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Proposal for the development of AutoVehicle

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AutoVehicle

Project Website : https://khemar1.github.io

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Executive Summary

As students in the Computer Engineering Technology program, we will be integrating the knowledge and skills we have learned from our program into this Internet of Things themed capstone project. This proposal requests the approval to build the hardware portion that will connect to a database as well as to a mobile device application. The internet connected hardware will include distance sensors and actuators for controlling the movement of the vehicle. The database will store the mapped area. The mobile device functionality will include remote controlling the vehicle and displaying the mapped area and will be further detailed in the mobile application proposal. I will continue to work together this Winter semester with Jan Yalda and Bilal Al-Fanous, who also built similar hardware last term and worked on the mobile application with me. The hardware will be completed in CENG 317 Hardware Production Techniques independently and the application will be completed in CENG 319 Software Project. These will be integrated together in the subsequent term in CENG 355 Computer Systems Project as a member of a 3-student group.

Background

The problem solved by this project is how to have a robotic vehicle that will be controlled as an RC car with a mobile application, and which can work independently as an autonomous car.

The Hardware which consists of the vehicle's chassis where all the parts are either connected or mounted on which includes the actuators, the H-bridge driver, the ultrasonic sensors and the brain of it all the Raspberry Pi 3. The vehicle's sensors are used to avoid obstacles that are detected and at the same time send data to be used to map an area that will be displayed in the mobile application. Through Wi-Fi the ability to remote control the vehicle is possible using the mobile application.

I have searched for prior art via Humber's IEEE subscription selecting "My Subscribed Content" [1] and have found and read the following three articles which provides insight into similar efforts.

- Algorithm Fusion for Feature Extraction and Map Construction from SONAR DataIsmail & Balachandran (2015)
- SLAM for robot navigation Temeltas & Kayak (2008)

- An Open-Source Scaled Automobile Platform for Fault-Tolerant Electronic Stability Control Katzourakis, Papaefstathiou, & Lagoudakis (2010)

In the Computer Engineering Technology program, we have learned about the following topics from the respective relevant courses:

- Java Docs from CENG 212 Programming Techniques In Java,
- Construction of circuits from CENG 215 Digital And Interfacing Systems,
- Rapid application development and Gantt charts from CENG 216 Intro to Software Engineering,
- Micro computing from CENG 252 Embedded Systems,
- SQL from CENG 254 Database With Java,
- Web access of databases from CENG 256 Internet Scripting; and,
- Wireless protocols such as 802.11 from TECH152 Telecom Networks.

This knowledge and skill set will enable me to build the subsystems and integrate them together as my capstone project.

Methodology

This proposal is assigned in the first week of class and is due at the beginning of class in the second week of the fall semester. My coursework will focus on the first two of the 3 phases of this project:
Phase 1 Hardware build.
Phase 2 System integration.
Phase 3 Demonstration to future employers.

Phase 1 Hardware build

The hardware build will be completed in the fall term. It will fit within the CENG Project maximum dimensions of 12 13/16" x 6" x 2 7/8" (32.5cm x 15.25cm x 7.25cm) which represents the space below the tray in the parts kit. The highest AC voltage that will be used is 16Vrms from a wall adaptor from which +/- 15V or as high as 45 VDC can be obtained. Maximum power consumption will be 20 Watts.

Phase 2 System integration

The system integration will be completed in the fall term.

Phase 3 Demonstration to future employers

This project will showcase the knowledge and skills that I have learned to potential employers.

The tables below provide rough effort and non-labour estimates respectively for each phase. A Gantt chart will be added by week 3 to provide more project schedule details and a more complete budget will be added by week 4. It is important to start tasks as soon as possible to be able to meet deadlines.

Labour Estimates	**Hrs**	**Notes**
Phase 1		
Writing proposal.	9	Tech identification quiz.
Creating project schedule. Initial project team meeting.	9	Proposal due.
Creating budget. Status Meeting.	9	Project Schedule due.
Acquiring components and writing progress report.	9	Budget due.
Mechanical assembly and writing progress report. Status Meeting.	9	Progress Report due (components acquired milestone).
PCB fabrication.	9	Progress Report due (Mechanical Assembly milestone).

Interface wiring, Placard design, Status Meeting.	9	PCB Due (power up milestone).
Preparing for demonstration.	9	Placard due.
Writing progress report and demonstrating project.	9	Progress Report due (Demonstrations at Open House Saturday, November 12th, 2016 from 10 a.m. - 2 p.m.).
Editing build video.	9	Peer grading of demonstrations due.
Incorporation of feedback from demonstration and writing progress report. Status Meeting.	9	30 second build video due.
Practice presentations	9	Progress Report due.
1st round of Presentations, Collaborators present.	9	Presentation PowerPoint file due.
2nd round of Presentations	9	Build instructions up due.
Project videos, Status Meeting.	9	30 second script due.
Phase 1 Total	**135**	
Phase 2		
Meet with collaborators	9	Status Meeting
Initial integration.	9	Progress Report
Meet with collaborators	9	Status Meeting
Testing.	9	Progress Report
Meet with collaborators	9	Status Meeting
Meet with collaborators	9	Status Meeting
Incorporation of feedback.	9	Progress Report
Meet with collaborators	9	Status Meeting
Testing.	9	Progress Report
Meet with collaborators	9	Status Meeting
Prepare for demonstration.	9	Progress Report
Complete presentation.	9	Demonstration at Open House Saturday, April 8th, 2017 10 a.m. to 2 p.m.
Complete final report. 1st round of Presentations.	9	Presentation PowerPoint file due.
Write video script. 2nd round of Presentations, delivery of project.	9	Final written report including final budget and record of expenditures, covering both this semester and the previous semester.
Project videos.	9	Video script due
Phase 2 Total	**135**	
Phase 3		
Interviews	TBD	
Phase 3 Total	**TBD**	
Material Estimates	**Cost**	**Notes**
Phase 1		
Raspberry Pi 3 Kit	$99.00	CanaKit
4WD Robot Platform	$42.94	Creatron Inc
L298N H-Bridge	$15.82	Creatron Inc
Mini Bread Board	$3.67	Creatron Inc
Jumper Wires(3-sets)	$6.86	Creatron Inc
HC-SR04 Ultrasonic Sensors (4)	$22.56	Creatron Inc
Standoffs F/F	$3.38	Sayal Elec
Portable Battery	$45.19	Scosche
Philips Head Screws	$5.64	Sayal Elec
Phase 1 Total	**<$200.00**	
Phase 2		
Materials to improve functionality, fit, and finish of project.		
Phase 2 Total	**TBD**	
Phase 3		
Off campus colocation	<$100.00	An example: [4].

Shipping	*TBD*
Tax	*TBD*
Duty	*TBD*
Phase 3 Total	**TBD**

Concluding remarks

This proposal presents a plan for providing an IoT solution for AutoVehicle This is an opportunity to integrate the knowledge and skills developed in our program to create a collaborative IoT capstone project. I request approval of this project.

References

[1] Institute of Electrical and Electronics Engineers. (2015, August 28). IEEE Xplore Digital Library [Online]. Available: https://ieeexplore.ieee.org/search/advsearch.jsp

Ismail, H., & Balachandran, B. (2015). Algorithm fusion for feature extraction and map construction from sonar data. In *IEEE Sensors Journal* (Vol. 15, pp. 6460–6471). https://doi.org/10.1109/JSEN.2015.2456900

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