their lockers. First, they can swipe their ISU card and second they can type in their ID number on the keypad. If they have their name registered as one of the locker holders, the corresponding locker will be opened. If they are not registered, there will not be any lockers opened and LCD will show error.

### II. Administrators:

Administrators can perform multiple tasks with the control box. They can swipe their ISU card and then type some code on the keypad so that the control box recognized that they are administrators. They will be able to use the keypad to open the lockers simultaneously or individually. Besides, they also can use the keypad to update information on SD card so that they do not have to take the SD card out so often. Lastly, they can pull the SD card out to update information most probably in the beginning and end of semester.

### 3. Requirements

#### 3.1 Functional Requirements

- Students are able to access their locker by swiping their ISU card on the card reader or by typing their ID number on the keypad
- The user panel will have a display to show the status of the system
- The user panel allow administrative to access lockers
- Since taking out SD card too often can be a hassle, administrators must be able to use keypad to update information on SD card
- The battery must have a lifetime of at least one semester.
- The SD Card must be able to read and store database of names and locker numbers so that administrators can easily update all information needed to make sure all students have access.
- The display on the user panel must show low battery status for locker module at least at the 20% stage so that administrative can change the battery before it completely die
- The wireless data transmission need to have the ability to transmit from the control box to locker module in the system at the longest distance from the transmitter to receiver the room allows.
- Control box and locker modules interact in two way wireless communication

### 3.2 Non- functional Requirements

- The end product should be designed to ensure safety and must abide by federal law and FCC regulations regarding wireless communication.

### 4. Deliverables:

We are expected to deliver the listed items below by the end of April 2014.

- Project plan
- Design Document
- Locker Access system –easy expandable number of locker modules and one user control panel with card swipe

### 5. Work Plan

#### 5.1 Project schedule

Below is the tentative for EE491 and EE492 (from September 2013 until April 2014).

Month	Plan
September	<ul style="list-style-type: none"><li>➤ Dividing Tasks</li><li>➤ Understanding Project</li><li>➤ Start project plan and design document</li></ul>
October	<ul style="list-style-type: none"><li>➤ Start implementation for prototype (to show the basic functionality)</li></ul>
November	<ul style="list-style-type: none"><li>➤ Project testing for basic functionality</li></ul>

	<ul style="list-style-type: none"> <li>➤ Finish project plan and design document</li> </ul>
December	<ul style="list-style-type: none"> <li>➤ Presentation for EE491 and continue with implementation</li> </ul>
January	<ul style="list-style-type: none"> <li>➤ Continue with design</li> <li>➤ Make improvement based on the testing result</li> </ul>
February	<ul style="list-style-type: none"> <li>➤ Start with PCB layout</li> </ul>
March	<ul style="list-style-type: none"> <li>➤ Final verification and finalize design</li> </ul>
April	<ul style="list-style-type: none"> <li>➤ Presentation</li> </ul>

## 5.2 Risks

- Safety of each group member is the first priority especially when we are dealing with electrical devices
- Risk of going over the estimated budget which is \$500 if we did not choose components carefully
- Low security in the system, because it is very easy to break the locker door. Furthermore the wireless communication between the locker and the control module is not encrypted, ie (hackers can get easy access to the system).

### 5.3 Resource Requirement

#### Cost :

##### 1) Control box :

Atmega328 = \$4.

Xbee serious 1 = \$23.

Keypad =\$4

Screen = \$27

SD card reader =\$10

Magnetic card reader =\$45

PCB board =\$10

+ Price of the case.

**Total for Control Box = \$123 + cost of the case**

##### 2)Locker Module:

Atmega328 = \$4.

Xbee serious 1 = \$23.

Servo = \$10.

PCB board = \$10

+ price of the locker and the case.

**Total price for Locker Module =\$47 + price of the locker and case.**

- **Total Calculated Cost =170 + (estimated \$30 for cases)**

### 5.4 Work Breakdown

#### 1. Roles

- Leader: Mohammed
- Communicator: Sherry
- Webmaster: Nurul
- Project plan leader: Shichao

## 2. Project Design

- Circuit in the control box: Sherry
- Software: Mohammed
- Xbee wireless communication: Shichao
- Circuit design in locker module: Nurul

## 6. Conclusion

Currently we are still working on the design and have a work breakdown so that every one of us have their own responsibility towards this project and hopefully can synchronize with our project schedule. We believe that we will do a great job for our client. This access system will definitely benefit future senior design students for coming years.