Progress Report for PortableHUD

Project Team: Amina Qurban
Anastasia Suprun
Pak Lun Hoi
Qing Zhuang
Yifeng Xie
Xuemeng Monica Li

Contact Person: Xuemeng Monica Li
xmli@sfu.ca

Submitted to: Dr. Andrew Rawicz – ENSC 440
Steve Whitmore – ENSC 305
School of Engineering Science
Simon Fraser University

Issue date: March 28, 2016

Revision: 1.1

1 Introduction

PortableHUD is an attachable device for sports helmets that could provide GPS location, speed, temperature, and RF communication to minimize distractions for the user. By using a Heads Up Display (HUD) attached to a helmet, SafeVision team is designing and implementing a device that would be portable and easily mountable to any type of helmets utilized for sports. The development of *PortableHUD* includes integrating GPS, speed, temperature and RF communication on master control panel, while integrating LCD on the Slave side using wireless communication, which can be extendable for users best fit. This progress report includes the current state of development, the financial review of the project, and the remediation.

2. Financial Review

SafeVision has received $300 funding from the Engineering Science Student Endowment Fund (ESSEF). Currently, the total actual cost is $354.15. By the completion of *PortableHUD*, it may cost more if there are unforeseen costs such as replacing broken components, etc. The actual cost and estimated cost of our project are list in Table 1.

Table 1: Current project costs

Items	Actual Cost ($)	Estimated Cost ($)
Arduino Uno	28.41	20
Arduino Mega	71.06	60
2.8' TFT LCD display	9.67	55
TEA5767 FM stereo radio	6.22	30
FM transmit	27.45	30
Micro phone amplifier	10.26	10
Ball speaker	13.51	10
GPS breakout	49.78	60
RTC	13.96	20
Digital temp sensor	6.36	15
RF wireless trans & receiver	13.55	25
Solderable breadboard	9.47	25
Jump wires	15.15	15
9V battery *2	9.47	30
GoPro mount	2.50	10
3D printing enclosure	20.00	60
tax & shipping	47.33	50
Total	354.15	525

3. Schedule

The original schedule could be found in Design Specification documents. Figure 1 shows the current state on original assembly milestone. Although planned to build up the module in series, we soon realized that working in groups of two would be the most efficient way to work. So instead of working in series module by module, we built up our modules in parallel. As shown in Figure1, the individual modules are mainly finished. The final integration and overall test are currently our main focus of work.

Copyright © 2016, SafeVision

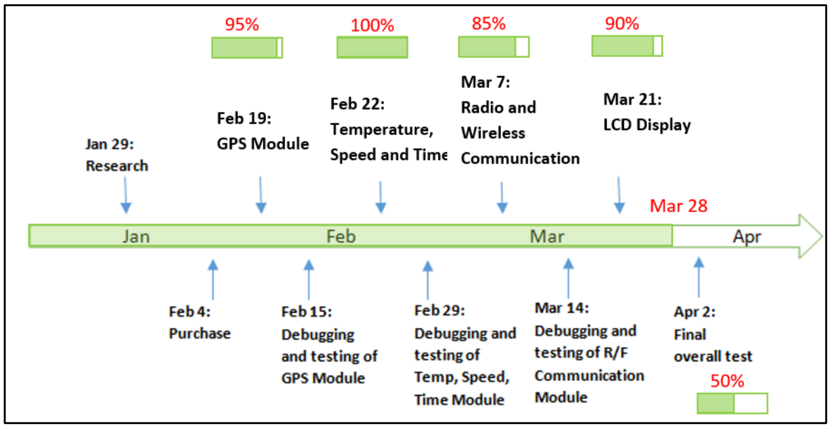

Figure 1: The original assembly milestone and current state

4. Progress Summary

The following section outlines progress achieved with integration of individual modules into one system, and materials acquisition, design and 3D printing of mechanical support.

4.1 Integration of Parts

The design specifications mentioned a use of Arduino Uno for the slave control panel. However, during the LCD and wireless receiver integration, iteration problems were encountered. Issues faced include low memory and pin availability on the board. As a result, we decide to use Arduino Mega for the slave control panel.

Presently, the functionality of each module is completed. Temperature module could get the temperature ranging from -40°C to 40°C with the precision of 2 decimal spaces. The GPS module could get the longitude, latitude, altitude, and speed with the precision of 2 meters. The timer module keeps track of the time even when the power is off. The Radio Frequency module provides the communication between two users and is able to provide two channels to switch between. To prevent the noise feedback from the speaker to microphone, we placed a switch to turn the speaker off when talking on the microphone. All of the modules mentioned above are built onto the master control panel. The data acquired from the master control panel is sent wirelessly to the slave control panel by the transmitter. On the slave control panel, the receiver from wireless module enables the slave panel to receive the data. The LCD displays the current position on a map, the current time, speed, temperature and RF channel.

4.2 Mechanical Design

So far, the SafeVision mechanical team has designed and 3D printed the extendable support for *PortableHUD*. The current design is using ramp clip teeth to hold the extendable support in place, and there is a lock system on top of the arm to lock the extended teeth so the sliding rail would not slide off from the system. The master control is attached to the back end and slave to the front of the extendable support. The whole system is mounted on the helmet using quick mount system. The material used for 3D printing is Polylactic Acid (PLA) plastic printed under 190°C.

4.3 User Meetings

After the first meeting with users, SafeVision team introduced GPS, time, temperature and RF communication with data displayed on LCD. GPS coordinates were displayed in numerical form. During the following meetings, users suggested to have a map with the pin that would represent

Copyright © 2016, SafeVision

current location. In the next iteration, SafeVision team expects to meet potential users again to discuss the usability and comprehensibility of the mechanical support.

5. Remediation

In the following section outlines parts integration and mechanical design remediation for *PortableHUD.*

5.1 Integration of Parts

Currently, LCD and wireless receiver have not been integrated together; as a result, there is a potential issue with the pin connections. As planned, LCD will be clipped on the Arduino Mega covering power pins. However, wireless receiver also needs an access to 5V and ground pins used by LCD. It is planned to solder wires to the bottom of Arduino Mega to provide receiver with the power. In case the approach fails, the second solution would be to run wires to LCD so there will be an easy access to the pins for the receiver; however, that solution would be less optimal in terms of space and weight. Also, the wireless communication module pair could transmit data from Master Arduino UNO to slave Arduino Mega board. If the wireless connection fails to work, we could revert to use wires to establish connections between the two boards.

The speaker is introducing static noise, which will make it difficult for others to hear the voice. A possible reason for this problem is the instability of the antenna. To compensate this problem, we could build a band-pass filter. Another problem is that we cannot change the volume of the speaker. To solve this problem, we could try to change the output voltage for the speaker in the software code. There is also a problem with microphone. Currently, the electret microphone is powered up with an extra circuit, which is easy to be broken. For future, we could integrate the circuit into a PCB or use a dynamic microphone.

The main problem for the GPS is that it does not provide the precise location of the user. One of the reasons is that the bad weather would influence the stability of the signals from the satellites. We would provide a warning explaining the limitations of *PortableHUD*. Another reason for the imprecision is that the antenna is not good enough. To minimize the instability, we could switch to a more sophisticated GPS module and get a better antenna.

5.2 Mechanical Design

One problem for the 3D printer is the low printing quality, which is caused by low z-axis accuracy. Another problem is that the gaps between layers are being created during printing, which makes the printed tube fragile and brittle when force is applied. SafeVision will solve the problems by fixing the z-axis accuracy through printing feed rate calibration or changing the printing direction so that the x-y direction can provide enough rigidity to cancel out the z-axis effect.

6. Summary

SaveVision completed the integration of GPS, time, speed, RF communication on the master control panel, enabled the wireless communication between two control panels, and combined the receiver with the LCD to show the data received on the screen. Currently the team is working on mechanical design of *PortableHUD*. The test plan slightly changed from the original test plan submitted during the Design Specification. After the mechanical design and the testing phase had been completed, SafeVision believes that a prototype of the product would be ready for demo on April 18, 2016.

Copyright © 2016, SafeVision