EE/CprE/SE 492 BIWEEKLY REPORT 5 (10/26/2019 – 11/8/2019)

Group Number & Project Title: (5) Road Safe Phone Case

Client: Christine Shea-Hunt

Advisor: Dr. Diane Rover

Team Members/Role: (Software) Zixiao Lu, Yifei Wang

(Hardware) Kedan Xin, Yue Chen, Sarah Baratta

Weekly Summary

For the past two weeks, the team has primarily focused on the state diagram, messaging system, and case reconstruction. At this point, the team has added the battery section into the case, added a wall to hold the servomotor, and modified the dimension of the case to fit more components without interference. For the state diagram, the team improved the previous one based on the advisor's suggestions. The team added one more state and several more inputs that had previously been combined into the diagram to display more precise activities of the project. To make the functionality even more clear, descriptions as to what the states were equivalent to ("Not Driving", "Driving", etc.) were added to the diagram. Lastly, the team received the Bluetooth module device this week. Moving past sending signals from the computer to the cellphone, the team will start to make a connection between the cellphone and the case's circuit.

Past week accomplishments

In the past week, the team completed the state diagram and made steady progress on modifying the case. The newly designed case has securely covered all mechanical and electrical components, which improved the project's reliability and security. It will be the second life-sized prototype and will be printed in the next few days using the university's 3D printers. It is planned that this will be the last prototype, and that one more version will be printed as the final product or, the deliverable, for the client.

The updated case design also minimized the interference of different parts by adjusting the placement of the walls within the case and by making small holes in the wall at the bottom designated for the wires to connect each component. Larger holes were also added to hold the motor for the locking mechanism and to allow a charger to reach the phone while it is locked away when the user is driving. These adjustments can be seen in the image on the following page.

1

Updated 3D Model of Case:

RFID Readers for detection

Charging port

Arduino Nano and other components
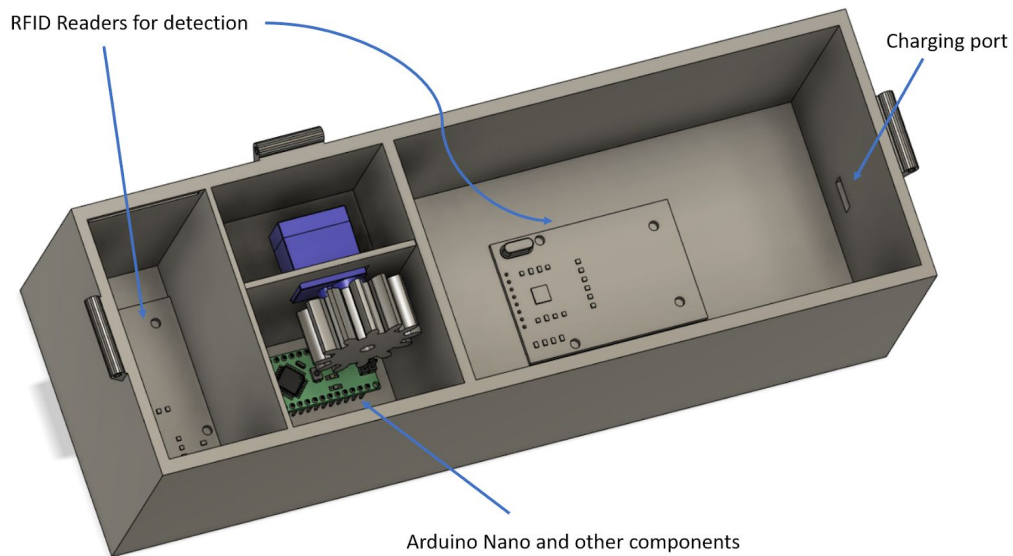
Other adjustments were made to the gear rack that locks either of the two case lids. The ridges on the rack were carefully placed to avoid the chance of a user pushing the gear rack to break the case or attempt to unlock one of the lids. As can be seen in the image on the right, the far-right ridge on the gear rack is completely up against the wall, which will prevent a user from pushing it any further. The opposite end will be flat against the middle cover, which will also prevent the possibility of grabbing the rack to pull it out the opposite way.

Gear and Gear Rack:
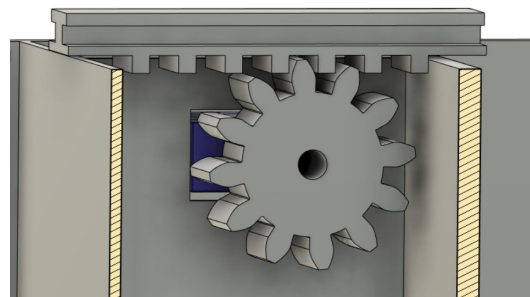
The first prototype also lacked an enclosure for the battery that is necessary for providing power to this portable circuit. The placement was chosen to be under the middle portion of the case to avoid taking up extra space in the phone or key portion of the case. The cover for the battery was a bit difficult to design, so this implementation will be reviewed before printing the final case.
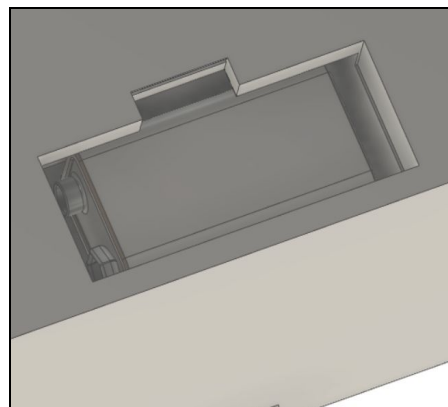
Battery Enclosure:
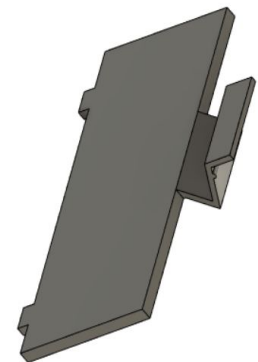
The state diagram was also improved upon. To be more precise and organized in reviewing the case operation, Chen created a table that related all 32 sets of possible input combinations to the 4 possible states. This was quite a lengthy table, so its entirety cannot be shown here. The full table can be found on the documentation page of the project's website whereas just a small portion is shown in the image below.

Preview of the State Machine Table:

| Present State (inputs in the order: edcba) a - cell phone in case / RFID b - cell phone case cover is closed / Magnet c - car key in case / RFID d - car key case cover is closed / Magnet e - emergency	Next State					
	00000	00001	00010	00011	00100	00101
A (Initial State. Can access both cell phone side and key side of the case. Lock is at key side locking position with cover open.)	A	A	A	B	A	A
B (Driving State. Access to the car key, lock the cell phone side.)	Invalid input	Invalid input	B	B	Invalid input	Invalid input
C (Not Driving State. Access to the cell phone, lock the car key side.)	Invalid input	Invalid input	Invalid input	B	Invalid input	Invalid input
D (Emergency State. Can access both cell phone side and key side of the case.)	D	D	Invalid input	Invalid input	D	D

Based on the table, a state diagram was constructed using only the valid inputs and transitions. The descriptions of the states A, B, C, and D are brief in the diagram; however, they have been described in greater detail in the table as to what the expected situation is during that situation.

State Diagram:
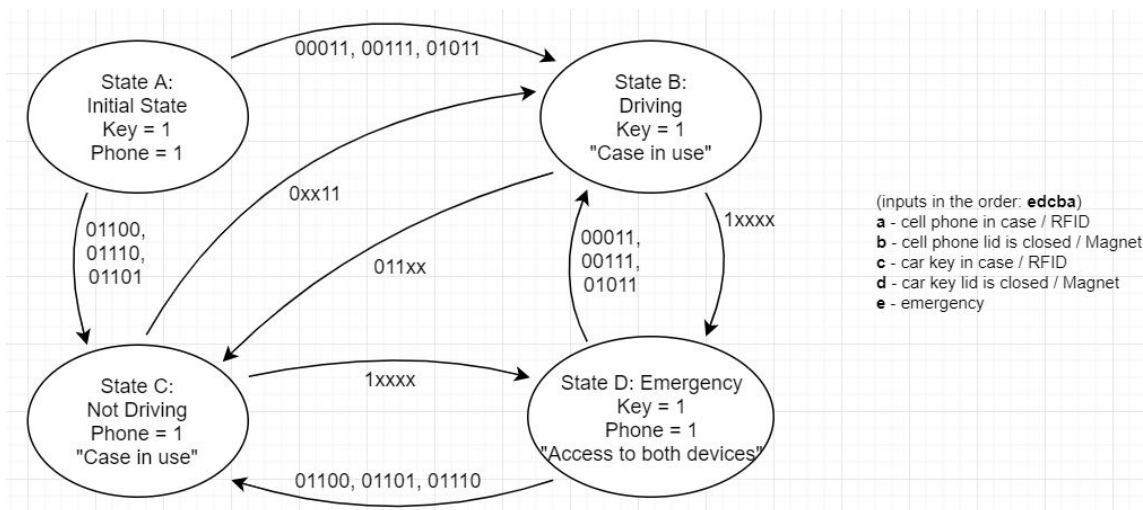
State D can be quite ambiguous or misleading by being named emergency state because this could correspond to a situation in which the user has lost their phone but needs to drive somewhere, in which they are using their phone while a mechanic is using their keys to assess their vehicle, and several other situations in addition to an actual emergency. The team plans to cover all these cases with a general statement along the lines of "The driver has access to both the phone and car keys", rather than a statement that will cause worry, such as "The driver has pressed the emergency button".

The app for the messaging system is also in the process of being developed. So far, testing using a cable to link the computer and cellphone has been successfully in display messages to a rudimentary app on an Android phone. Shown in the image on the right is the initial messages before any formatting. Testing has begun using the Bluetooth module.
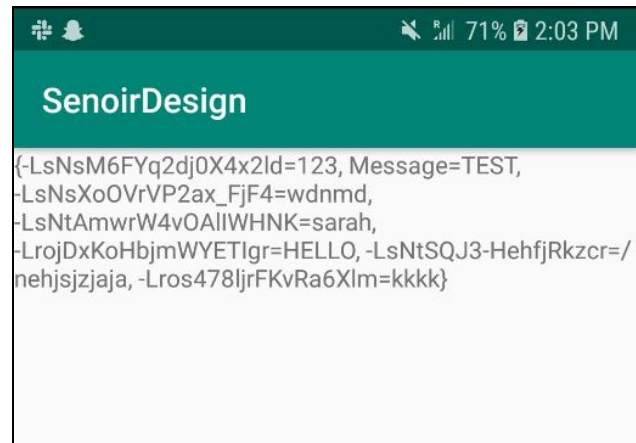
Described below is what each individual team members worked on:

Zixiao Lu: Meeting with advisor, working on state diagram, revision on code with Yifei. Collaborate with other teammates on the state diagram. And now with the help from Yifei and me, we could successfully sending messages from our phone to the other end.

Yifei Wang: Meeting with advisor, redesign the model, and revision on the communication code. Built up an understanding on firebase when working together with Lu. Collaborate with other teammates on the state diagram.

Kedan Xin: Met with the advisor to provide an update and receive advice for messaging system. Revised the 3D model and received additional input for disguising all circuit components changes from Sarah. Testing the bluetooth module. Helped rework the state diagram.

Yue Chen: Met with the advisor. Reworked on the state diagram by creating a detailed table that included all state transitions whether they are a valid state or unvalid/never possible. Worked on the case layout design with Kedan and Sarah.

Sarah Baratta: Updated advisor and received advice. Making adjustments to the life-sized case with Kedan. Drawing the updated state diagram and providing better explanations as to what the states represents.

Individual Contributions Table:

Name	Individual Contributions	Hours This Week	Hours Cumulative
Zixiao Lu	Meeting with advisor, working on state diagram, revision on code with Yifei. Collaborate with other teammates on the state diagram.	5	74
Yifei Wang	Meeting with advisor, redesign the model, and revision on the communication code. Built up an understanding on firebase when working together with Lu. Collaborate with other teammates on the state diagram.	6	78
Kedan Xin	Met with the advisor, revised the 3D model, received Sarah's input for adjustments to model , testing the bluetooth module, helped rework the state diagram.	8	92
Yue Chen	Reworked on the state diagram and case design with Sarah and Kedan, helped to redesign the case.	6	84
Sarah Baratta	Revision of the state diagram, meeting with the professor, editing the case design with Kedan, working on product use description.	7	88

Plans for the Upcoming Week

For the upcoming week, the team will continue to work on the case reconstruction, so that it can be finalized for the last version of the case that will be delivered to the client. At the same time, the team will start to implement the Bluetooth module on the microcontroller and create a connection between the cellphone and the case. Another portion of this messaging system that still needs to be worked upon is the formatting of the app so that messages can be sent in a neat manner between the driver and the individual that will receive the notifications to help monitor the user's driving habits.

Described below is what each individual team members plans to work on:

Zixiao Lu: After the bluetooth successfully set up, I would modify the code to fit the overall design. And in the meantime, collaborate with other teammates on the bluetooth.

Yifei Wang: Working on the 3D design and set up the bluetooth module. Collaborate with Lu on the message sending code.

Kedan Xin: Go to the printing center to print out the version 2 of the life-sized prototype and assemble them together with other components. Keep working on bluetooth module, so that it is easily integrated into the existing circuitry.

Yue Chen: Continue to work on case design with Kedan and Sarah, and maybe start soldering the circuits with smaller wire. Help to implement the Bluetooth function on the microcontroller.

Sarah Baratta: Review new life-sized prototype and possibly begin soldering the components together with the new, extremely small wire that the team recently purchased. Continue working on a sort of user manual to provide to the client.