

A larger version of the eLok systems logo, featuring the same text and icons as above, but with a drop shadow effect.

**eLok systems**

## Post-Mortem for Audolok

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## Glossary

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<b>3G</b>	Third Generation of Mobile Telecommunications Technology
<b>4G</b>	Fourth Generation of Mobile Telecommunications Technology
<b>iOS</b>	iPhone Operating System
<b>LAN</b>	Local Area Network
<b>MCU</b>	Microcontroller Unit
<b>PWM</b>	Pulse Width Modulation
<b>TCP</b>	Transmission Control Protocol
<b>TTL</b>	Transistor-Transistor Logic

# 1. Introduction

Audolok is a smart door system aimed to alleviate challenges faced by individuals with limited mobility and strength. Audolok has three main features:

- Lock/Unlock using mobile application
- Automatically open and close door
- Electronic shareable keys

Since Smartphone's are becoming very popular in today's generation, all the features are conveniently accessed via the companion mobile application: *Audolok App*. Smartphone's use touch screen technology therefore require very little strength to perform tasks. eLOK Systems took advantage of this feature to alleviate challenges of unlocking and opening doors, in addition to preventing future injuries involved in performing such tasks. Audolok is an assembly of systems containing an Arduino Mega 2560, a Wi-Fi module and a motor driver. Mechanical parts controlled by the MCU's are gears, servo motors and linear actuators. A database will provide locations for authority and server based actions. A conceptual model of Audolok is shown below in figure 1.

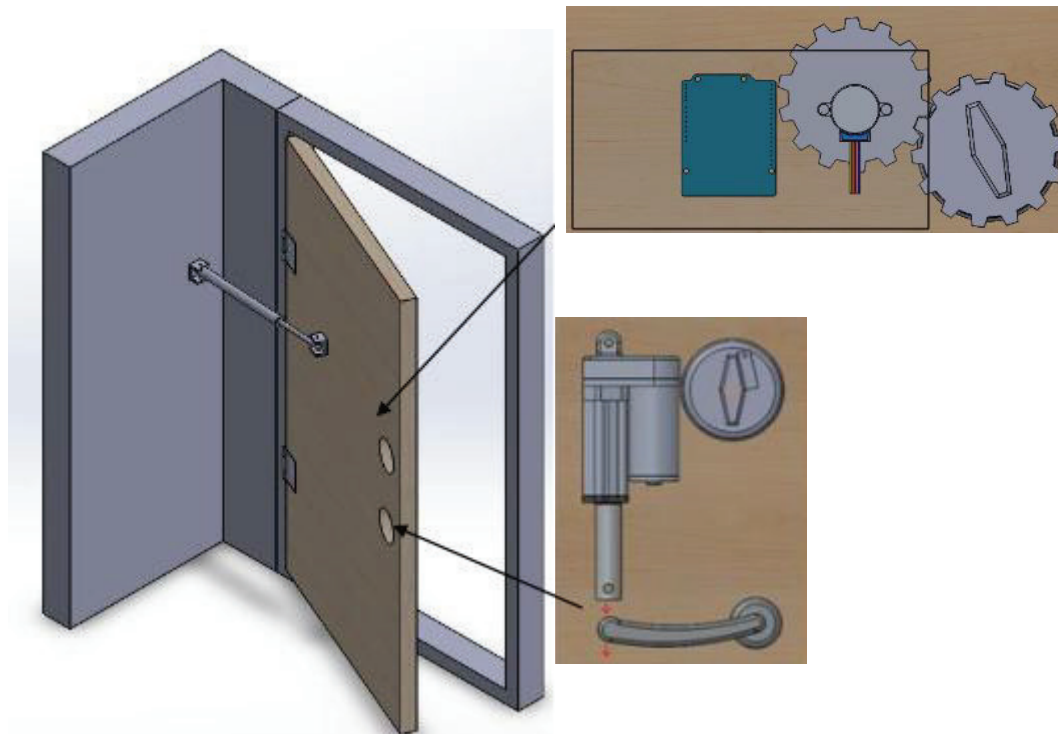


Figure 1: 3D conceptual model of Audolok

## 2. System Overview

Figure 2 below shows the block diagram of the system overview of Audolok.

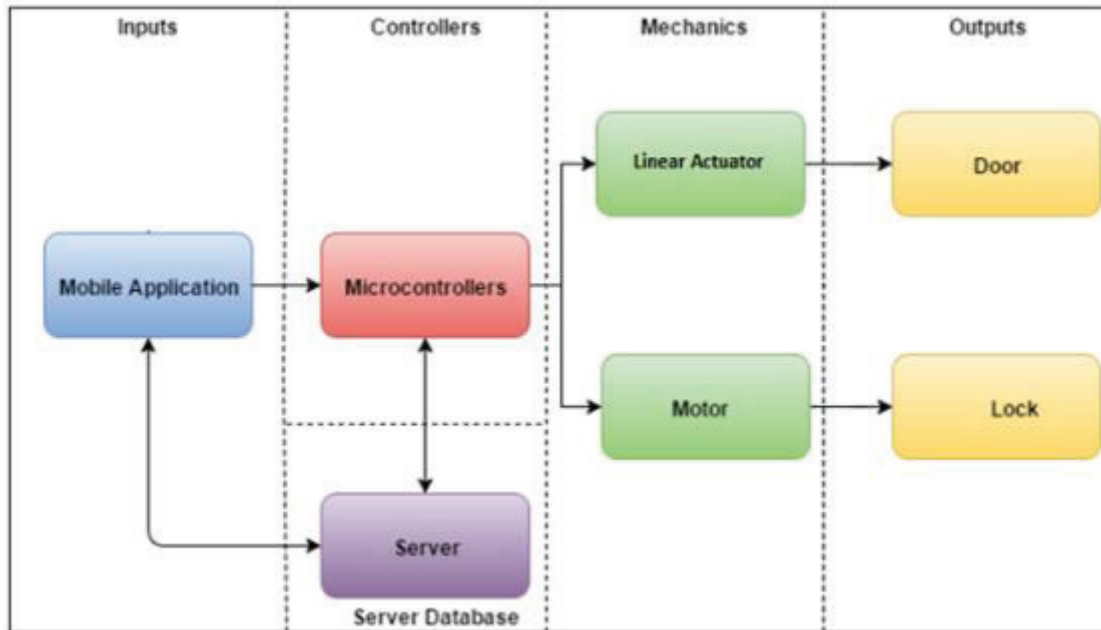


Figure 2: Block Diagram of Audolok's Systems

Each section of the block diagram is described below.

### Input

**Mobile Application:** The mobile application communicates with the microcontrollers and the server. Users are able to lock/unlock, open/close the door with the app, as well as check the door status and view a log of when the door has been unlocked. In addition, the users are able to share keys to other users.

### Controllers

**Microcontrollers:** The microcontrollers receive signals from both the server, for authentication, and the application for commands. When a command is received, the microcontroller tells the motors and linear actuators to run.

### Server

**Server:** The server communicates with the microcontroller and the mobile application. The server is where all the authentication data is stored. Once the server confirms the identity of the user, it allows access to the system. It also stores data of when the door is locked and unlocked which can be shown in a log on the mobile application.

### Mechanics

**Motor:** A motor is used to rotate the deadbolt lock. Two gears are used (as shown in figure 1) to connect the motor to the deadbolt lock. Once the microcontroller receives a

command to lock/unlock the door, the motor will start rotating in its respective direction, counter clockwise for unlocking and clockwise for locking.

**Linear Actuators:** Two linear actuators are used in the system. One linear actuator is used to open and close the door, and the other is used to open and close the door handle. The linear actuator will extract to close the door and retract to open the door. For the door handle, the linear actuator will be extended when the door handle is closed (initial state) and retract to pull the handle down to open the door handle.

### Outputs

**Lock:** The motor, along with mechanical parts such as rotating arms, will turn the lock, which unlocks the door. When the door closes, these mechanisms will turn back to lock the lock.

**Door:** When the linear actuator for the door is retracted, the door will be pulled open. When the linear actuator for the door is extended, the door will be pushed closed.

## 3. Schedule

Figure 3 below shows a Gantt chart of Audolok’s schedule to date. The blue represents the original plan, and the red represents the plan changes. From the chart, we can see that the beginning of the project has been on schedule, however closer to the demo date, we encountered problems with the software which greatly delayed our work. Thankfully, we were able to complete a working prototype by the demo date.

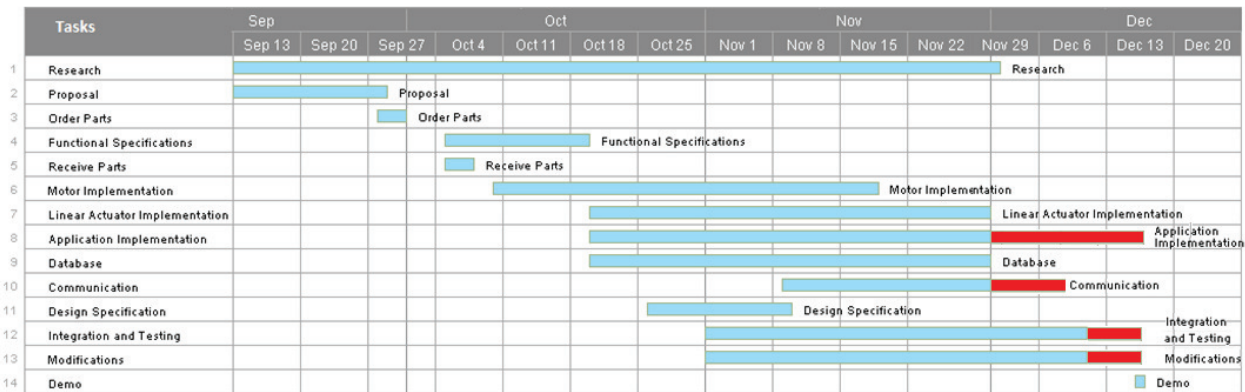


Figure 3: Gantt chart of Audolok

## 4. Finance

Component Name	Estimated Cost (\$)	Actual Cost (\$)	Difference (\$)
Arduino Uno R3	35	30	+5
Arduino Mega 2560	50	40	+10
ESP8266 Wi-Fi Module	60	40	+20
Xbee Shield	38	20	+18
Motor	20	16	+4
Dead Bolt Lock	15	10	+5
Door Structure	50	25	+25
3D print and PCB print	50	N/A	+50
Basic Components	30	50	-20
Tax and Mailing Fee	30	80	-50
Contingencies	100	140 (2xLinear Actuator ) 100 (miscellaneous)	-40 -100
Subtotal	478	551	-73

From the table above, our estimated cost was \$478 and our actual cost to date is \$551. Therefore we went over budget by \$73 so far because of a few remediation and modifications. There were a few changes in materials and components used throughout the developmental phase, but since our team had extras from previous projects, we were able to use those and save money. In addition, we located various suppliers for wood and plastic and were able to scrounge around their recycling bins and for the gears, we used old timing belts from a car garage.

## 5. Challenges

During the developmental stages of Audolok, there were many challenges and problems we had to face. Some challenges were overcome; however some challenges caused minor remediation, reevaluation and modifications. The following sections describe challenges we have faced during the development of Audolok.

### 5.1 Learning Curve

One common challenge our team had was learning about the stepper motor, servo motor and linear actuators since these components are new to each team member. After researching and reading the datasheets, we implemented test programs to the components, but at first, they did not work as they should. That means a lot of time was spent on debugging in order to figure out why each component wasn't working as it should and how to properly program the components.



## 5.2 Motors

Originally, we chose a stepper motor to rotate the deadbolt lock, however when testing, the stepper motor would vibrate give out some heat, so we were worried that this would cause problems in the future. With those results, we swapped the stepper motor for a servo motor, which means more time spent on learning. The servo motor we bought was continuous, so finding the right delay to turn the motor 90 degrees clockwise and counterclockwise was a challenge, but since the deadbolt lock doesn't require a perfect 90 degree rotation, then we could just approximate.

## 5.3 Linear Actuators

Similarly, the linear actuators gave us some problems that set us back a few days. First of all, there is not much information on linear actuators online, and there is not many sample codes we could use to test the linear actuators, so we had to do a lot of research to figure out how to manipulate them. Once we figured it out, we tried to integrate the motor and linear actuators together in their respective sequence. One sequence worked (linear actuator1, linear actuator2, motor), however the reverse (motor, linear actuator2, linear actuator1) did not work. We were all puzzled by this since it's the same commands but in reverse. We tried a variety of different methods to code the motor and linear actuator combination, but had no success. We figured the delay had something to do with the problem, but even with different implementations that got rid of the delay, the linear actuators wouldn't move after the motor rotated. Finally we solved the problem by detaching the motor in the code (using `myservo.detach()`). This solution is not ideal, and will have to be further looked into in the future, but for now, we will have to stick to this solution because of time constraints.

## 5.4 Door Structure

The door structure was challenging because none of our team members have much experience in woodworking and mechanics. We purchased an already assembled door for testing, but opening and closing it was a bit tight and the door wasn't quite square with the frame. Also, since it's the winter, the cold temperatures cause the door to expand and then the door wouldn't close. We had to expand the frame width as well as straighten the frame in order to get the door to open and close properly. We also had different plans on how we would attach the linear actuator that opens the door. Because the door cannot stand up by itself, we had to attach a plank of wood to stabilize it. Since we have to bring the door around, we could not build a nice structure to imitate a house door, so the placement of some components had to be changed. Originally we wanted the linear actuator that opens the door on the top of the door, so that it would not get in the way of anything, however that means we would have to attach a piece of wood to

the top and we could not figure out how to attach that without getting in the way of the door. So we changed the linear actuator to the bottom, but it interferes with the stabilization wood plank, therefore we had to cut a hole in the wall.

## 5.6 Communications

We selected the ESP8266 as the wireless communication device for its highly integrated feature, ease of implementation on product phase and ability to save more energy than traditional Arduino Wi-Fi Shields. However, the third party serial Wi-Fi module has encountered many problems. The very first problem is the loose wire connection between ESP8266 and Arduino which caused significant interference on communication and an external power supply was needed to stabilize the operation, and an additional logic level shifter between the Arduino and ESP8266 is essential as they talk in different TTL levels. In order to solve these problems, an Xbee Shield and Wee ESP8266 module was introduced, but the serial connection between Arduino and ESP8266 was relocated on Serial1 for debugging purpose at Serial0. In addition to the hardware configuration, the ESP8266 has 2 modes: Access Point and Station, and it can only operate in 1 mode, so the firmware has to introduce firmware mechanisms on server/client switch which caused extra energy consumption. Finally, the ESP8266 is still a qualified wireless communication device for Audolok.

## 5.7 Software

The challenges for software parts are mostly about integration and communication with the microcontroller unit. The problems occur one after another once the development of the iOS application began. Various versions of xcode cause internal conflicts in the simulator, wrong paths of files and images cause abnormal visualizations to the user interface, and using wrong frameworks and libraries cause the application to fail. Among all these, the most challenging one is still the integration of the hardware system and the TCP connection with the MCU. We spent half a month debugging and troubleshooting when merging all controllers and views together, but they still did not work at the end of November, which forced us to come up with a plan B.

Plan B is a website based application, which is entirely structurally different from an iOS application, but is a more familiar architecture. The database creation and setup is fluent, and registration and login system was coded soon as well. When it comes to the communications with the MCU by sending sockets, errors keep popping up because the Ethernet does not allow TCP server/client connection and we had to use local address network (LAN) instead.

## 5.8 Project Management

In addition to the technical challenges, the eLOK System team also faced lots of challenges on project management as this is the first time to manage professional level project. The challenges mainly distributed on following areas: project coordination, material management and time management.

As the eLok system team was divided into 3 parts: Hardware/Mechanical, software and communication/firmware, so the project coordination will play a crucial part in team management. At first, the team was solely operated in segmented groups, and there has been inefficient communication between groups until integration testing, especially for communication between software and hardware. This inefficient coordination is the major cause on schedule delay and remediation.

The material management was also another key challenge in product management. We had to order parts 3 separate times because of lack of proper planning. First order was from Taobao.com, second order from RP Electronics and third order from Taobao.com. The first order had many redundant components such as Bluetooth, Stepper Motor and LN 2003 drivers which were replaced in the later developmental stages, and the progressive product development cycles also generate conflicts between specification of design and products, and the efforts to makeup the specification deficit between components and product is also time consuming.

Last but not least, the time management was also an essential part of project management for its time consuming nature. Due to some time conflicts on members' timetable, the synchronization of project progress was influenced. For example, the final periods has a significant impact on integration phase.

In conclusion, many challenges and problems had occurred due to the lack of management experiences for this scale of project, and after these challenges and problems, the eLOK Systems team has acquired the skills and amplitude on how to efficiently coordinate between different teams, more efficient bills of material and time management.

## 6. Group Dynamics

The group was split into three parts: Hardware/Mechanics, Software and Communications/Firmware. Lexi and Ellson focused on the hardware and mechanical aspects of the project, Chi worked with the communications and firmware and Christy focused on the software portion. Each member helped the other teammates when they could in order to create harmony in the group and help solve problems and challenges.

## 7. Individual Learning

### Lexi

Turning an idea into a proof-of-concept and building a prototype is definitely a big challenge. From my previous co-op, I have gained some knowledge in product development and have met with potential investors. However, the product I previously worked on has already been started and for this project, we had to start from scratch. The very first challenge we had was coming up with an innovative idea which has not already been developed. We came up with a lot of ideas but they were too simple so we had to dig a little deeper. When we finally finalized our idea, the journey began.

Many challenges came up when working with the motors and linear actuators. Since this was my first time working with the Arduino, I had to learn about that first before implementing and testing. It's not as simple as plugging each component in and it magically will do what you want. I have learned that it takes many iterations and improvements to come up with the desired output. This was my first time to work with the Arduino IDE, sketch and design circuits and implement and test everything. Troubleshooting was the hardest part since Arduino's are new to me, when things didn't work, it was hard to find a solution. However, the experience I have gained working with the Arduino is very valuable and will be useful in future projects and later to the industrial level.

Since one of my previous co-ops included mechanical tasks and machine shop tasks, I was able to contribute those skills to our project and build the door structures and enclosure. I enjoyed applying these skills to our project and teaching my other team members more about this. I have also learned that communication is very important. Without proper communication, there could be miscommunication and interpretation of concepts and tasks. Communication helps to bring everyone to the same page.

I have heard from previous students that working together with friends on such a big project like Capstone can break friendships, however I believe that this course has brought us closer together. Even if sometimes we didn't get along, or had different views on suggestions or designs, we were able to work it out and come up with solutions.

Overall, Capstone has given me tons of new knowledge and was a great learning experience. I will definitely use all the skills, both technical and non-technical, to my future workplace and group projects.

## Ellson

During the project development, I have learned a lot about microcontrollers, linear actuators and motors. I had a good opportunity working with my teammates and learned new things from working with them. I have not only gained technical skills, but I have also learned interpersonal skills. Organization and planning is a key skill to have when doing a project, and this has been reflected greatly during the semester. I saw that when things were not planned very well, there would be problems. Therefore planning a lot ahead of time is crucial. At the beginning of our project, we spent a lot of time researching before we ordered our parts, so we got delayed to start the project. After we got all the parts, we spent even more time to test each one and figure out how to program them. But since the team has good dynamics, we worked together to solve the problems and were able to overcome most of them.

In addition, I have learned what types of documents are needed for good project management and learned how to write each type. Writing is not my strongest skill, but I was able to practice a lot while helping write all the documentation needed for our project. We were able to meet all the deadlines for the documentation because we learned to start early just in case we were faced with problems or needed to add/change anything last minute.

Teamwork is also very important in group projects because everyone has to be able to work together and cooperate so that there are no team conflicts. Everyone needs to be understanding and listen to each suggestion of the other teammates in order to be fair to each other. If there's no teamwork, it will take longer to complete tasks.

## Christy

This project did teach me a lot during the semester. When we group up, the topic was decided by all members together which means everyone has enthusiasm and passion towards the project and it is a great beginning of the semester which indicates the success we will have at the end.

Being the only member oriented in Computing Engineering in the developing group, I accepted to take all responsibilities in software development and then, with help from Chi, do the communications between software and the MCU. Designing, implementation, testing and debugging was challenging because I could not seek much help from my teammates since they don't have much knowledge in that area. I am also taking software development course at the same time and I thought that I could benefit from the course materials to help me on this project.

When I started to work on the iOS application, I felt that it is really huge pressure. The learning experience about objective-C, xcode, Github and Cocoa is fun, but when bugs appear and there is only you to solve they will become nightmares. To

work more efficiently, I used waterfall development process model instead spiral development process model to have unit testing when each phase is finished then to do the integration and communication testing together as one. It may be a good idea if the developing group is large consisting multiple members, but for me, the result turns out that the integration causes many error because of internal conflicts among different controllers and I have to find a backup plan.

Then I have a plan B which is a web server based application supporting by a structure including PHP, Apache and mySQL database. This is a structure I am familiar with so that I could built it rapidly. The registration and login pages work perfectly, and the email verification guarantees the authentication of the identification of users and enhance the security level of the system, which is a good thing. Because back to when I was working on the iOS application, I was worrying about safety of the user's' information through the whole process, and for a web server based application, I do not need to concern that because there are various protocols to protect users' information. And we use a third party application to control the state of the lock, which works perfectly.

In this journey, besides teamwork and determination, if there is any other thing I learn, is always trying your best to find a backup plan. Do not panic, just try your best. And sometimes the backup plans could work better than you expected.

## Chi

It is the first time to get involved in a full product development cycle from proposal to prototype demonstration. During the process, I have been exposed not only to technical problem solving, but also management and coordination, and furthermore, it also brought my troubleshooting skills to the next level.

As a hardware/firmware engineer, coordinator and CFO of eLOK Systems, I have accumulated lots of technical experience on embedded system design, communication system design, bills of material and finance management. For example, on the embedded system design, as our team selected Arduino Mega 2560 as microcontroller, and our system was designed as tasks oriented, and the nature of Arduino Mega 2560 does not support multi-thread (multi-task). However, the fast prototyping from Arduino series was highly desired by our project, so we have to come up with alternatives to implement our task based firmware architecture under arduino's constraint. After evaluating our specification and AVR architecture, we have introduced Finite State Machine with time fragment to simulate the scheduler, and it significantly simplified our project complexity of implementation, and it also enabled more efficient microcontroller kernel operation. To sum up, the process of capstone project had significantly improved the problem solving and troubleshooting skills.

In addition to those technical work themselves, the technical coordination was another challenging part as our team was divided into 2 parts: Hardware and Software, and the relatively isolated work distribution also expect a higher level of coordination skills to manage the hardware and software team to stay on the same track. In addition to coordination, these other management skills such as material managements and bills of materials also have been improved a lot compared to prior to capstone project.

Finally, the Audolok system offered me a chance to integrate my previous experience and knowledge in an industrial product development cycle, and it also brought new knowledge on both technical and non technical aspects, and to myself, this is a very valuable experience in my life.

## 8. Workload Distribution Chart

The following table summarizes the workload distribution of each member of eLOK Systems. The weights are represented by x's where more x's represent primary responsibility.

Task	Lexi	Ellson	Christy	Chi
<b>Mechanical Design and Implementation</b>	xx	xx		x
<b>Mechanical Testing</b>	xx	xx		x
<b>Hardware Design and Implementation</b>	xx	x		xx
<b>Hardware testing</b>	x	x		x
<b>iOS App Development</b>			xx	
<b>Server and Database Implementation</b>			xx	x
<b>Web Application Development</b>			xx	
<b>Communication Implementation</b>			x	xx
<b>Assembly and Prototype Testing</b>	xx	xx		xx
<b>Structure</b>	xx	xx		x
<b>Documentation</b>	xx	x	x	x
<b>Research</b>	x	x	x	x
<b>Minutes/Administration</b>	xx	xx	x	x



## 9. Conclusion

By the end of the semester, the eLOK Systems team made an idea into a proof-of-concept design and built the first prototype of Audolok. Each team member learned a lot while researching, developing ideas and designs and overcoming challenges. We learned that success is working together as a team, and that planning and organization is crucial. We all got to know each other a bit better and have experienced many memories together which we hope to continue in future projects. This project has prepared us for future engineering careers and product development.

Future improvements of Audolok would be to add the features that we originally intended to implement, but didn't have time and resources to complete. These features include a camera to remotely view who is at the door, and the door button feature which notifies the user's phone that someone is at the door. In addition we wish to improve the design of the enclosure and gears and figure out a better way to attach each component to the door in order to make them more user friendly.



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## Appendix A: Meeting Minutes

### Meeting Minutes 1

Friday, 09.11.2015 4pm

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#### Attendees

Lexi Chor, *CEO*  
Ellson Dai, *CTO*  
Chi Zhang, *CFO*  
Christy Tao, *CIO*

#### Agenda

##### Last Meeting Follow-up

1. First meeting, no follow-up

##### New Business

1. Discuss possible project topics
2. Share background on courses, work/school schedules

#### Notes

##### IDEAS

- Christy
  - GPS tracking device for kids and pets
- Ellson
  - Temperature Mug
- Lexi
  - Auto Lock for door (home or meeting rooms)

#### Action Items

1. Research everyones idea, see which ones are better, how can we implement...etc

#### Next Meeting Agenda Items

- Share any new ideas
- Share any new info on old ideas
- Research information
- Choose which idea we want to share with prof

# Meeting Minutes 2

Monday, 09.14.2015 4:30pm

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## Attendees

Lexi Chor, *CEO*  
Ellson Dai, *CTO*  
Chi Zhang, *CFO*  
Christy Tao, *CIO*

## Agenda

### Last Meeting Follow-up

1. Researched ideas
2. any new ideas for proj
3. which proj we choose to present to prof

### New Business

1. new ideas?

## Notes

### NEW IDEAS

- Chi
  - Body movement detector. feedback for running
- Ellson
  - expand on Temperature Mug
- Lexi
  - voice controlled appliance, light, radio...etc (discarded because too much noise...wont be good product)

## Action Items

1. Everyone write ideas on gdocs and expand so we have written doc. materials, description etc.

## Next Meeting Agenda Items

- Finalize idea to present to prof

# Meeting Minutes 3

Monday, 09.21.2015 10:30am

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## Attendees

Lexi Chor, *CEO*  
Ellson Dai, *CTO*

## Regrets

Chi Zhang, *CFO (SICK)*  
Christy Tao, *CIO (WORK)*

## Agenda

### Last Meeting Follow-up

1. Review gdocs for ideas

### New Business

1. share ideas with prof

## Notes

- Ellson new idea: parking finder/locator app
- Andrew was not in office. Try tomorrow

## Action Items

1. Find Andrew and share ideas. get approval

## Next Meeting Agenda Items

1. Share Andrews feedback with group

# Meeting Minutes 4

Monday, 09.22.2015 4:30pm

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## Attendees

Lexi Chor, *CEO*  
Ellson Dai, *CTO*  
Chi Zhang, *CFO*  
Christy Tao, *CIO*

## Agenda

### Last Meeting Follow-up

1. Talk with Andrew for feedback

### New Business

1. Share feedback with group
2. Start proposal

## Notes

- Feedback: Mug and parking too easy. Lock ok
- Suggest to make automatic open so good for disabled people

## Action Items

1. Refer to previous proposals to get more ideas on detailed sections

## Next Meeting Agenda Items

1. assign roles for writing proposal
2. discuss content details

# Meeting Minutes 5

Wednesday, 09.25.2015 4:30pm

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## Attendees

Lexi Chor, *CEO*  
Ellson Dai, *CTO*  
Chi Zhang, *CFO*  
Christy Tao, *CIO*

## Agenda

### Last Meeting Follow-up

1. Make final decision on proposal topic
2. Have a group discussion on final details about the topic

### New Business

1. Assign roles to group members

## Notes

- Lexi: Executive summary, letter of transmittal, intro, system overview, edit
- Ellson: Market analysis, resources, risks and benefits
- Chi: Budget and finance, scheduling
- Christy: conclusion, proposed design

## Action Items

1. everyone will finish parts by Friday. will see what we are missing

## Next Meeting Agenda Items

1. discuss parts to order

# Meeting Minutes 6

Monday, 09.28.2015 2:30pm

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## Attendees

Lexi Chor, *CEO*  
Ellson Dai, *CTO*  
Chi Zhang, *CFO*  
Christy Tao, *CIO*

## Agenda

### Last Meeting Follow-up

1. Finalize all parts to order

### New Business

1. Discuss any last minute details for Proposal

## Notes

- Parts needed
  - Arduino Uno
  - Arduino Mega
  - Wi-Fi Shield
  - Motor Driver ULN2003
  - Stepper Motor 28byj-48 5V

## Action Items

1. Chi will order all parts
2. Once parts received, read datasheets for each component

## Next Meeting Agenda Items

- 1st week Oct take break for midterms
- Next meeting discuss functional specifications

# Meeting Minutes 7

Monday, 10.12.2015 2:00pm

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## Attendees

Lexi Chor, *CEO*  
Ellson Dai, *CTO*  
Chi Zhang, *CFO*  
Christy Tao, *CIO*

## Agenda

### Last Meeting Follow-up

1. Recall previous discussions and actions

### New Business

1. Discuss functional specifications
2. Refer to previous functional specifications to get ideas on detailed sections
3. Figure out which sections are required specifically for our product
4. Assign sections to each group member

## Notes

- Lexi: LoT, ExSum, Intro, Sys Overview, Overall sys, Mech Sys, Edit
- Ellson: Audience, Classification, Overall Sys, Mech Sys,
- Chi: Overall Sys, MCU, Sustainability, Safety
- Christy: Software, Conclusion

## Action Items

1. Everyone to finish parts by Friday
1. Lexi will edit over weekend

## Next Meeting Agenda Items

1. Friday, check what is missing
2. Oral progress report with Lukas



# Meeting Minutes 8

Friday, 10.16.2015 2:30pm

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## Attendees

Lexi Chor, *CEO*  
Ellson Dai, *CTO*  
Chi Zhang, *CFO*  
Christy Tao, *CIO*

## Agenda

### Last Meeting Follow-up

1. All sections complete?

### New Business

1. What is missing for functional specs
1. Go over TA email guidelines

## Notes

- Almost all is done, just need conclusion and fix parts according to TA emails

## Action Items

1. Start editing and formating (Lexi)

## Next Meeting Agenda Items

1. Oral Progress

# Meeting Minutes 9

Thursday, 10.22.2015 1:00pm

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## Attendees

Lexi Chor, *CEO*  
Ellson Dai, *CTO*  
Chi Zhang, *CFO*  
Christy Tao, *CIO*

## Agenda

### Last Meeting Follow-up

1. Too many Functional Spec?

### New Business

1. Go over project progress
2. Go over rubric
3. Prepare for oral report to TA Lukas

## Notes

- None

## Action Items

1. Go over comments and suggestions from TA
2. Research parts and start figuring out connections etc.

## Next Meeting Agenda Item

# Meeting Minutes 10

Friday, 10.30.2015 2:30pm

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## Attendees

Lexi Chor, *CEO*  
Ellson Dai, *CTO*  
Chi Zhang, *CFO*

## Regrets

Christy Tao, *CIO* (*In Surrey using Mac since Lab1 has no Xcode*)

## Agenda

### Last Meeting Follow-up

### New Business

1. Test components in lab1
  - a. Wi-Fi shield
  - b. Stepper Motor

## Notes

- Stepper motor is jittering, figure out why
- Code accounted for pin order [8,10,9,11] so we didn't have to connect wires accordingly
- Jitter lessened
- Christy is testing some basic functions in xcode, prototype in 2ish weeks

## Action Items

1. Get Motor to rotate both ways, 90deg and 180deg testing.

## Next Meeting Agenda Items

1. Design specifications

# Meeting Minutes 11

Wednesday, 11.04.2015 2:00 pm

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## Attendees

Lexi Chor, *CEO*  
Ellson Dai, *CTO*  
Chi Zhang, *CFO*  
Christy Tao, *CIO*

## Agenda

### Last Meeting Follow-up

1. Motor works as it should

### New Business

1. Design Specifications
2. Review past documents
3. Decide what needs to be put into our design spec
4. Separate parts

## Action Items

1. Everyone to finish their parts by Friday
2. Edit over the weekend

## Next Meeting Agenda Items

# Meeting Minutes 12

Monday, 11.14.2015 2:00 pm

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## Attendees

Lexi Chor, *CEO*  
Ellson Dai, *CTO*  
Chi Zhang, *CFO*  
Christy Tao, *CIO*

## Agenda

### Last Meeting Follow-up

1. Check all sections are complete

### New Business

1. Unit Test plan for each subsystem
2. What is missing from remaining sections of Design Spec
3. Discuss about integrated test

## Action Items

1. email prof for 3 day extension

# Meeting Minutes 13

Monday, 11.16.2015 1:00 pm

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## Attendees

Lexi Chor, *CEO*  
Ellson Dai, *CTO*  
Chi Zhang, *CFO*

## Regrets

Christy Tao, *CIO (not needed, Hardware team meeting)*

## Agenda

### New Business

1. Linear Actuator Status
2. Motor Status
3. Communications Status

## Notes

- Motor works
- Linear actuator code isn't working with button
- Communications isn't working due to interference on wiring

## Action Items

1. Review linear actuator code, do research, fix by end of next week
2. Continue working on communications, plan done by end of next week

## Next Meeting Agenda Items

1. linear actuator status
2. communications status
3. integration testing for mechanical parts

# Meeting Minutes 14

Friday, 11.18.2015 2:00 pm

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## Attendees

Lexi Chor, *CEO*  
Ellson Dai, *CTO*  
Chi Zhang, *CFO*  
Christy Tao, *CIO*

## Agenda

### Last Meeting Follow-up

### New Business

1. A drive board is desired for integration of linear actuators and motors

## Notes

- L298N is capable to drive linear actuator
- Use servo motor instead of stepper for higher torque and ease of use
- Order a better encapsulated Wi-Fi Module called ESP8266 Wee and Xbee shield

## Action Items

1. Next Meeting Agenda Items
2. Fix Servo Motor's library Problem
3. Use 1 day express shunfeng for delivery
4. Purchase L298N motor driver for linear actuator and servo motor from RP electronic
5. Purchase Logic level shifter and USB-TTL module for ESP8266 firmware update
6. Purchase ESP8266 Wee Module and Xbee Shield as plan B

# Meeting Minutes 15

Monday, 11.23.2015 12:00 pm

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## Attendees

Lexi Chor, *CEO*  
Ellson Dai, *CTO*  
Chi Zhang, *CFO*  
Christy Tao, *CIO*

## Agenda

### Last Meeting Follow-up

1. Taobao Shipping successfully delivered to friends' house and they will arrive next week
2. Servo Motor Problem fixed
3. Linear Actuator and Servo works with L298N

### New Business

1. Process Report
2. Modification on Test Plan

## Action Items

1. Finish everyone's parts for process report and bring them together for integration
- 2.



# Meeting Minutes 16

Friday, 11.24.2015 2:00 pm

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## Attendees

Lexi Chor, *CEO*  
Ellson Dai, *CTO*  
Chi Zhang, *CFO*  
(Hardware Team Only)

## Agenda

### Last Meeting Follow-up

1. Test Plan and Process Report all Submitted
2. Taobao order arrived

### New Business

1. Unit Test for mechanical system
2. Unit Test for communication system

## Notes

- UDP/TCP connection?
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## Action Items

1. Use Button to simulate input for mechanical system for unit test
2. Use android app called UDP and TCP server to send and receive message with ESP8266+Arduino for unit test.

## Next Meeting Agenda Items

# Meeting Minutes 17

Thursday, 12.10.2015 2:00 pm

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## Attendees

Lexi Chor, *CEO*  
Ellson Dai, *CTO*  
Chi Zhang, *CFO*  
(Hardware Team Only)

## Agenda

### Last Meeting Follow-up

1. Unit Test for communication and mechanical system finished\
2. TCP connection is better for its connection oriented nature

### New Business

1. Doorstate problems
2. Integrated Test of mechanical system and communication system with UDP/TCP server to simulate unfinished apps

## Notes

- DoorState may be stored in EEPROM for nonvolatile case
- DoorState can also be stored on web server

## Action Items

1. Use EEPROM and Server End to store door state and compare the performance

## Next Meeting Agenda Items

1. Determine which feature is more suitable for Audolok