Small Equipment Checkout System

Team: SDMAY19-13

Website: http://sdmay19-13.sd.ece.iastate.edu/
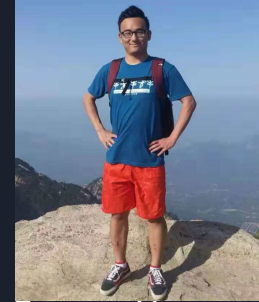
Advisor & Client: Leland Harker

Team Members

Yimin Wang
Major: Electrical Engineering
Team Role: Project Manager
Technical Role: Hardware Team

Jiaxin Li
Major: Electrical Engineering
Team Role: Treasurer
Technical Role: Hardware Team

Fengnan Yang
Major :Electrical Engineering
Team Role: Reporter & Meeting manager
Technical Role: Hardware Team

Caining Wang
Major: Computer Engineering
Team Role: Software Reporter
Technical Role: Software Team

Bei Zhao
Major: Computer Engineering
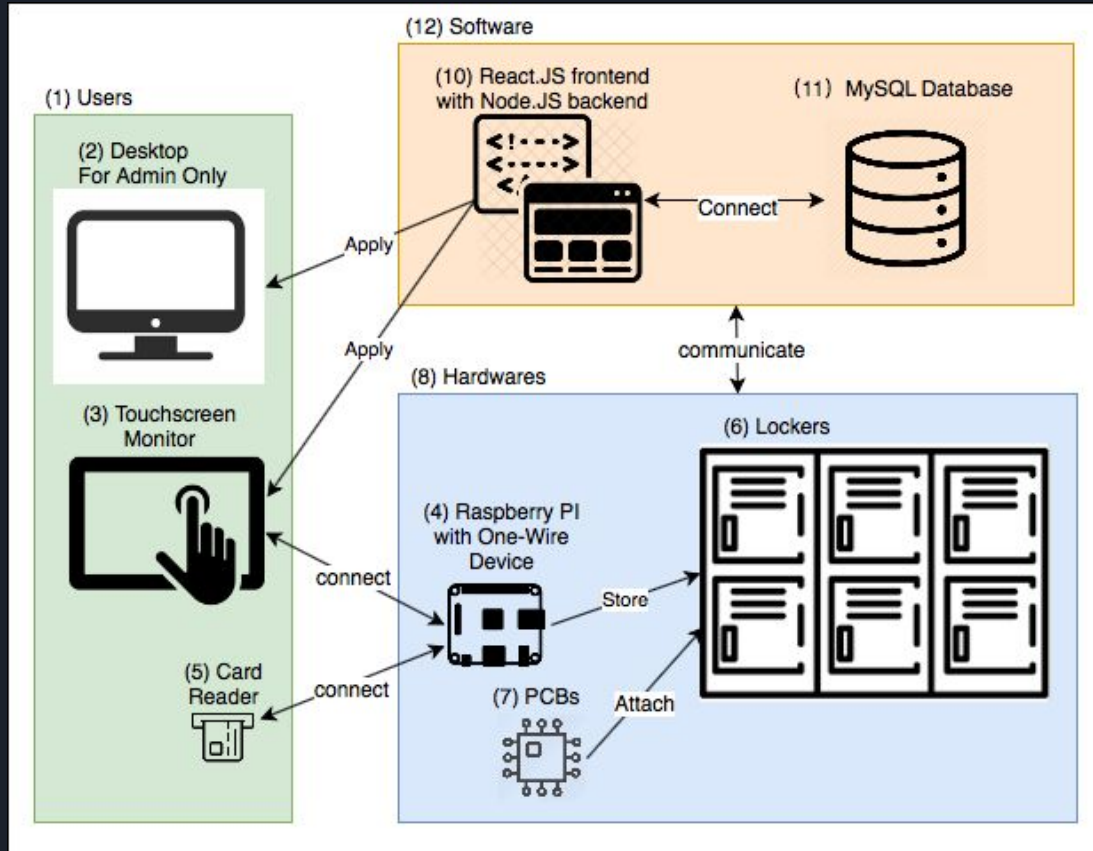Team Role: Secretary
Technical Role: Software Team

Project Plan

Problem Statement

- Continuing sdmay18-01 Group's work

- ETG limitations in working time

- Low efficiency

- Waste of human resource

Conceptual Sketch

Functional Requirements (For students)

- View available equipment
- Log in and out
- Select an equipment item to checkout
- Turn on the LED to check equipment
- Determine checkout duration
- View currently checked out equipment (personal)
- Return equipment, close checkout record
- Report system misuse or broken items
- Receive Email Reminder

Functional Requirements (For Administrators)

- Log in and out
- CRUD available equipment
- Determine max checkout durations for items
- CRUD student users, records, and user privileges
- Receive email status reports
- Create update, remove lockers
- Add new Administrators

Non-functional Requirements

- Maintainability:

Our product could be maintained by ETG for future usage. ETG will have documents and resources to access the whole system to make adjustment such as add more lockers.

- Security:

Implement applications to protect personal information.

Technical/Other Constraints/Considerations

- Limitation of choices of extended software and hardware
- Control all 34 lockers
- New function: door close/open detecting

Potential Risks & Mitigation

- Unfamiliar with software system

Both of our software group members are not familiar web design which includes Javascript, SQL, HTML Layout, PHP, etc. Our members may meet unexpected difficulty during the learning.

Estimated Cost List

TOTAL ESTIMATE COST VALUE: $722.99

ITEMS: 16

Manufacturer number	DESCRIPTION	REORDER QTY	COST	TOTAL COST VALUE
7.95891E+11	Mini Electromagnetic Electric Control Door Cabinet Drawer Lockers Lock	34	$2.69	$91.46
MP-3014-1100-50-80	LED COOL WHITE 5000K 80CRI	34	$0.15	$4.96
XJS 11x5.5x11mm	Metal Taper Conical Compression Spring	34	$0.18	$6.12
DS2406+-ND	One-Wire Slave Device	34	$4.10	$139.40
LM2575T	IC REG BUCK 5V 1A TO220-5	34	$2.41	$81.94
LMC662CN	IC OPAMP GP 1.4MHZ RRO 8DIP	34	$1.62	$55.08
1528-2233-ND	Jumper Wires	9	$1.95	$17.55
LM 555CN	IC OSC SINGLE TIMER 100KHZ 8-DIP	34	$1.02	$34.51
RASPBERRY PI B	Resberry Pi	1	$29.95	$29.95
DS2482S-100+T&RTR-ND	One-Wire Mater Device	1	$1.68	$1.68
DRV5023AJQLPGM	Hall Effect Senor	34	$0.79	$26.86
PS1240P02BT	AUDIO PIEZO TRANSDUCER	34	$0.48	$16.46
2197	HDMI FLAT CABLE - 1 FOOT / 30CM	1	$3.95	$3.95
U050-003	USB 2.0 A TO MICRO-USB B CABL 3'	1	$4.65	$4.65
	PCB	34	$6.08	$206.72
	Resistors and Capacitances Kits	34	$0.05	$1.70

Compare with other self service locker
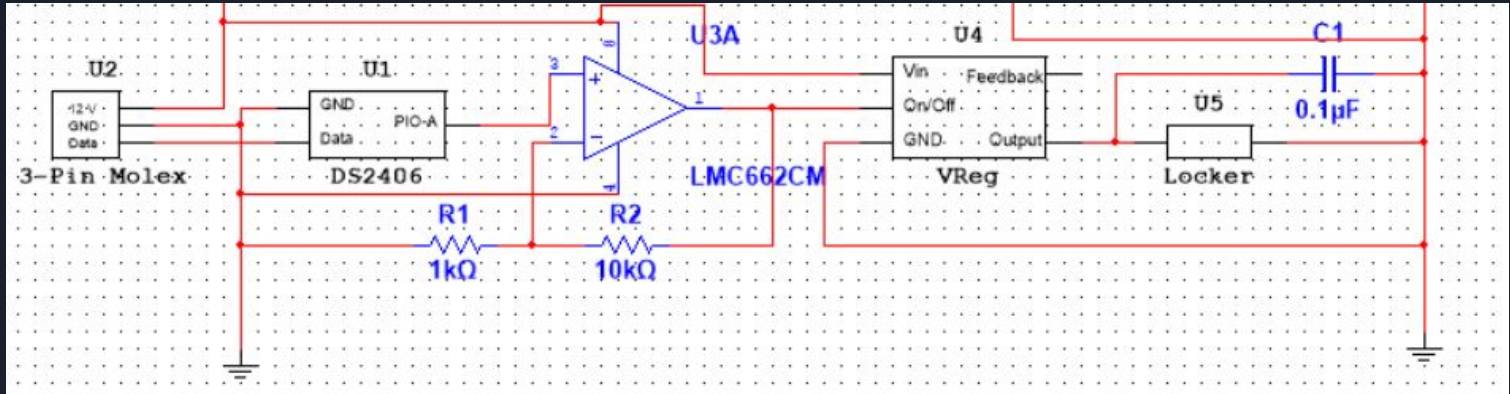
System Design
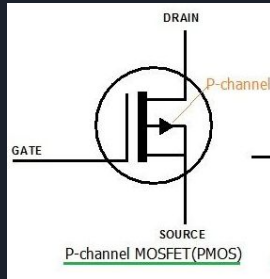
Hardware

Circuit Design (Lock System)

- Components
  - ➢ Connecter : 3-pin Molex
  - ➢ Slave Device : DS2406
  - ➢ Operational Amplifier : LMC662CN
  - ➢ Voltage Regulator : LM2575T
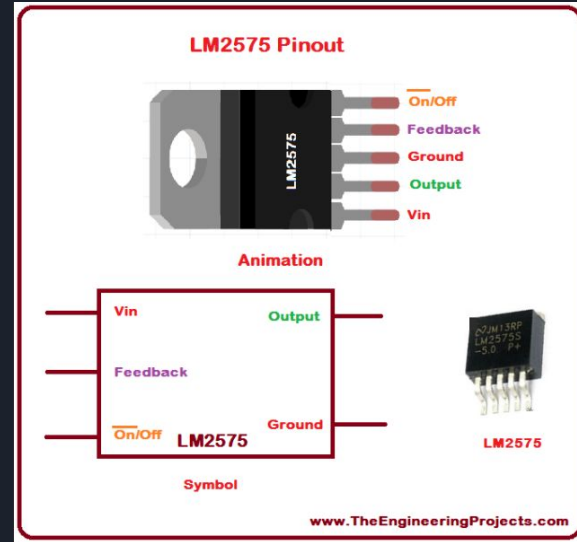 - ➢ Lock : 12V Electric Lock

Switch Control

Pmos

Vgs <= Vth

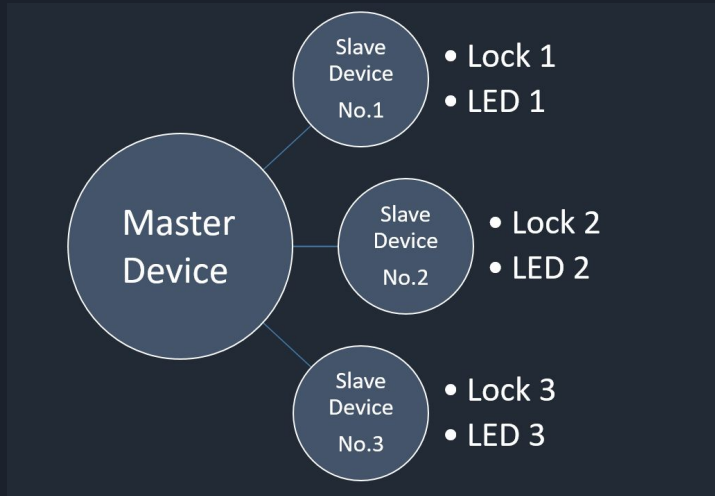Interference with 12 volts Power Supply
(Slave Device Stop Working)

Voltage Regulator

Vin = 12 volts, On/Off <= 1.6 volts
Supply Constant Voltage Level
No interference

Lock System Improvement

- Upgrade Slave Device (Multiple PIO Pins)
- Design circuit for LED control and Door detecting system
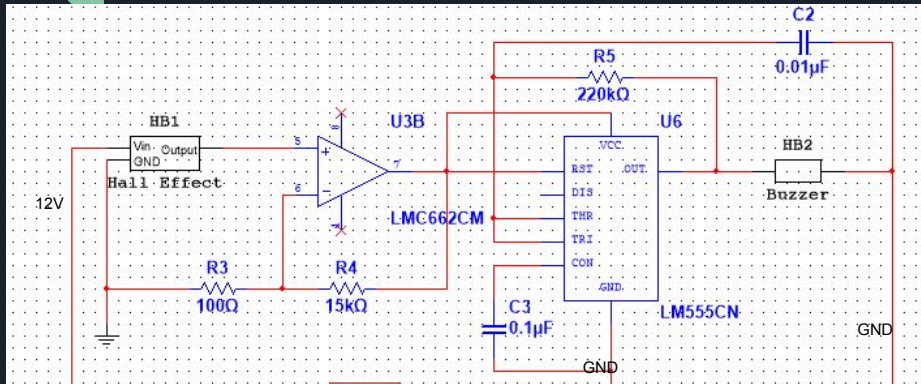- Parallel all lock system

8-Channel Addressable Switch (DataSheet)

Circuit Design (Door Detecting System)

- Components
  - ➤ Sensor : Hall Effect Sensor DRV5023
  - ➤ Square Wave Generator : Timer 555
  - ➤ Operational Amplifier : LMC662CN
  - ➤ Buzzer : PS1240P02BT

Voltage Supply: 12V from Raspberry Pi
Sensor output: 0V/76 mV
Non-inverting Amplifier: 11.45 V
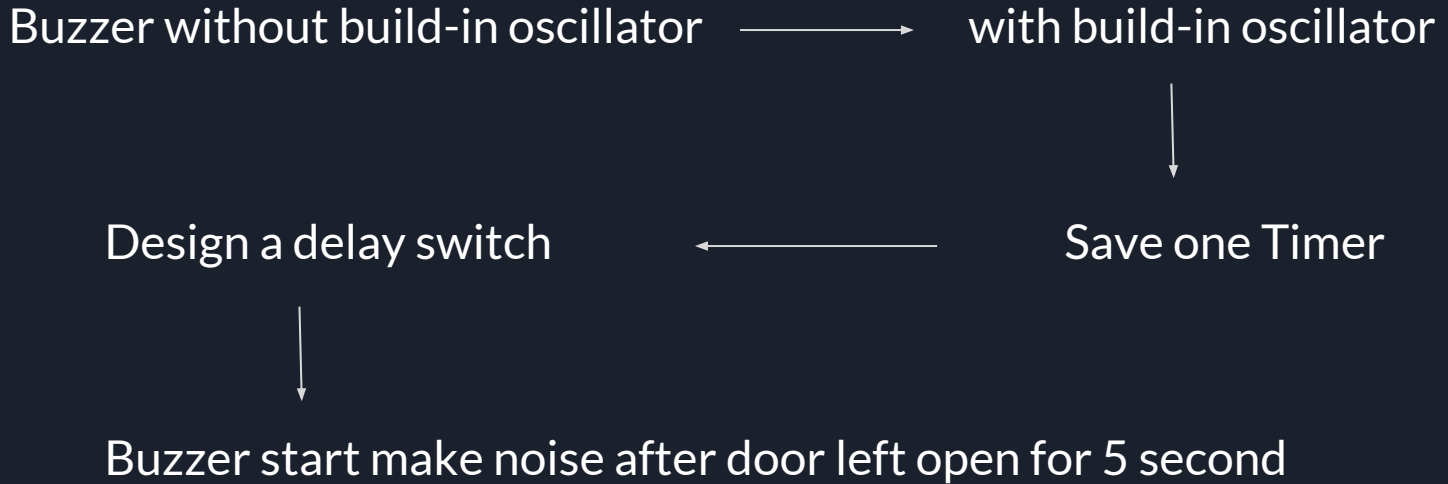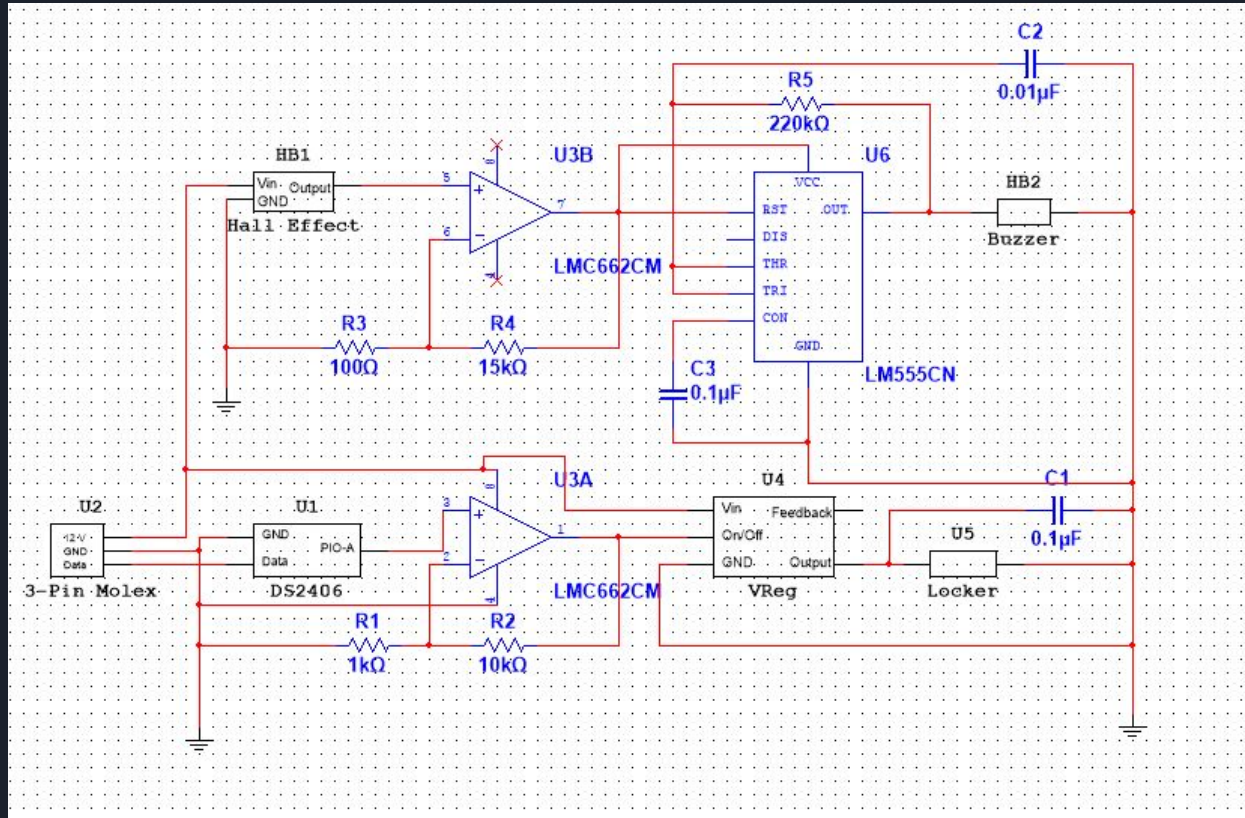Square Wave: 300 Hz, 11.7 V

$$f = \frac{1}{0.693 * 2R * C} \; Hz$$
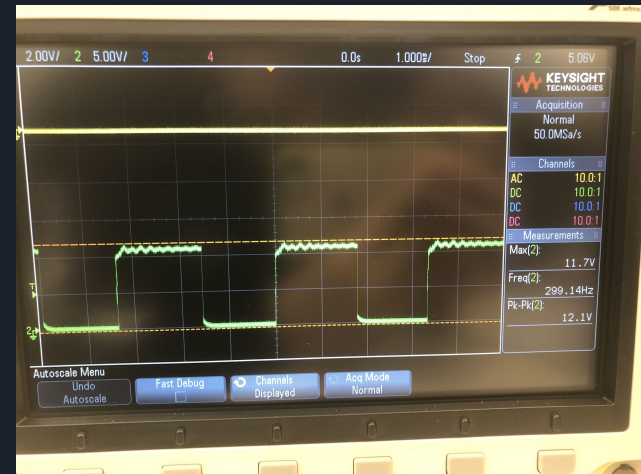
Potential Improvements

Buzzer without build-in oscillator $\longrightarrow$ with build-in oscillator

Design a delay switch $\longleftarrow$ Save one Timer

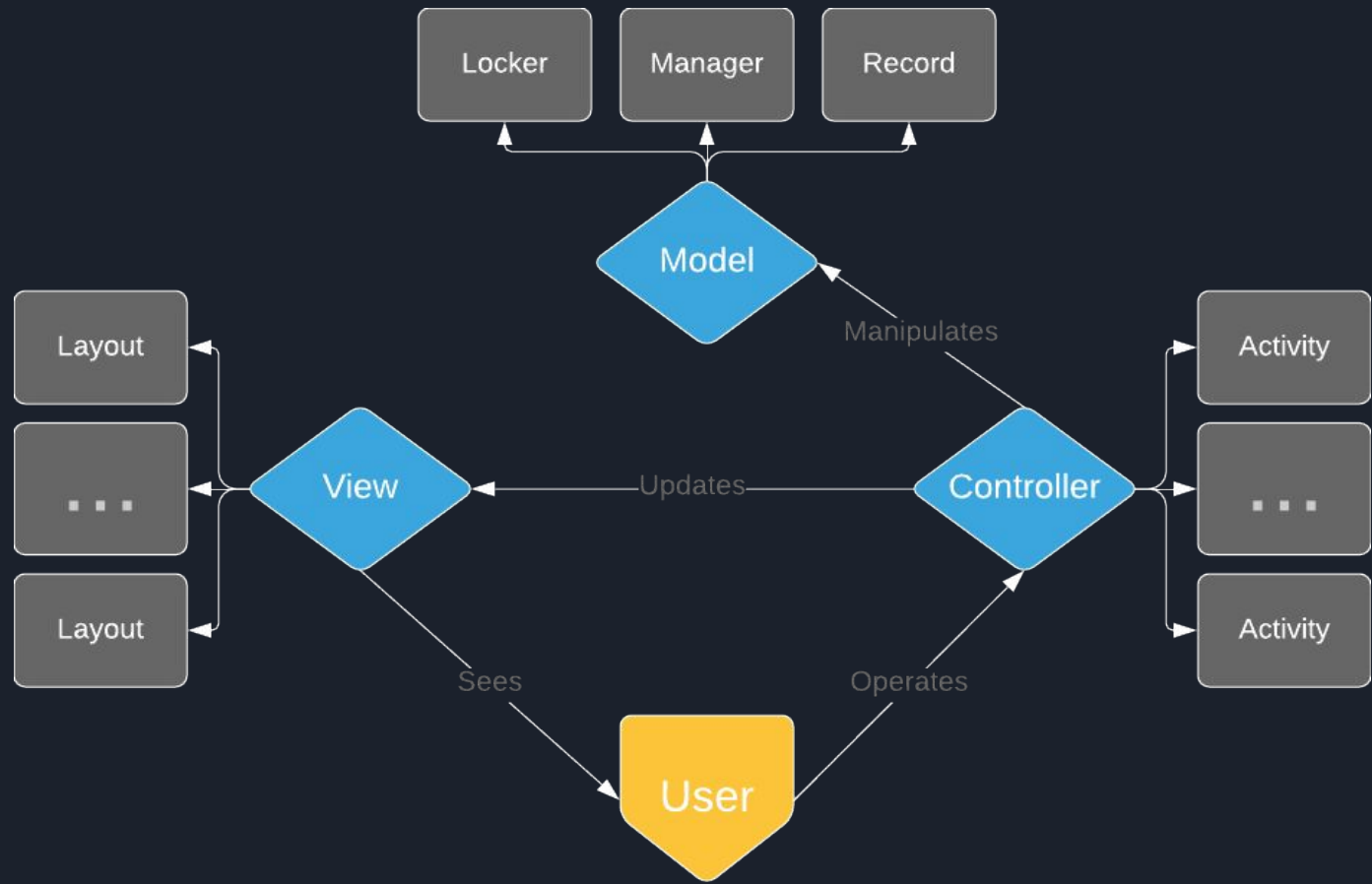Buzzer start make noise after door left open for 5 second

Whole Circuit

Software

Previous Team's work

- Doesn't meet all requirements.

- Checkout process is wrong.

- Used a difficult language we are not familiar with.

Android Design

Model - Database

Locker

Uid

Item

Description

Address

CurrentBorrower

isBorrowed

isMissing

Record

Uid

Type

Date

Borrower

WhichLocker

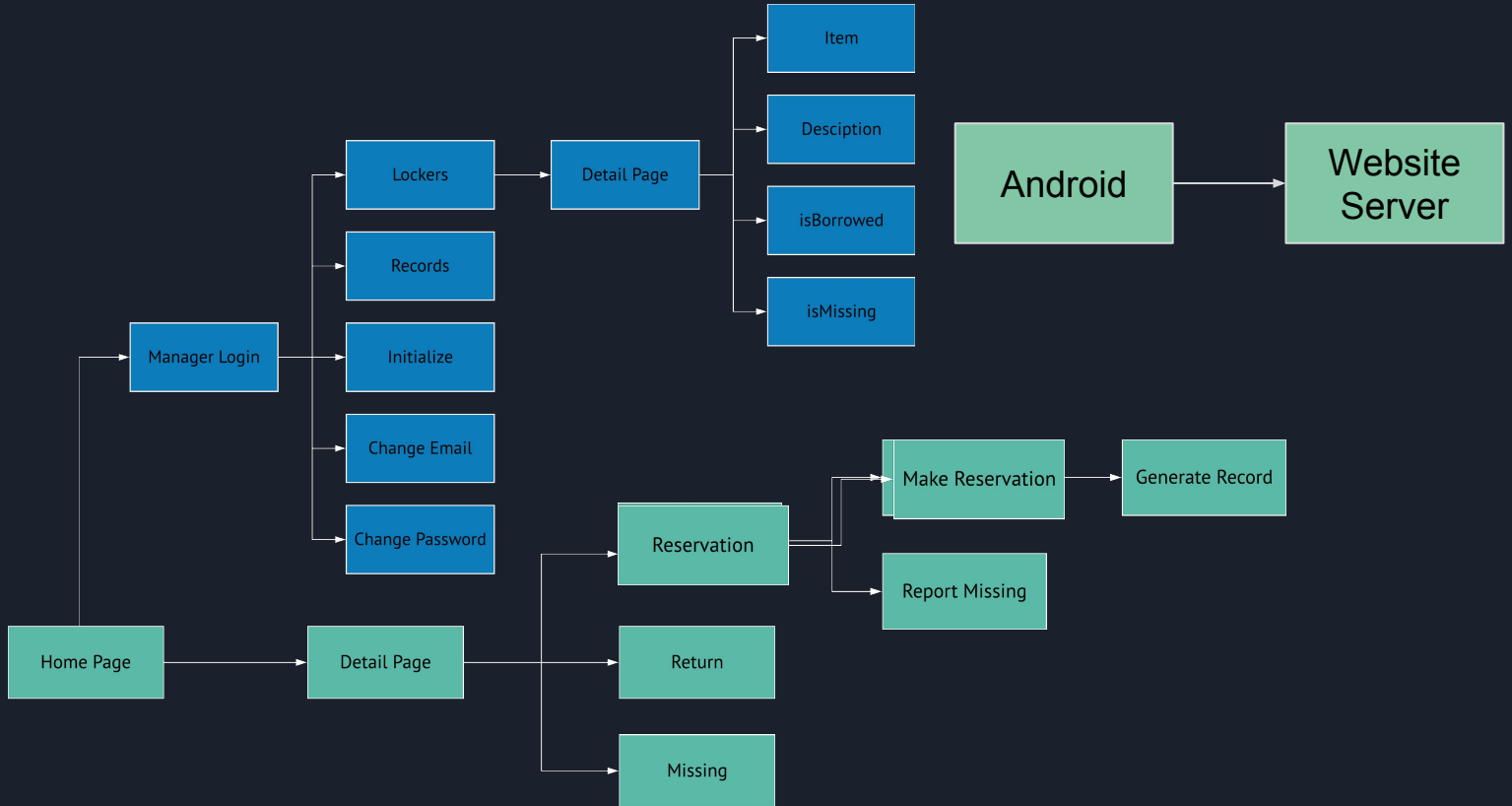**Manager**

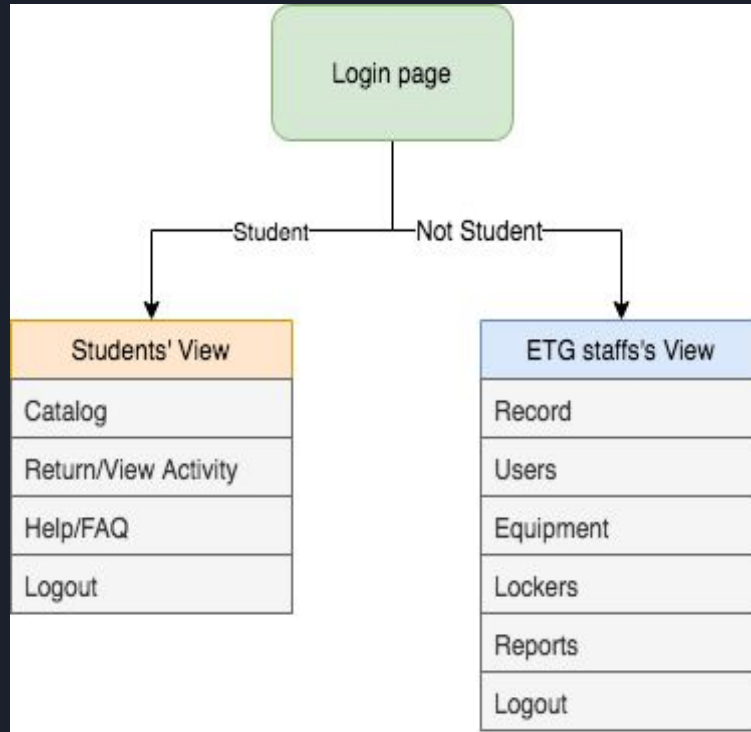Uid

Password

Email Address

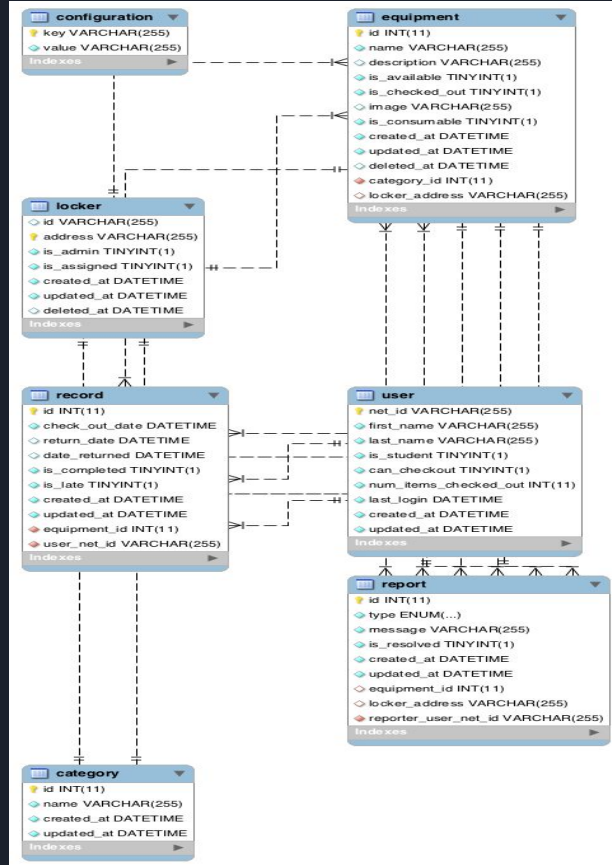Shelf's Size

Detailed Design

Next Step

Web application Functional Design

Improvement:

- Optimize the User Interface
- Move the Login process after students check out or return activity (based on clients' requirement).

Database schema of Web application

Improvement:

- Add Deleting data function to prevent over-stack.
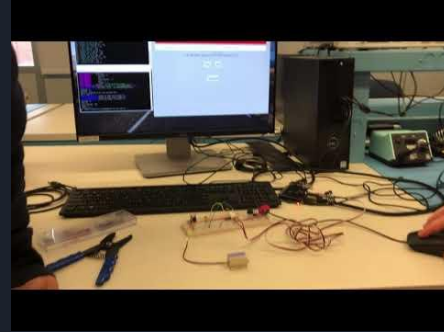- Refactor current structure.

Test Video

Demo Video User Version

- https://youtu.be/79feE-crR1I

Demo Video Administrator Version

- https://youtu.be/be98EIBO1B0

Conclusion

Current project status with respect to milestones

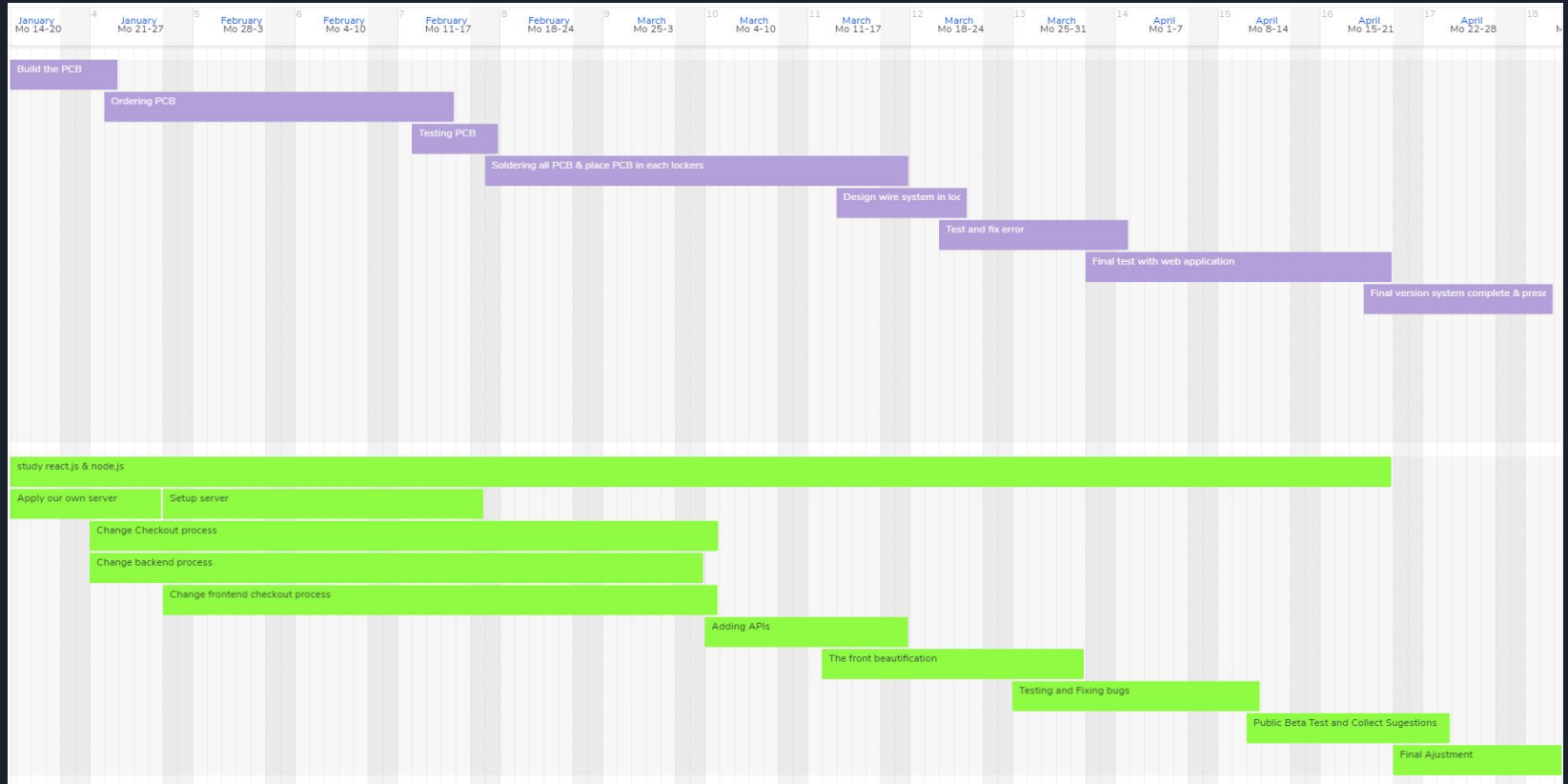| Task	Effort Level	Description
Setup locker units database	Low	Simply request a database from ETG and implement tables based on clients' requirement
Setup OWFS Server	Medium	Configure the Server based on the instruction of the OWFS website corresponding to the one-wire device.
Implement SMTP service	Medium	Setting up SMTP is not very hard, but we are not familiar with JS it could cause some trouble.
Install Raspbian on Raspberry Pi	Low	We need to install a OS on Raspberry Pi, there are guide online, it wouldn't be hard.
Setup Backend	High	The backend is based on node.js, it's a completely new thing for us, it needs a long time studying.
Implement Frontend Functions	High	The frontend is based on react.js, we haven't learned it before, we will need to learn it while implement through the whole project.
Design the door detecting circuit	High	New function. Use hall effect sensor and magnet to detect the position of the locker's door. And use a buzzer to alarm users.
Design the lock circuit	High	Main function. Use a 1-wire chip to assign an unique address for one locker, then design the voltage supply of lock, which is controlled by 1-wire system.
Combine circuits and test	Low	Connect lock and door detecting circuit and test.

Current project status with respect to milestones
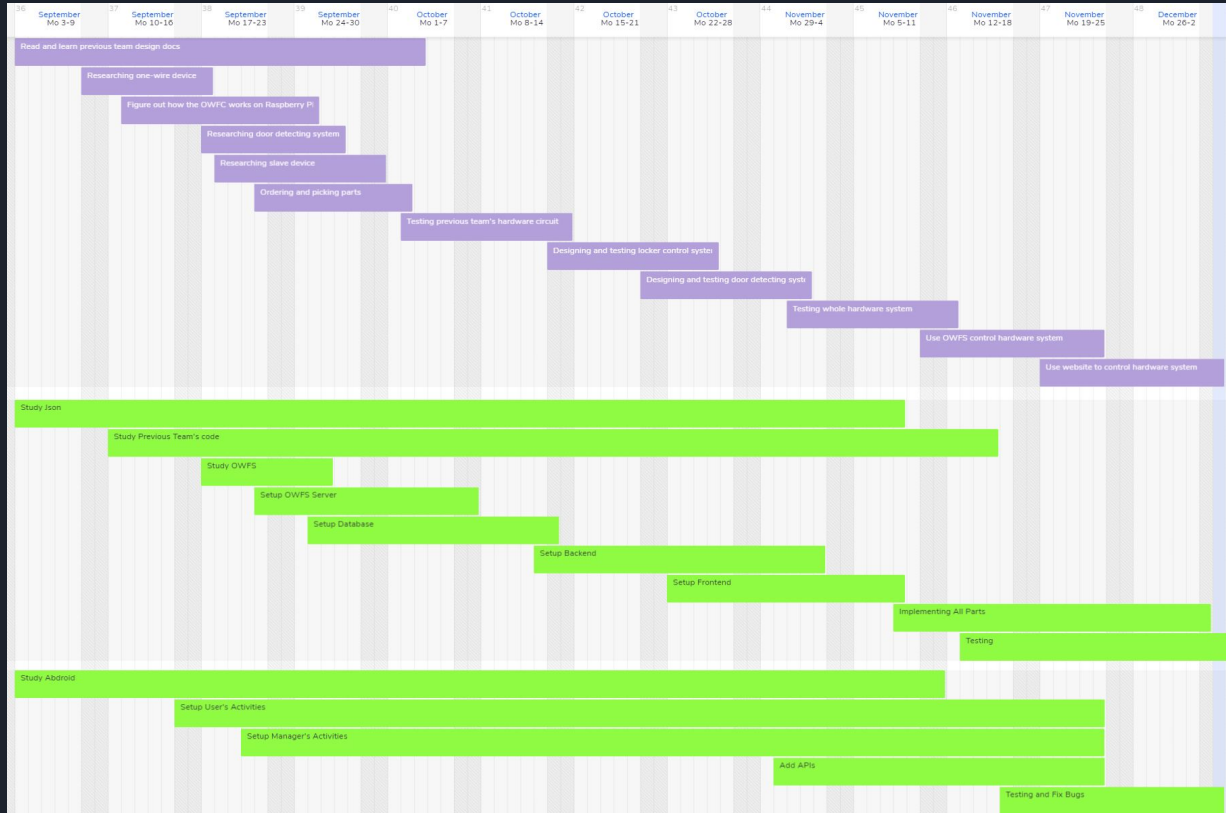
Contributions Of Each Project member
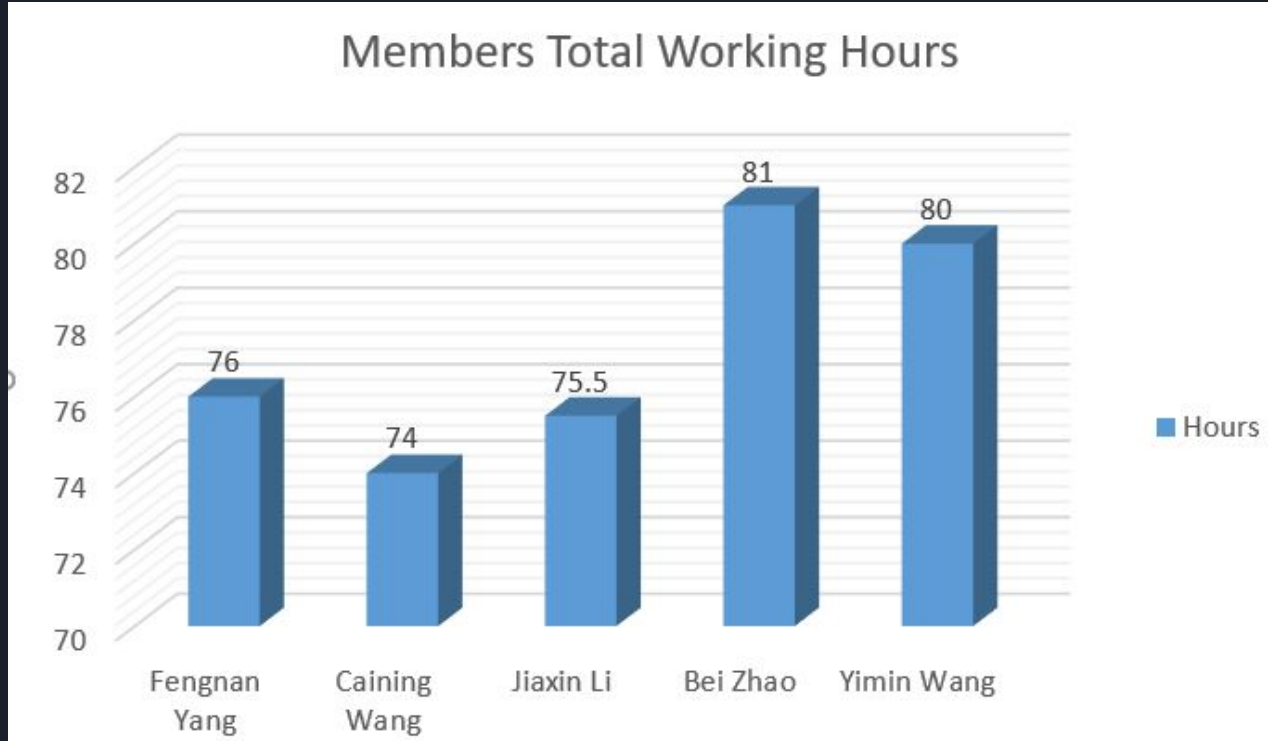
Plan for next semester

Thanks

Q&A