Initial Project Documentation

Safety Helmet

Group 3

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Project Narrative

Commuting the roads in today's world can be a very challenging and dangerous experience. Our highways and local roads are scattered with cars, trucks and motorcycles and we must all share the roads equally. One of these forms of transportation does not have the same safety and benefits than the others and is in a great disadvantage when traveling on the road. You probably might have guessed already that we are referring to motorcycle transportation. Data from the NHTSA shows that in 2017 per registered vehicle, the fatality rate for motorcyclists was 6 times the fatality rate for passenger car occupants. 5,172 motorcyclists were killed in motor vehicle traffic crashes that year. The NHTSA estimates that helmets are 37 percent effective in preventing fatal injuries. What if we are able to bump that percentage up and successfully able to prevent more deaths? Our group believes that this is possible by adding technological advancements to the helmets that are currently in circulation.

The goal for our project is to implement important safety features to a current motorcycle helmet that will aid the driver while they are traveling on the road. We are aiming to create a low cost, easy to use and accurate safety helmet that will alert the driver when other vehicles on the road are getting too close to them or their blind spots. We also want to notify the driver if they appear to be displaying symptoms showing that they might possibly be going to sleep and lastly want to create a notification system that will quickly notify their emergency contact in their phones and the authorities if a crash occurs. Many helmets currently on the market just offer one of these features and do not taylor to the safety aspect of what we are trying to focus on.

In order to alert the driver of any incoming vehicles getting too close to them we will install a camera and ultrasound sensors on the helmet to notify the driver that an object is getting dangerously close. The notifications will take place through either speakers installed inside of the helmet or some sort of visual notification. A camera will also be used to detect eye movement and notify the driver if they are displaying signs of possible going to sleep. Lastly we will use an app and through camera and sensors if a collision has occurred and the driver does not respond to the app notifications a text/call will be made to the emergency contact in their phones as well as possibly to an emergency dispatch. If time and money permits, we would also like to add a heads up display that will notify the driver of how fast they are going along with gps directions.

Specifications

The helmet will provide safety features for driver by monitoring driver conditions and environment conditions. The helmet will have ultrasonic sensors to detect vehicle in driver’s dead spot, rear camera to provide a view of the back. Infrared camera to detect if a driver is falling asleep and a sensors to detect accident. The helmet will be activated only when used

therefore a sensor to detect if not in use will be applied. The helmet will have a display to display data such as speed, RPM, warnings and backward view will be projected to the side view of the driver inside the helmet so it's not obscuring view. The main control and processing will be done with on board MCU and additional intense computation will be done on mobile device via a mobile application. The MCU will collect data and transmit the data to the mobile device.

Size must be small enough to be user friendly and can be fitted inside average size helmet, no larger than 3 inches wide and 2 inches tall.

Weight must be relatively light weight since it's carried by the driver for a long period of time therefore no heavier than 4.8 ounces.

Power usage must be low enough so batteries can last long enough for a full average ride (if not using onboard 12 volt battery).

Cost must not be larger than 500 USD.

Usability should be simple enough for the average person to operate. Set up time should be less than 30 seconds.

Microphone should be able to give the driver the ability to send voice commands to a mobile device.

Speaker to wake up driver when sleep is detected through the camera.

Analog to Digital Converter should convert audio signal from a microphone at a resolution of minimum 16 bits.

Digital to Analog Converter should convert digital audio signal to analog so it can be played through speakers.

Bluetooth 4.0 Module should communicate with mobile device to transmit and receive data that require more processing power.

Back View Camera minimum of 1280x720 pixel camera for capturing back view.

Sleep Detection Camera infra-red thermal camera with minimum resolution of 320x240 pixels.

Sensors minimum of 2 ultrasonic sensors,1 gyroscope.

Temperature Sensor should be within 1 degree C accuracy.

DC to DC Converter should handle up to 15 volt maximum so it can be connected to an onboard 12 volt battery (prototype will not use 12 volt bike battery).

Project Block Diagram

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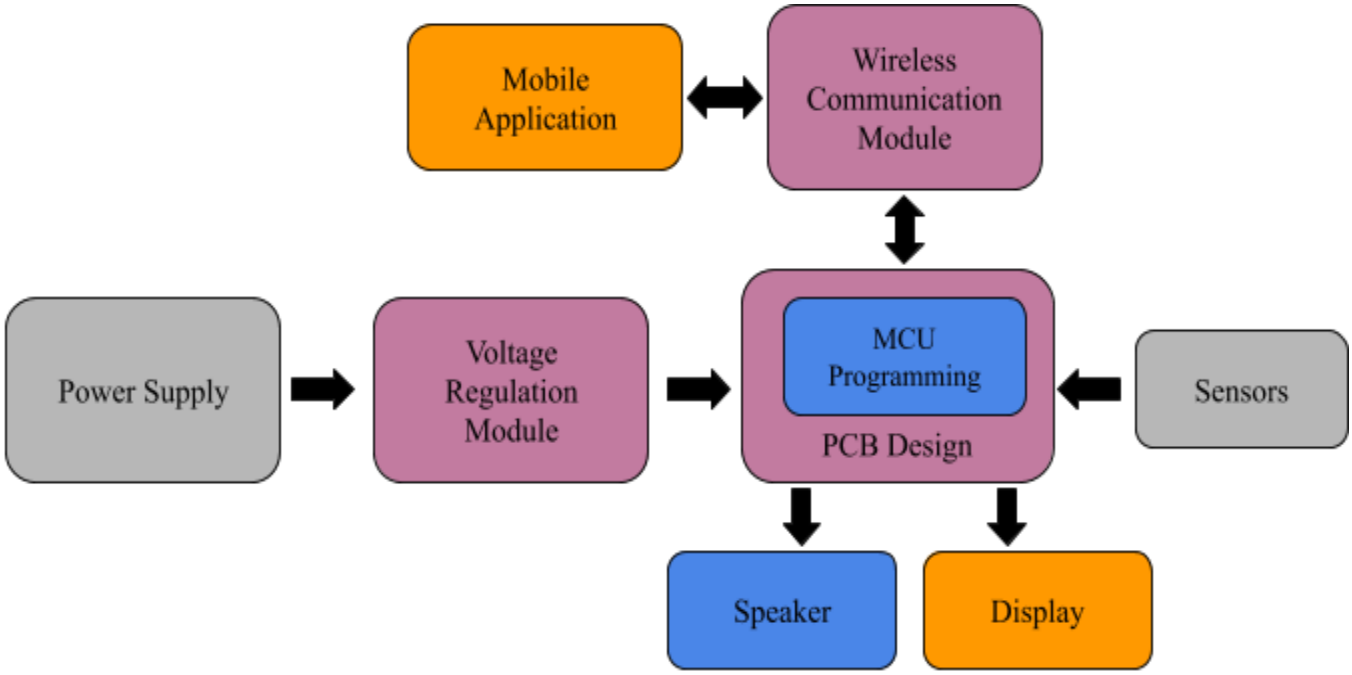

Group Member	ID	Block/Task
Daniel Ram		Microcontroller Programming, Speaker Interface
Mariela Barragan		Power Supply, Sensor Integration
Alejandro Velasco		Voltage Regulation Module, PCB Design, Wireless Communication
Michael McCoy		Mobile Application (Computer vision), Display

Block	Status
Power Supply	Research
Wireless Communication Module	Research / To be acquired
Mobile Application	Research
PCB	Research
Microcontroller	Research / To be acquired
Display	Research / To be acquired
Speaker	Research / To be acquired
Voltage Regulation Module	Research
Sensors	Research / To be acquired

Estimated Project Budget and Financing

One of the goals for our project is to keep the cost down. We have seen similar projects that ended up costing around $400. For our project, we are splitting the cost 4 ways. Our goal is to keep the cost at a fraction of the price compared to similar products that are currently out in the market. The table below summarizes the main expenses that will be necessary for this project to be built successfully. Everything is a rough estimate of what the different components would cost and prices are subject to change.

Component	**Quantity**	**Price**
Helmet	1	$50
Microcontrollers	1-2	$30
Camera	2	$60
Sensors (gyroscope, Ultrasonic Sensor, ect..)	Multiple	$25
Electric Components (resistors, Capacitors,	Multiple	$15
PCB	1-2	$20

Speaker	1	$10
Display	1	$20
Bluetooth 4.0	1	$20

Project Milestone Schedule

Semester 1: (Senior Design I)

Task (s)	Time Frame
Form Group	1/6/2020 -1/10/2020
Project Idea	1/13/2020-1/17/2020
Divide and Conquer Document	1/31/2020
Project Approval	2/3/2020
Choosing Components (Microncontroller, Sensors, etc	February 2020
Power Supply	February 2020
PCB Design	March 2020
Software Design	March 2020
Sensor Interference/Communication	March 2020/April 2020
Ordering All Components	March 2020/April 2020
Start Assembling	May 2020

Semester 2: (Senior Design 2)

Task (s)	Time Frame
Continue Assembling	May 2020/June 2020
CDR Presentation	TBA
Conference Paper	TBA
Testing	May 2020/June 2020
Make Final Revisions	June 2020/July 2020
Finals Presentation	TBA

Conclusion

When we were brainstorming trying to figure out what should we make for our senior design project, we decided that we should come up with a problem we wanted to solve, and our project would be the solution to that problem. We wanted to make something that would keep motorists safer and that's how the idea of the smart helmet was born. The smart helmets that are currently in the market, tend to be too costly and don't have all the safety features that we want to include in ours. When we are making this project, usefulness, affordability, and ease of use will be at the core of it.