Senior Design I

Initial Project and Group Identification Document

Divide and Conquer

09/09/16

Automated Vehicle Anti-Theft Security System

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Group # 15

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Introduction

Getting into a car accident is never fun, especially when there is no way to tell whose fault it is officially. It is also never fun when someone attacks your car when you are not around. That is why for our project, we plan on creating a solar powered, fully automated car anti-theft security system. The system is capable of sending notifications, alerting appropriate authority, and able to record reliably in order to catch any intruder/car accidents to safeguard against false insurance claims. Having security footage of any incident will make car owners not only safer, but make post events after an incident much quicker and easier to handle with the indisputable evidence eliminating a he said/she said deal.

We plan on making our project very economical, allowing for anybody to buy. This way it can be cheaper to create and cheaper for the potential consumer. We want our project to consist not only of an economical design, but also a very user friendly design. This includes making minimal maintenance attention required, we all know cars already need enough maintenance work by themselves. But we also want to make our project device easy to install and use on a daily basis. Making the device phone compatible via text and or application will make the device very simple and quick to use.

We also want to reduce the amount of power used so we can store excess power that is converted from the solar panels on top of the car. This way we can store energy and use it when there is not enough sunlight out to make the camera's fully functional and maintain reliability at nighttime or during a storm. Cameras do not consume much power, so using a large battery will mean we can have a high capacity for the cameras to all work continuously for several hours without any sunlight.

The device shall be as wide and long as the rooftop of whichever type of car we use for the demo. It should also be locked down in position and hard to remove so thieves cannot simply try and take it off. It should be relatively lightweight and relatively aerodynamic so it does not produce a lot of drag when the car is moving at high speeds. The device will also be water resistant so that the device can be fully functional when wet and finally can withstand different weather conditions.

To make the user's car as secure as possible, we plan on putting motion sensing technology into our design that can detect movement even when the car is completely off without affecting the car's battery. Once motion is detected the cameras will all turn on and continue recording and saving footage until motion has stopped. The car owner will also be notified through phone by a generic message making them aware of the incident at the same time it has happened. Very few current car security systems implement these technologies, we are not aware of any that currently send real time alerts to the car owner when motion has been detected.

Other car security systems do not yet offer solar powered cameras and do not have any of the features that this new device is offering. There are very few 360 car security systems on the market and those very few are not connected to the top of the car and do not offer phone friendly service (1). The main problem however is that these security systems are not centralized and require much more effort to install and replace (2).

References:

(1) https://www.alibaba.com/product-detail/360-bird-view-system-360-degree_60343845985.html

(2) http://www.aliexpress.com/store/product/Free-Shipping-360-degree-Full-view-assist-car-DVR-parking-assistant-system-Digital-Video-Recorder-DVR/1629531_32259079036.html

Requirement Specifications

- The device will fit securely on top of vehicle
    - Device is no taller than 2 feet
    - No larger than roof of car
- Motion detection to detect any potential threats
    - Detects movement from up to 2-3 feet
- Capability to send alerts wirelessly to user's phone
    - Using Wifi/Bluetooth for wireless communication
    - Able to be notified in timely matter; no more than 30 secs
    - User also able to send audio alert back to device
- Audio amplifier speaker
    - Allows user's audio alert to be heard by intruder
    - Warns intruder potentially stopping the crime
- Solar Powered Battery
    - Solar Panels charge battery during day
    - Very low energy consumption when device is in idle
- Main Storage Device
    - Able to hold at least 10-15 min. of footage
    - Begins overwriting data when full
- Basic Processor
    - Will delete old digital data when space is full
    - Will cut charging to the batteries once they have reached capacity
    - Send automated reports and start recording when receiving threshold inputs from the motion detector
- 4-6 independent security cameras (See *Figure A.* below)
    - One camera will be facing forward in the interior dashboard
    - Three cameras will be placed on the top of the car

        i. Two cameras will be placed on the sides of the car, each having a wide viewing angle
        ii. One camera will be facing towards the back of the car
- Front camera detachable
    - Dedicated battery that lasts at least 1 hour independently
    - Independent storage device
    - Secured to dashboard
- Three layers of the device:
    - The bottom layer
        i. Baseboard made of durable plastic
        ii. Securely attached to the top of the vehicle
    - The middle layer will consist of the hardware
        i. Including a battery, a digital data storage platform, cameras, and a pcb board
        ii. Covered in weather resistant material
    - The top layer
        i. Consists of no less than 2 solar panels
        ii. Each connected directly to the battery in the middle layer
    - Sealant will be used to keep everything waterproof
- Phone Application
    - Simple, Clean, and Easy-to-use
    - Displays alerts and allows user to contact appropriate authorities or alert back

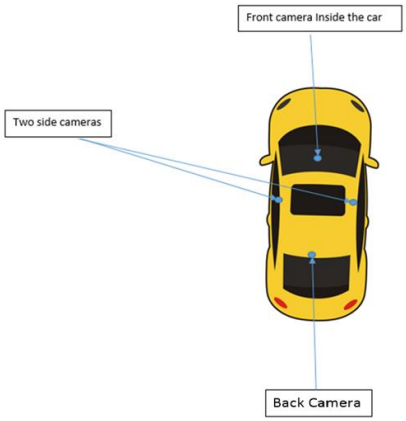
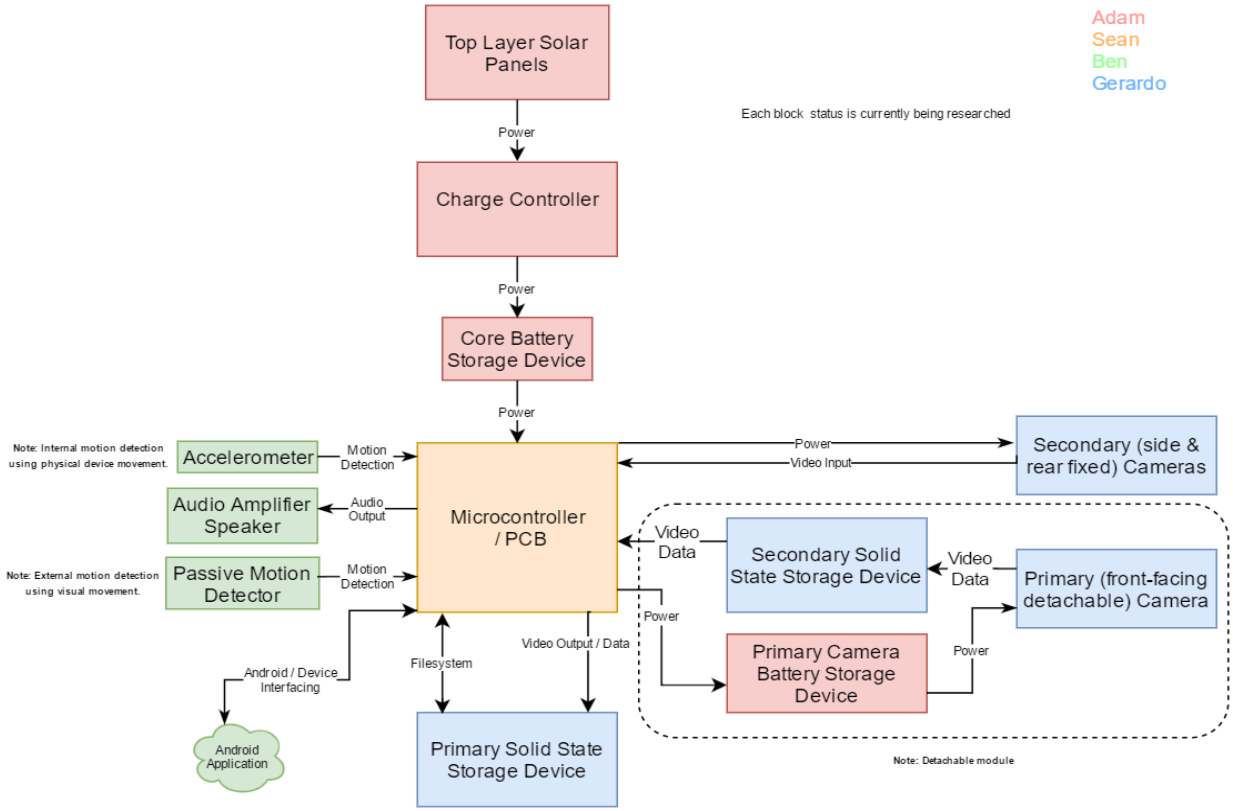


Figure A. *Car Model*

House of Quality Trade-off Table

			Engineering Requirements					
			Wireless	Camera Resolution	Solar Energy	Cost	Dimensions	Motion Sensors
			+	+	+	-	-	+
Marketing Requirements	1) Ease of Management	+	↑↑			↓	↓↓	
	2) Accuracy	+	↑	↑↑				↑↑
	3) Video Quality	+		↑↑		↓↓		
	4)Durability	+			↑↑	↓		
	5) Cost	-	↓	↓↓	↑	↑↑	↓	↓
	6)Portability	+			↓		↑↑	

Block Diagram



Estimated Budget and Financing

The prices listed below are estimates from online research and taking into account a range that consists combining the least and cheapest amount of necessary materials as well as the upper portion of the range is considering the more expensive types of materials. Prices are subject to change after further research, implementation and testing. Currently there are no sponsors for this project and the costs would be covered by the group members.

Description	Quantity	Price per Unit	Total Estimated Price
Motion Sensors	**3 - 4**	**$10 - $30**	**$30 - $120**
Solar Panels	**1 - 2**	**$30 - $70**	**$30 - $140**
Solar Panel Battery	**2**	**$10 - $20**	**$20 - $40**
Security Cameras	**4 - 6**	**$20 - $40**	**$80 - $240**
Wireless Capabilities	**1**	**$30 - $50**	**$30 - $50**
PCB	**1 - 2**	**$50 - $100**	**$50 - $200**
Microcontroller	**1**	**$10 - $35**	**$10 - $35**
Solid State Drive	**2**	**$20 - $50**	**$20 - $50**
Sealant	**1**	**$15**	**$15**
TOTAL			**$285 - $890**

Milestones

FALL 2016	
Description	Dates
Senior Design 1 Project idea	August 23-August 26
Discussion of Roles	August 27
Writing Documentation	August 29-September 8
Initial Project	September 9
Research	September 12-October 1
Writing Draft for Table of Contents	October 1-October 30
Table of Contents	November 4
Individual Writing and research	November 5-10
Draft Document	November 11
Designing Prototype	November 12-21
Filling in Documentation	November 21-28
Last checks and review	November 28-December 5
Final Senior Design 1 Document	December 6
Purchase all components	December 10-December 17

SPRING 2017	
Description	Dates
Build prototype	TBD
CDR Presentation	TBD
Test Prototype	TBD
Conference paper	TBD
Middle Term Demo	TBD
Finalize Project	TBD
Final Demo and Presentation	TBD