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F.I.M.P. Project

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January 16, 2016

Proposal for the development of Project Name

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Executive Summary

As a student in the Computer Engineering Technology program, I will be integrating the knowledge and skills I have learned from our program into this Internet of Things themed capstone project. This proposal requests the approval to build the software app that will connect to a hardware as well as to a mobile device application. In the app, we will have camera incorporated along with a controller that will be used to control the hardware. The database will store the coordinates of the robot arm and the angles that the motor and arms need to be when it returns to rest position. The mobile device functionality will include some very basic test functions and commands to move the arm. It will log any lags or imperfections and save that data, so the developer can later look it at and make improvements to the hardware or software. In the winter semester I plan to form a group with the following students (Alay Lad, Hennok Tadesse, and Tanav Sharma), who are also making similar app this term and working on the mobile application with Tanav Sharma, Alay Lad, and Hennok Tadesse. 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 2 or 3 student group.

Background

This project will solve many problems. Along with solving problems it will also be very innovative. It will help gamers with better precision, and interact with games. With the haptic feedback feature it will create a real life experience for the user and allow them to make better decisions. Scientists and engineers can use this arm, for experiments where they need to have certain amount of distance clearance from the test site. It can also withstand great amounts of temperature that the normal human hand or body won't be able to bear. Scientists can deal with hot object like lava rocks, or other hot surfaces. These arms can also be used in space, where the astronauts can use the arm from their space ship. Also the app will be saving information received from the arm, and provide logs, so the user can use it to make his/her reports and also use the information to make changes to better the app or hardware.

The first article is about a continuous-time decentralized neural control scheme for trajectory tracking of a two degrees of freedom direct drive vertical robotic arm.(Vázquez, Jurado, Castañeda, & Santibáñez, 2016)

The second article is about the Gesture Controlled Robot (GCR) which is a robot that can be moved according to our hand movements. (M & Anvesh, 2016)

The third article is about the instantaneous current profile tracking control for minimizing torque ripple of switched reluctance motors. (Makino, Kosaka, Matsui, Hirayama, & Ohto, 2013)

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		
A microcomputer composed of a quad-core Windows 10 IoT core compatible Broadcom BCM2836 SoC with a 900MHz Application ARM Cortex-A7 32 bit RISC v7-A processor core stacked under 1GB of 450MHz SDRAM, 10/100 Mbit/s Ethernet, GPIO, UART, I²C bus, SPI bus, 8 GB of Secure Digital storage, a power supply, and a USB Wi-Fi adaptor.	>$80.00	An example of a retailer: [3].
Peripherals with cables		
Sensors		
Actuators		
Hardware, etc.		
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 creating and testing solutions for complete physical tasks. This is an opportunity to integrate the knowledge and skills developed in our program to create a collaborative IoT capstone project demonstrating my ability to learn how to support projects such as the initiative described by [2]. I request approval of this project.

References

M, G., & Anvesh, P. (2016). Contolling of servomotors according to pitch and yaw and roll motions of accelerometer. In *2016 international conference on energy efficient technologies for sustainability (iCEETS)* (pp. 886–889). https://doi.org/10.1109/ICEETS.2016.7583873

Makino, H., Kosaka, T., Matsui, N., Hirayama, M., & Ohto, M. (2013). PWM-based instantaneous current profile tracknig control for torque ripple suppression in switched reluctance servomotors. In *2013 iEEE 10th international conference on power electronics and drive systems (pEDS)* (pp. 1055–1060). https://doi.org/10.1109/PEDS.2013.6527176

Vázquez, L. A., Jurado, F., Castañeda, C. E., & Santibáñez, V. (2016). Real-time decentralized neural control via backstepping for a robotic arm powered by industrial servomotors. *IEEE Transactions on Neural Networks and Learning Systems*, *PP*(99), 1–8. https://doi.org/10.1109/TNNLS.2016.2628038