UNIVERSITY *of* MARYLAND
EASTERN SHORE
™

SCHOOL *of* BUSINESS AND TECHNOLOGY
Department of Engineering and Aviation Sciences

Smart Delivery

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Introduction

Autonomous self-driving vehicles are growing exponentially in popularity within new age technology. There are only a few level 5 self-driving vehicles that requires no human activation to drive. These self-driving cars are being used to transport goods and people around the world. Furthermore the electric car is preferred more often because it offer economic, global, and environment benefits. The car that we plan to design will deliver food to people autonomously.

Background

On the campus of the University of Maryland Eastern Shore there are many students that worry about their next meal and how they are going to get hold of it. A college student has numerous of responsibilities on their table that limits their ability to obtain in a necessary time. In most colleges' freshman are not allowed to have cars and people with cars must pay a lot of money for parking and fees. This limit the amount of college students with cars and increases the amount of college students walking around campus. The gruesome schedule of college students makes it hard for them to eat food when its offered.

At the University of Maryland Eastern shore students are offered food at the locations including Students Service Center, Engineering & Aviation Sciences Complex, Hawk's Nest, Waters Hall. In the Students Service Center they offer students plateau dining, and oasis staff dining. Often students argue and complain about the food they receive from the cafeteria. This leads them to eat the chic-fila food the university provides.

When college students are in their dorm after a long day of classes and stressful lecturing. They still must do homework and study for their classes. At that point they are tired of walking and going to get some food that is at least .4 miles away. Furthermore, during the school year there are not always clear and sunny days. Especially at UMES in the winter the weather can get rough. This will disable students from going outside and getting the food they need to satisfy their stomach.

"Among the 214 National Universities that reported these data to U.S. News in an annual survey, the average percentage of students who brought cars to campus in the

2016-2017 academic year was 46.8 percent".

CHAPTER 1. INTRODUCTION

Objective

Design an autonomous electric car that can deliver food to designated locations on the University of Maryland Eastern Shore campus.

Design Requirements

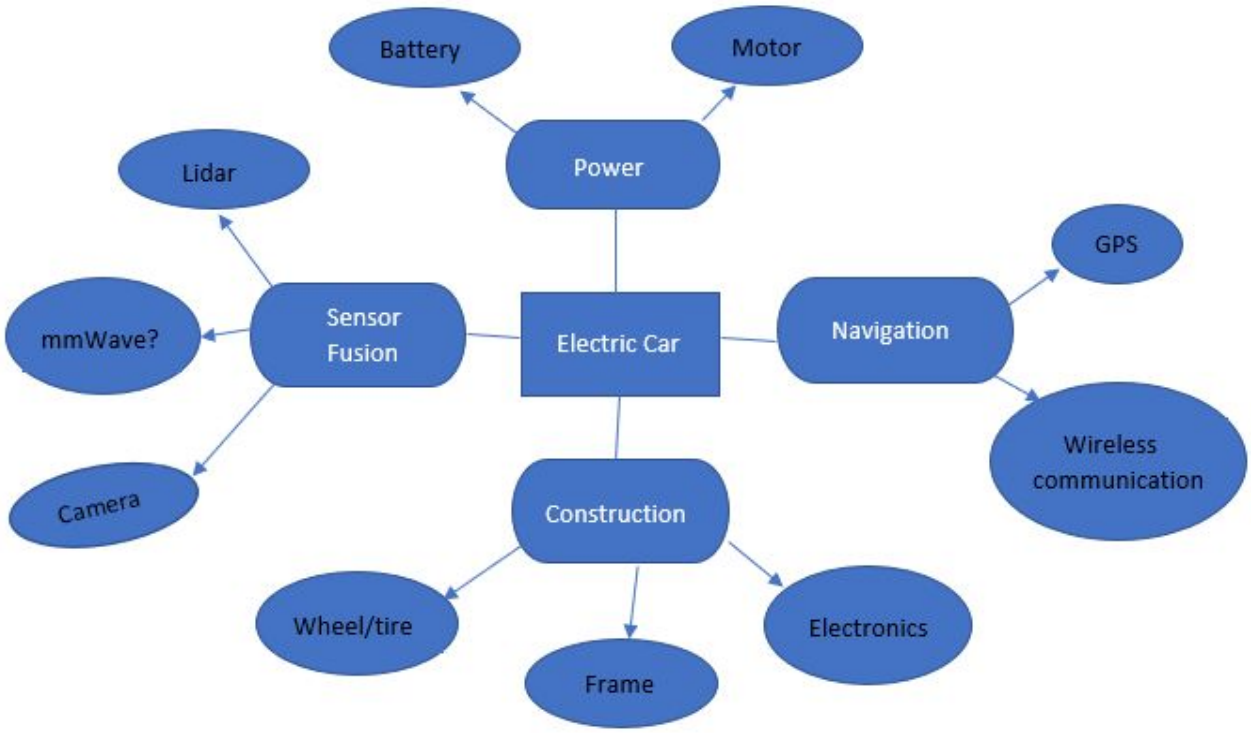
1. Travel distance a total of 2 miles
2. Carry up to eight pounds of food
3. Will deliver one meal at a time
4. open and close of food compartment
5. Localization of car
6. Reach designated ordering locations
7. Speed of 5-10 mph
8. Detect and drive on the sidewalk
9. Enable driving across non traffic crosswalk
10. Detect and maneuver moving pedestrians
11. App order menu
12. Notification of order arrived
13. Application interface with the electric car

Design Constraints

1. Tires might not be able to withstand certain road conditions
2. Driving in rough weather conditions

3. System is incapable of going up stairs or ramps

System Diagram



TASKS

Task1: Vehicle Structural Design

- Subtask 1.1: CAD of structure
- Subtask1.2: Construct chassis
- Subtask 1.3: Implement wheel and tyre thread
- Subtask 1.4: Implement upper body frame
- Subtask 1.5: Configure all body parts

Task 2: Configure Electronic Components

- Subtask 2.1: Assemble and implement microcontroller(Arduino)
- Subtask 2.2: Assemble and implement PWM signals with DC motor
- Subtask 2.3: Assemble and implement servo

Subtask 2.4: Assemble and implement battery

Subtask 2.5: Assemble and implement Electronic Speed Controller(ESC)

Subtask 2.6: Assemble and implement GPS

Subtask 2.7: Apply electrical components in structure

Task 3: Application Design

Subtask 3.1: Coding for the app

Subtask 3.2: Interface GPS

Subtask 3.3: Launching and Testing of the app

Task 4: Computer Vision

Subtask 4.1: OpenMV Cam H7 Hardware Assembly

Subtask 4.2: Image processing on OpenMV IDE

Subtask 4.3: Line edge detection algorithm

Subtask 4.4 Test accuracy and algorithm

Subtask 4.5: Interface with Arduino microcontroller

Subtask 4.6: Assemble camera on electric car front

Task 5: Lidar Configuration

Subtask 5.1: Lidar hardware assembly

Subtask 5.2: Arduino IDE algorithm implementation

Subtask 5.3: Lidar Mapping and Navigation

Subtask 5.4: Test accuracy and algorithm

Subtask 5.5: Interface with Arduino microcontroller

Subtask 5.6: Mount lidar hardware on system

Task 6: Remote controller design

Subtask 6.1: construct remote controller

Subtask 6.2: Interface with arduino

Task 7: System Testing, evaluation, and enhancement

Subtask 7.1: Test Functions

Subtask 7.2: Evaluate and enhance if necessary

Subtask 7.3: Repeat process

Timeline

Time	Tasks			Comments
	Montraz Oliver	Eli Nbede	Kevin Harper	
Week 1	Subtask 1.1 & 1.2	Task 3	Subtask 1.1	Start of Vehicle Design & App Design
Week 2	Subtask 1.4	Subtask 1.2	Subtask 1.2 & 1.3	Continued vehicle design
Week 3	Subtask 1.5	Subtask 1.5	Subtask 1.5	Completion of vehicle design
Week 4	Subtask 2.3 & 2.5	Subtask 2.2 & Task 3	Subtask 2.1& 2.4	Start of electric component tasks & continued app design
Week 5	Subtask 2.7 & 4.1	Subtask 2.6	Subtask 2.7	Start computer vision while finishing electronics

Week 6	**Subtask 4.5 & subtask 4.2**	**Subtask 4.5 & Task 3**	**Subtask 4.5**	**Continued electronic components and app design**
Week 7	**Subtask 4.2**	**Subtask 4.2 & Task 3**	**Subtask 4.2**	**Image processing**
Week 8	**Subtask 4.2 & 4.5**	**Subtask 4.2 & Task 3**	**Subtask 4.2**	**Image processing**
Week 9	**Subtask 4.2 & 4.3**	**Task 3**	**Task 6**	**Remote control design begins & app is completed and tested**
Week 10	**Subtask 4.2 & 4.3 &4.4**	**Subtask 5.1 & 5.5**	**Subtask 5.1 & Task 6**	**Begin of lidar tasks**
Week 11	**Subtask 4.2 & 4.3 & 5.2**	**Subtask 5.2**	**Subtask 5.2 & Task 6**	**Design of lidar and openMV**
Week 12	**Subtask 4.2, 4.3**	**Subtask 5.3 & task 6**	**Subtask 5.3 & task 6**	**Remote testing**
Week 13	**Subtask 4.2, 4.3, & 4.4**	**Subtask 5.4**	**Task 6**	**Computer vision completion and testing & remote testing**
Week 14	**Subtask 4.6**	**Subtask 4.6**	**Subtask 4.6 & task 6**	**Working on computer vision & completing controller design**
Week 15	**Subtask 4.4 & 5.2**	**Subtask 4.4 &5.5**	**Subtask 4.4**	**Computer vision testing**

Week 16	**Subtask 5.6**	**Subtask 5.6**	**Subtask 5.6**	**Working on lidar system**
Week 17	**Subtask 5.2**	**Subtask 5.2**	**Subtask 5.2**	**Working on lidar system**
Week 18	**Subtask 5.4**	**Subtask 5.4**	**Subtask 5.4**	**Completion of lidar and testing**
Week 19	**Task 7**	**Task 7**	**Task 7**	**Testing/revise**
Week 20	**Task 7**	**Task 7**	**Task 7**	**Testing/revise**
Week 21	**Task 7**	**Task 7**	**Task 7**	**Testing/revise**
Week 22	**Task 7**	**Task 7**	**Task 7**	**Testing/revise**