UNIVERSITY OF MISSOURI – COLUMBIA
DEPARTMENT OF ELECTRICAL ENGINEERING & COMPUTER SCIENCE

GPS and Notifications for Child Safety System

ECE 4970 CAPSTONE PROJECT
INDIVIDUAL CONTRIBUTIONS REPORT

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Abstract

This project is an all in one system that monitors the conditions inside a vehicle, so a caregiver is alert to whether the safety of a child is at risk also to ensure that no child is forgotten inside a vehicle. The system monitors the temperature around the child and whether a child is present or not if environment surrounding the child is deemed unsafe the current caretaker is alerted via a call. If the current caretaker does not respond or change the conditions around the child secondary contacts are alerted and if there is still no response the authorities are alerted and given the GPS coordinates. This project is designed to combat the issue of parents leaving their children in a vehicle and putting their lives at risk. An average of 37 children die each year in hot cars. These include instances where a child has been forgotten in a car, accidentally locks themselves in a car or trunk, or, in a small number of cases, when a child has been intentionally left in a car. This project is designed to assist in regulating these numbers. My contribution to this project is the contacting the caretakers and authorities and gathering the coordinates via a GSM module. The system makes calls and plays an automate message when the call is connected. The system requires the recipient of the call to press one if they receive the alert if not a voice mail is left, and the next contact is called and if still nothing changes the authorities are called, which is all the intended operations however My sub program does not currently connect to the main program, so it cannot know when to make the calls.

***Index Terms*— Accident prevention, child safety, computerized monitoring, mobile communication, global positioning system (GPS), global system for mobile communication (GSM)**

Professor

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Chapter 1. Introduction

Report Purpose

This report documents my contributions to my group's Capstone design project. Provided herein are detailed descriptions of each assembly and/or software element that I designed, created, tested, and integrated into the project.

A separate group report titled *Reducing the Risk of Children Left in Cars Using an Integrated Car Seat Alarm System* establishes and documents the project-level information that (1) defines the project's overall concept, specifications, and goals, (2) explains the project's functionality and theory of operation, (3) describes the evaluation of completed project, and (4) documents the project's outcomes.

Individual Contributions Summary

Figure 1 displays a simple functional block diagram (FDB) of the project at a system level.

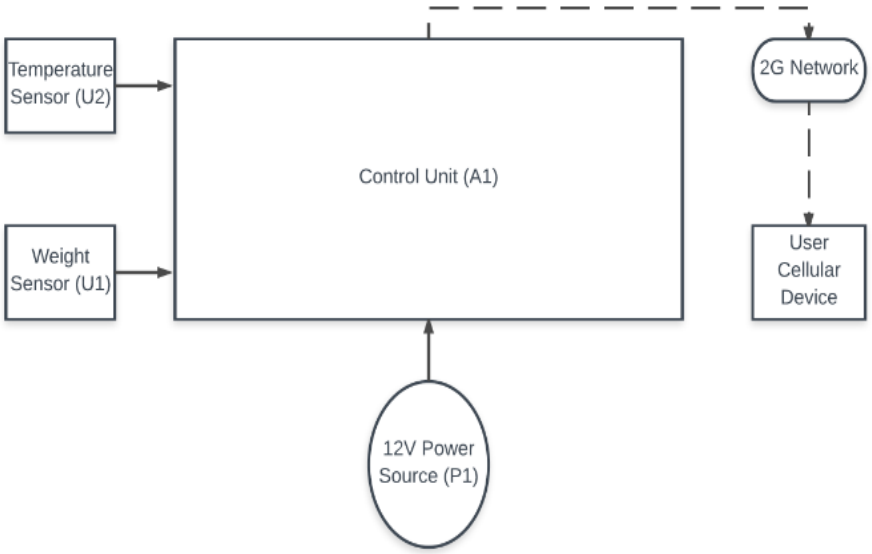

Figure 1: Functional block diagram system.

Figure 2 displays a FDB of the central unit A1. For my contribution I am responsible for BT2 (GSM Battery pack) and U5 (GSM Cellular Device).

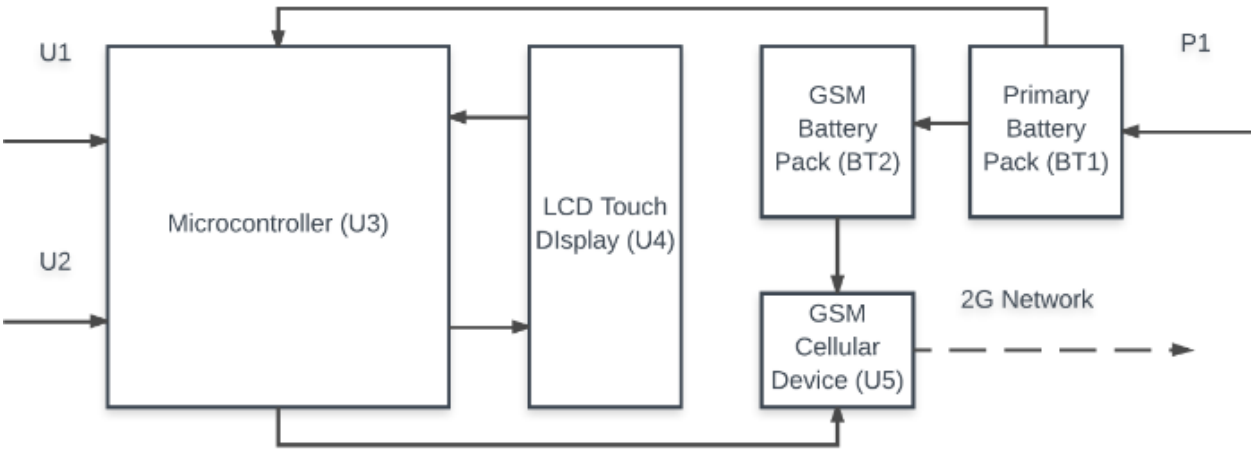

Figure 2: Functional block diagram of A1 unit.

Figure 3 displays the software architecture of the project. I am responsible for the COMM (Notifications) and partially involved in the log which needs to be access in order access contact information.

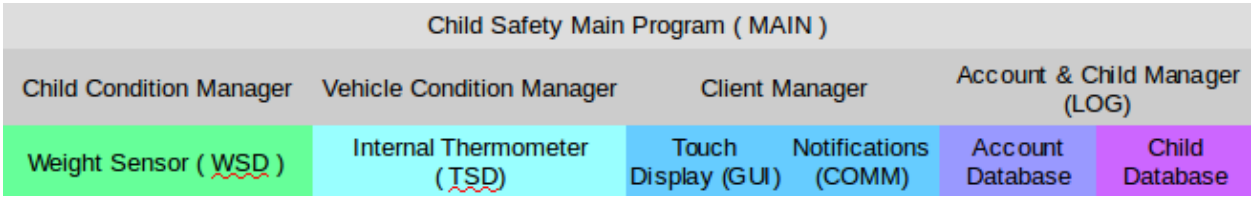

Figure 3: Child safety system software architecture, technology stack diagram.

Report Overview

The remainder of this report is organized as follows. In chapter 2 detailed information on my contribution to the CARS project is given such as the identification of each functional hardware element, the assumptions I had to make, hazard-related information, how it works and its compliances. In chapter 3 I discuss my personal time line. In chapter 4 I give a conclusion of my contribution including my successes, limitations, failures and suggested improvements. And finally, appendixes for the bill of materials, source code listings and test data.

Chapter 2. Contributions

Element Identification

This chapter provides detailed information on my contribution to the CARS project. I am responsible for the Control unit U5 and control unit BT2 inside the FBD in figure 3. Also, I am responsible for the COMM within the client manager.

Graphics

Figure 4 shows a circuit diagram of my contribution and Figure 5 displays a photo of the actual circuit. in the circuit diagram the sim808 is the GSM module embedded in the FONA. The audio jacks on both the FONA and the raspberry pi are connected via a wire.

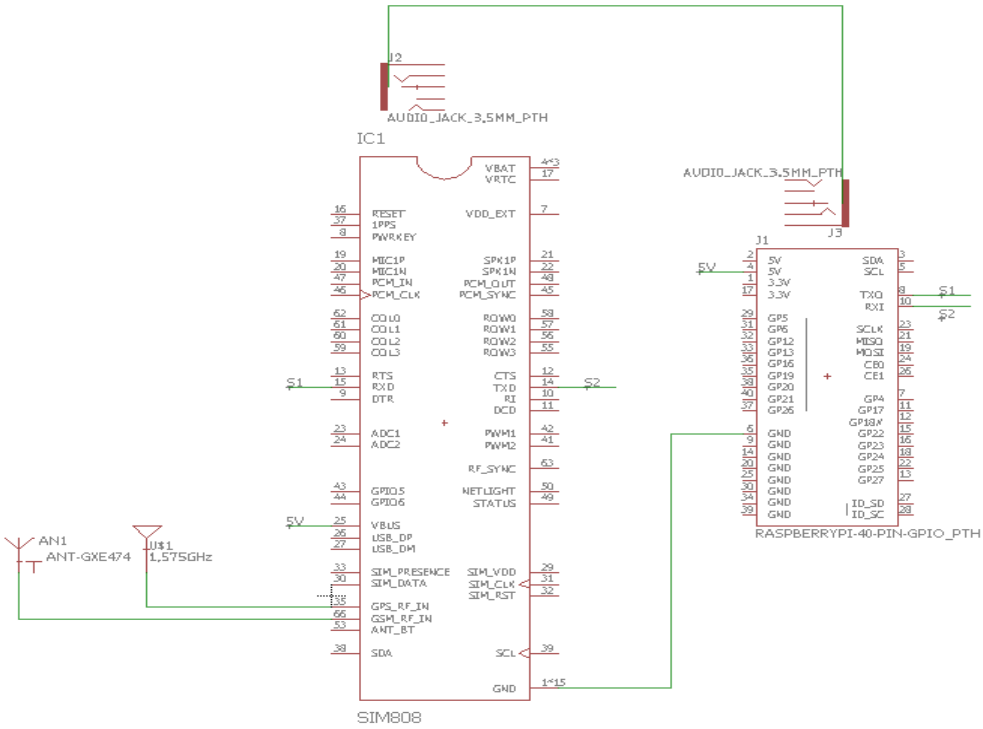

Figure 4: Circuit diagram of my contribution.

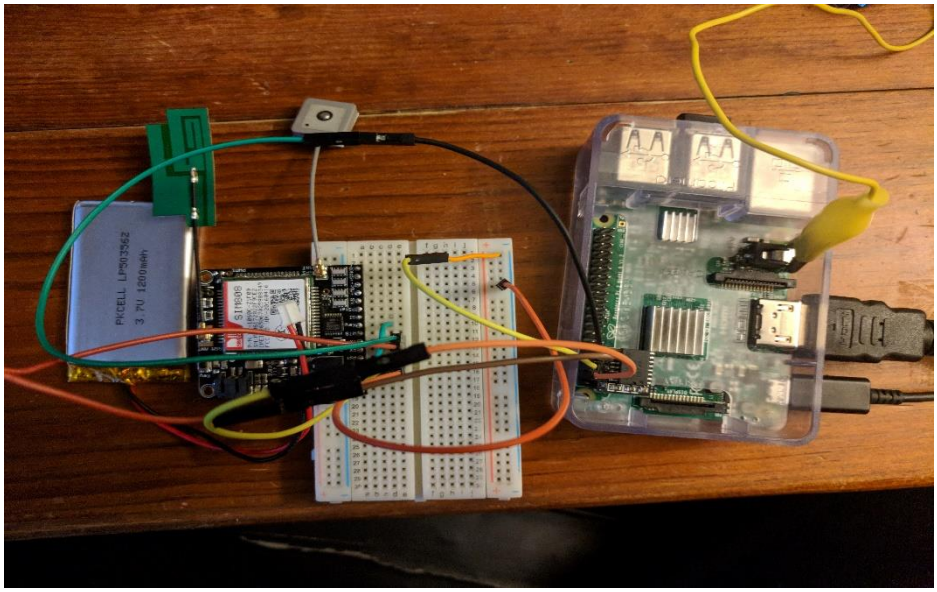

Figure 5: Photo of actual circuit.

Conception

Since designing and manufacturing a GSM module would be too much for this project we bought and off-the-shelf GSM module. the coding was designed using the tutorials provided by adafruit [2]

Theory of Operation

This element waits for a command from the main program that tells it that it is time to start calling the emergency contacts. It goes through a file containing the contact information leaving voicemails and waiting for a call to be answered. If call is not picked up by any one it grabs the GPS coordinates, contacts the authorities and gives them an alert with the coordinates.

Compliance

My contribution had to combine with the rest of the project and fit within our $150 limit and fit inside the enclosure with the rest of the project's components.

Chapter 3. Timeline Analysis

Proposed Timeline

Figure 6 shows the timeline I proposed at the beginning of the project.

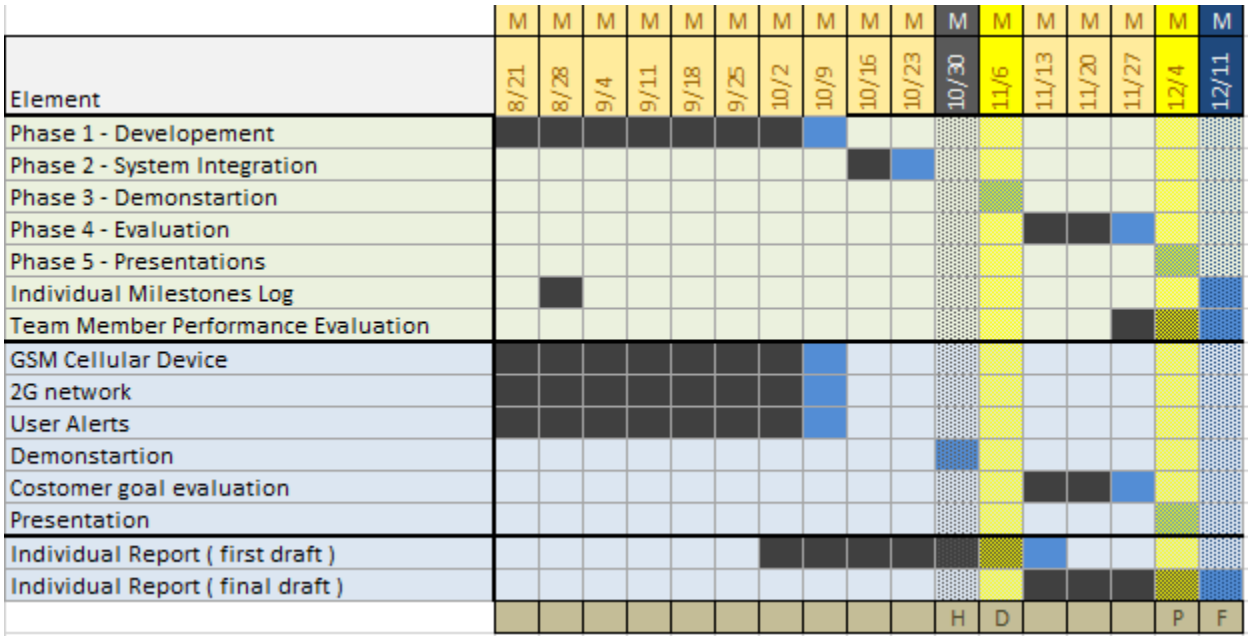

Figure 6: Proposed timeline of individual contribution.

Actual Timeline

Figure 7 shows the actual timeline of my progress. The differences in the timelines are due to the delay with order parts and conflicts during the integration phase due to the programs being written in different languages.

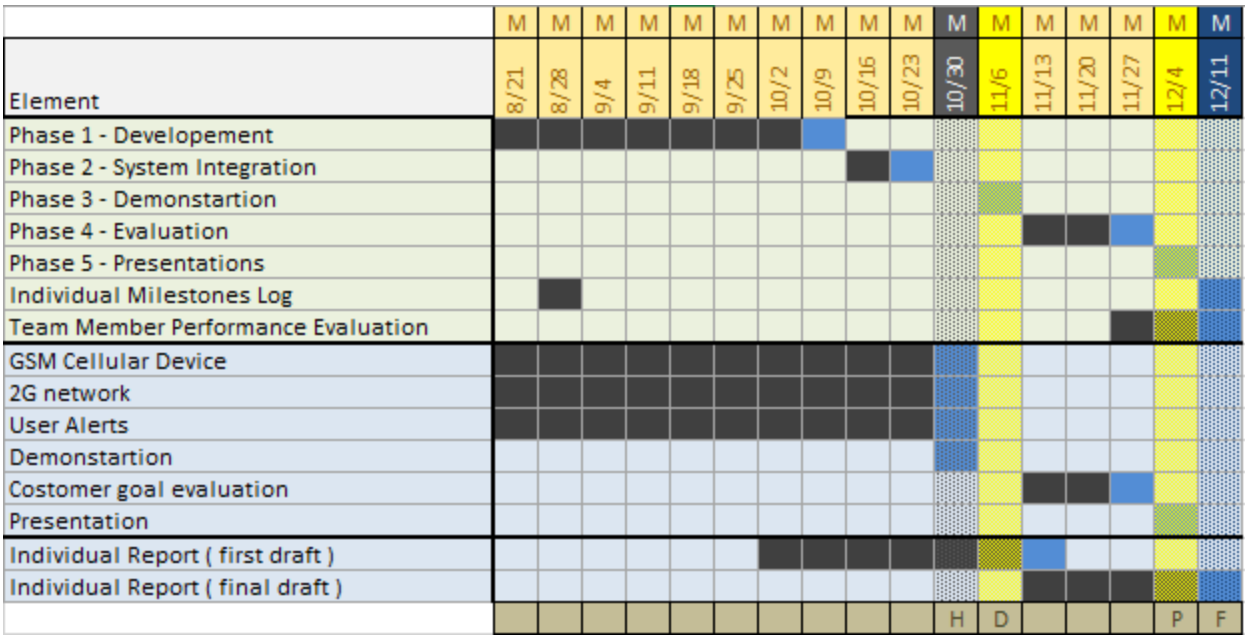

Figure 7:Actual timeline of individual contribution.

Chapter 4. Conclusions

Successes

The final iteration of my contribution acts exactly as it should. It receives commands from the main program, successfully makes calls, plays the message and gives the coordinates

Limitations

My contribution contains a GSM module to make calls which means it is only able to makes calls in a place with a good signal.

Failures

Currently there are no failures with my contribution.

Suggested Improvements

The audio software used to play the messages starts the audio before it produces the sound. So, I had to add a small delay at the beginning of each audio clip which makes the playing of GPS coordinates longer than necessary. I would find a better method for playing the audio. Also, GPS coordinates won't do much for the authorities looking for the vehicle, so I would maybe add an alarm with a unique same to alert them to the location or add a description of the vehicle to the alert message.

Appendix A. Bill of Materials

This appendix contains tables of the parts purchased and used for my contribution to the project.

Table 1 shows part purchased for Unit U5 of the functional block diagram shown in figure 2.

Item Description	Manufacturer	Manufacturer's Part #	Distributer	Distributer Part #	$/each	Total quantity
Adafruit FONA 808 Cellular + GPS Breakout	Adafurit	2542	Mouser	485-2542	49.95	1
Passive GPS Antenna uFL - 15mm x 15mm 1 dBi gain	Adafurit	2461	Mouser	485-2461	3.95	1
Slim Sticker-type GSM/Cellular Quad-Band Antenna - 3dBi uFL	Adafruit	1991	Adafruit	1991	2.95	1

Table 1: GSM cellular divice parts.

Table 2 shows part purchased for Unit BT2 of the functional block diagram shown in figure 2.

Lithium Ion Polymer Battery – 3.7v 12000mAh	Adafruit	285	Adafruit	285	9.95	1

Table 2: GSM battery pack parts

Appendix B. Source Code Listings

Accompanied with this report is a zip file “individual_contribution_code.zip” containing the code developed for my contribution.

Works Cited

[1] http://www.cnn.com/2016/08/05/health/hot-car-deaths-charts-trnd/index.html