Road Safe Phone Case

Team Number: sddec19-05
Website: http://sddec19-05.sd.ece.iastate.edu/
Client: Christine Shea-Hunt
Advisor: Dr. Diane Rover

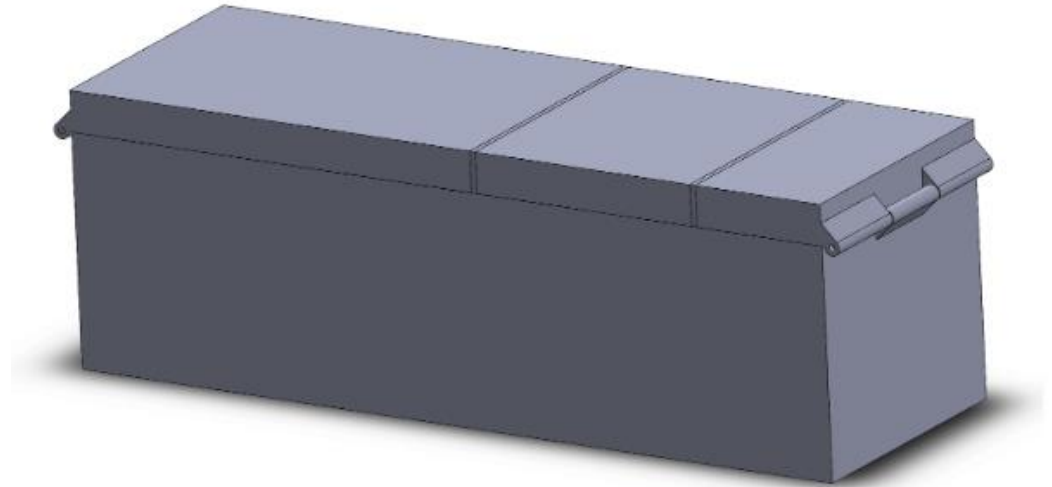# Problem Statement

- Phone: Communication, Entertainment

    Distracted Driving

- Solution:
    - Create a two sided case

Conceptual Sketch

Phone/Key Case Diagram
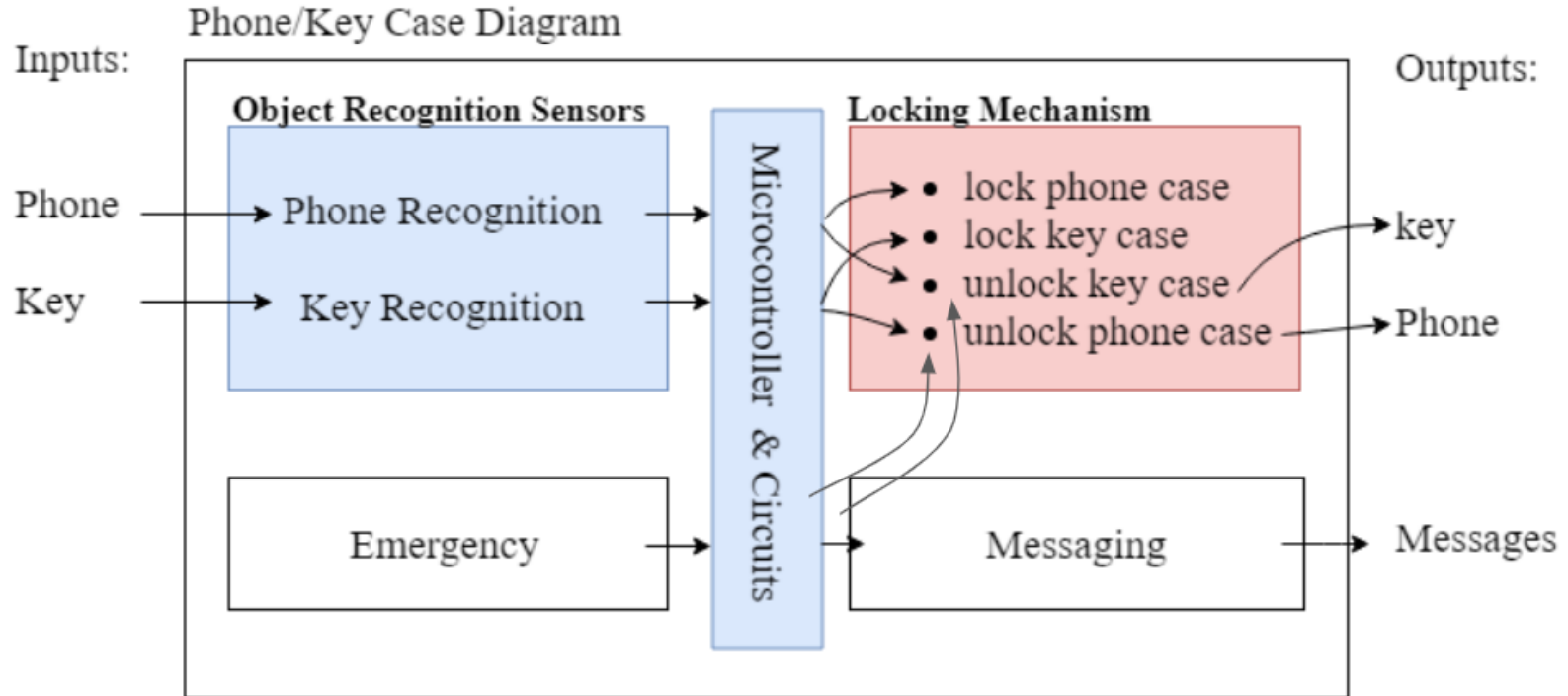
Functional Requirements

- Target: Parents, children
- Normal operations:
  - Restrict phone access while driving
  - GPS
- Emergency:
  - Immediate access to phone or key
  - Messaging
  - Reset

Technical/Other Constraints/Considerations

- Timeline: Two semesters

  - Unexpected: broken parts, faulty design

- Budget: $500

- HW or SW Approach:

  - Team's capabilities

  - User needs

Market Survey

Potential Risks & Mitigation

- Limited time → Divide workload, become experts

- Limited budget → Look for cheaper alternatives

- Marketability → Look for cheaper alternatives

- User safety → Confidence in team's work

- Designer liability → Include user manual and warnings

Resource/Cost Estimate

- 3D Printing Materials $20
- Microcontroller $10
- Communications Module $15
- Sensors (RFID and reed switch) $5
- Minor circuit components $5
  - Resistors, wires, etc.

TOTAL: **$55**

Project Milestones & Schedule

Four major components:

1. Locking mechanism   → Spring
2. Object recognition sensors   → Spring
3. Emergency access and alert   → Fall
4. Final life-size product design   → Fall

Lastly:

1. Integrate all subsystems   → Fall

Functional Decomposition

- Physical Phone Case

- Arduino with Corresponding Circuit

- Motor Locking Mechanism

- Lid Detection Sensor

- Radio Frequency Identification (RFID) Module

- Emergency Situation Response Module

- Global Systems for Mobile Communications (GSM) Module

HW/SW/Technology Platform(s) used

HW:

- Arduino - microcontroller

- Circuit - switch, push buttons, etc.

- RFID Card Reader/Writer - phone/key detection
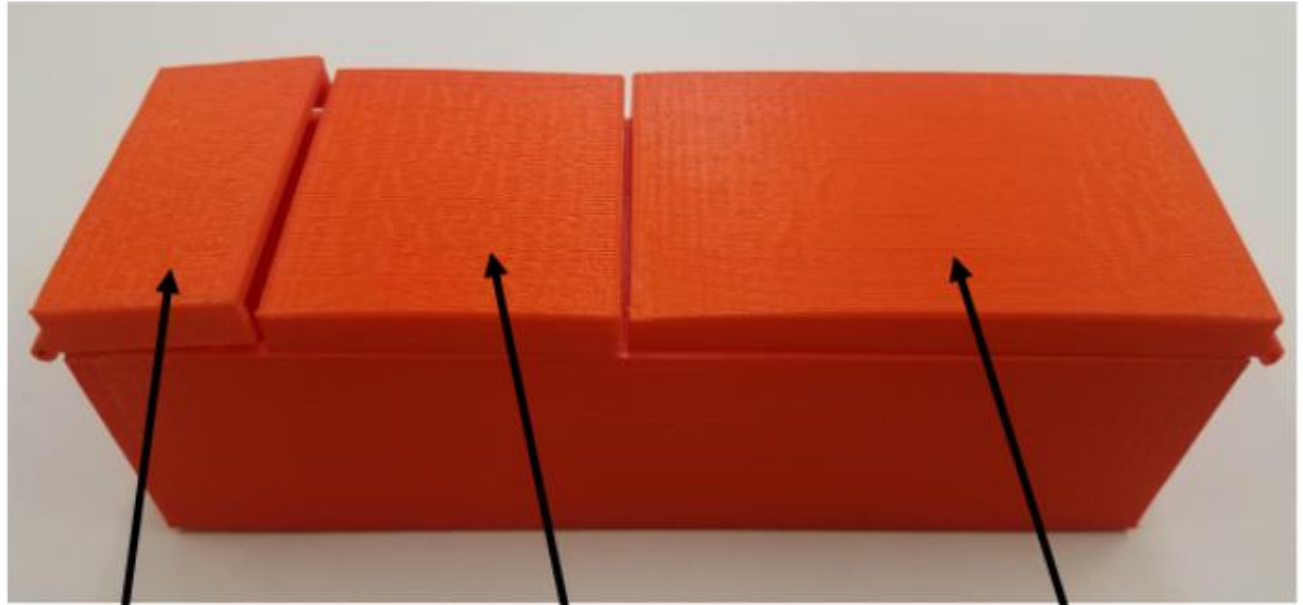
- 3D printer - print 3D model of the case

SW:
- Solidworks - create 3D model of the case
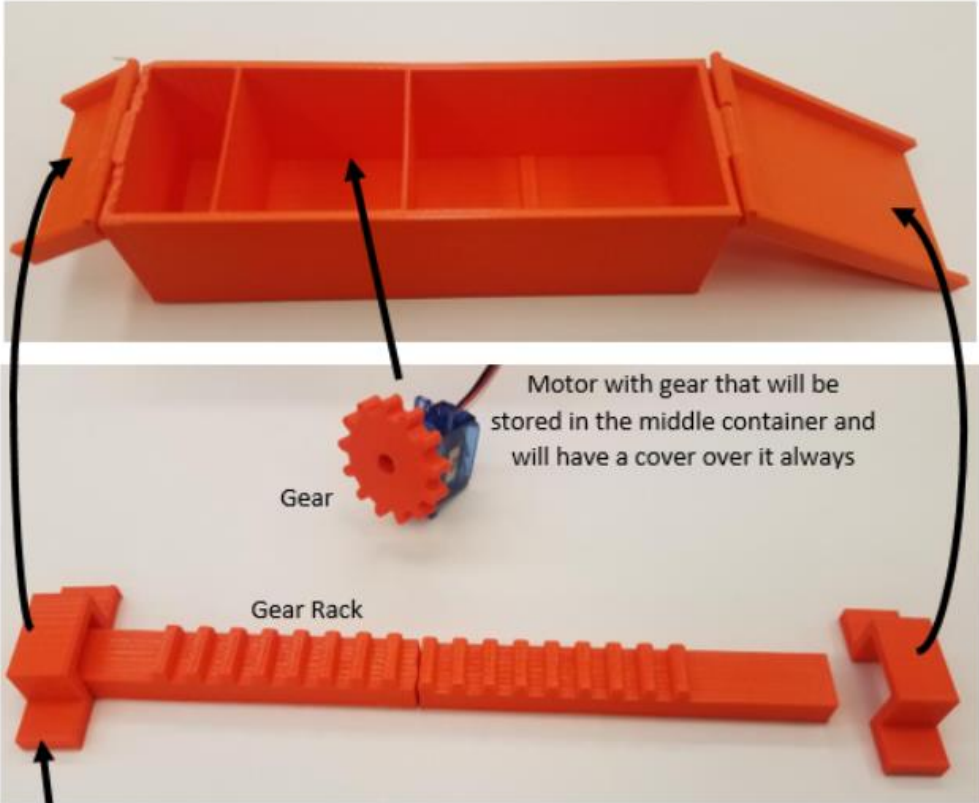
Detailed Design

Phone Case

(1:2 scale):

Key side with cover that WILL open

This middle cover will not open; this will be where the motor for the locking system is contained.
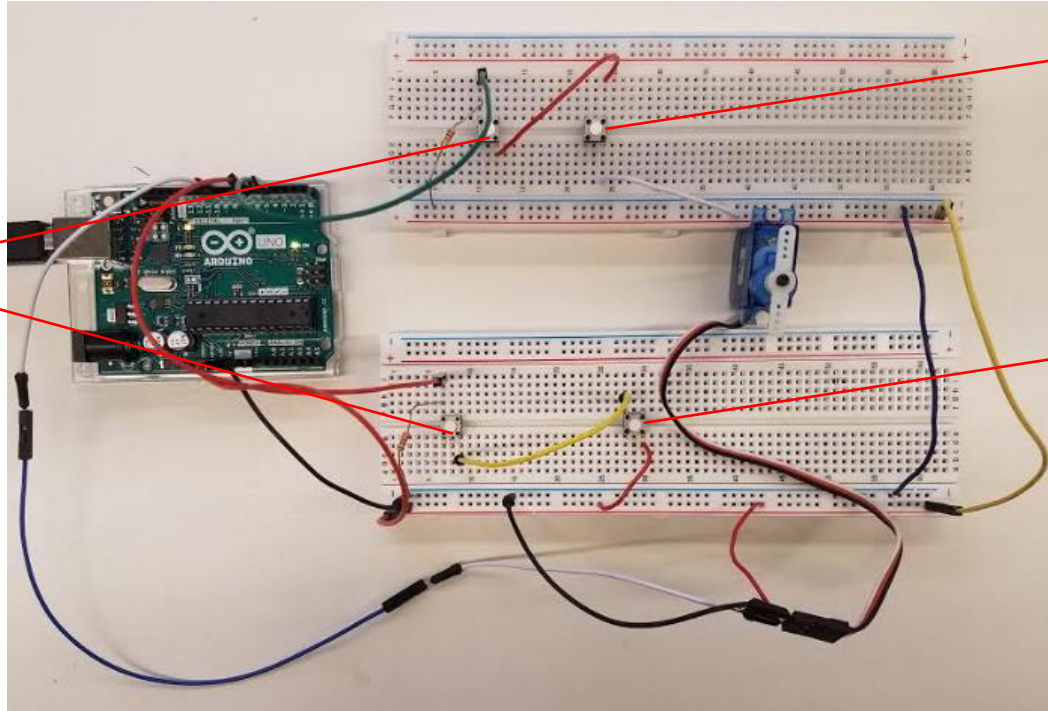
Phone side with cover that WILL open

Sensors and Locking Mechanism

Motor with gear that will be stored in the middle container and will have a cover over it always

Gear

Gear Rack

This will be under the lid for each side of the case, and the gear rack will slide through to prevent one lid at a time from opening
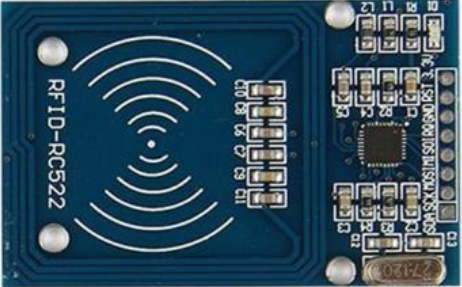
Arduino with Circuit

Phone Detection

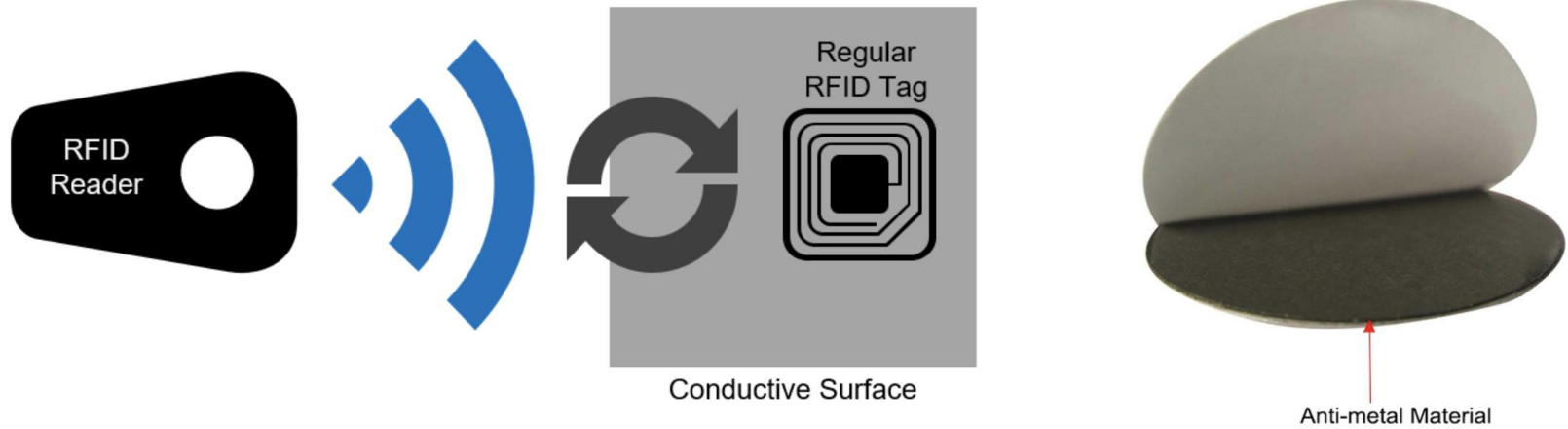Close/ Open Lid Sensor

Key Detection

RFID Module

Emergency Situation Response and GSM Module (To be determined)

Test Plan

1. Object Detection
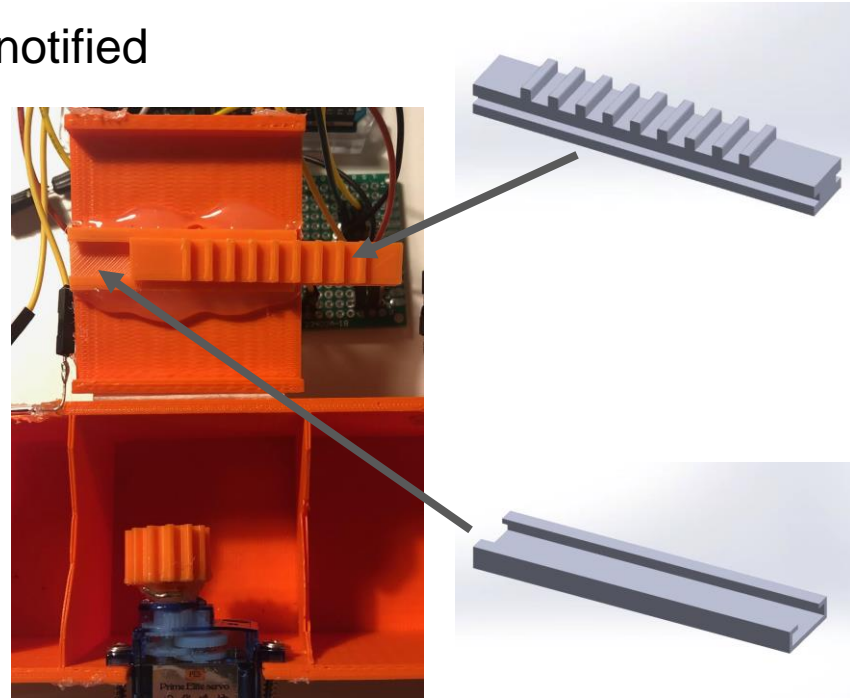
2. Locking Mechanism

3. Emergency Access and Alert
   a. To let driver get the phone or key fob immediately, the team design a button to achieve the function
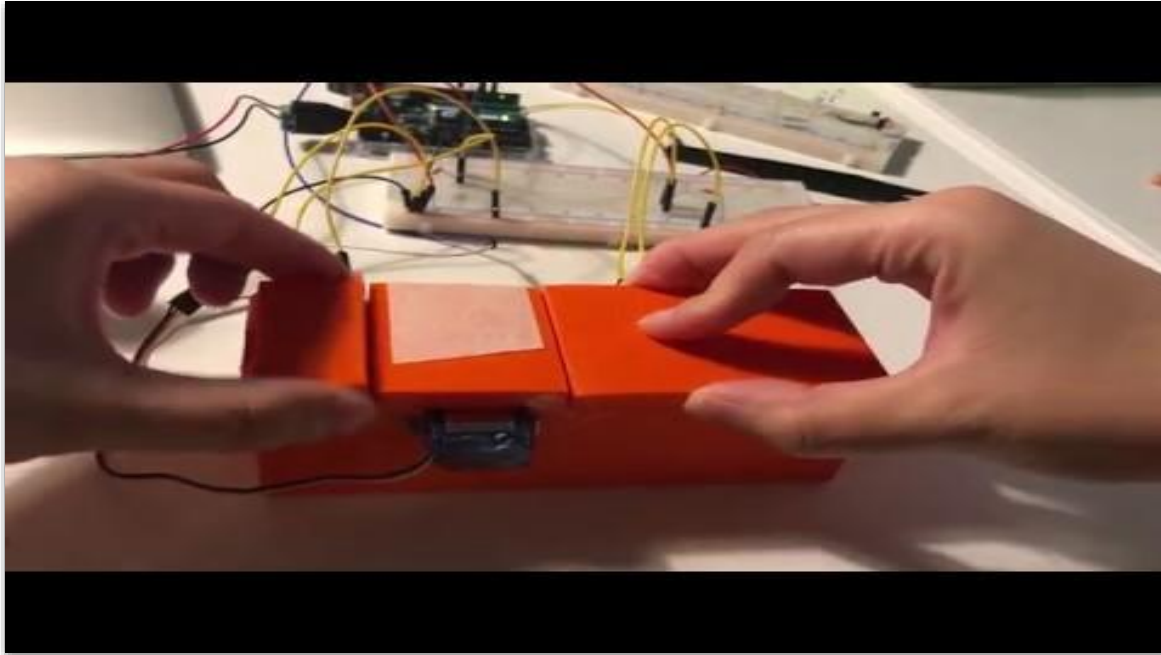   b. At the same time, the parents will be notified

4. Physical Case
   a. Mechanical alignment
   b. Durability

5. Testing Product
   a. Test each component separately
   b. Assemble them together

Prototype Implementations

Prototype Version 1

- Lock
- Reed switch(detect close/open of the case)
- 3D printed case

Conclusion

At this point, the team has prototyped about 50 percent of the demanded functionalities:

- Interlock mechanism

- Lid sensor operation

- Case design

Uncompleted functionalities:

- RFID recognition

- Emergency messaging system

Task Responsibility/Contributions

Sarah Baratta - Point contact of the project team, report editor, project leader

Yue Chen - Hardware designer, Circuit designer, team coordinator

Kedan Xin - Hardware designer, 3D model designer, circuit and sensor tester

Yifei Wang - Software designer, progress recorder, troubleshooting technician

Zixiao Lu - Software designer, parts ordering, evaluator

Plans for the next semester

Finish the remaining functionalities:

- RFID recognition or more ideal phone/key detection

- Emergency response system

Future Application:

- This project is a restrictive product and may not have high market demand

- The experience and knowledge can be used for future vehicle development