Modular Robotics: Molucube

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SCHEDULE AND VALIDATION PLAN

REVISION – 1
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Table of Contents

1. Schedule

Task	4-Oct	11-Oct	18-Oct	25-Oct	1-Nov	8-Nov	15-Nov	22-Nov	29-Nov
Motor Driver and Power Delivery Designs Complete									
Rpi MCU circuits designed									
Computer Vision design completed									
Housing Design completed									
Power Delivery Motor Driver Parts Ordered									
Rpi & MCU prototype boards created									
Computer vision parts ordered									
Housing/Connector Parts Ordered									
Power Delivery Motor Driver Start PCB design									
RPi & MCU PWM Signal generation									
Computer Vision Python script									
Housing/Connectors Assembled & Tested									
Power Delivery Motor Driver PCB design complete									
Rpi & MCU Motor Controller testing and UART signal generation									
Training and Testing Model on a saved video									
PCB Design Completed/Parts Ordered									
Power Delivery Motor Driver PCB Components ordered									
MCU Network Test									
Making program able to detect real time on live feed									
Boards Assembled									
Power Delivery Motor Driver order and test on perfboard									
Sensor Testing									
Adjusting arm's design to match robot's modules sizes									

Testing/Toublshooting Boards									
Power Delivery Motor Driver Solder PCBs									
Printing and Assembling Arm									
Connection Between Boards									
Power Delivery Motor Driver buffer week/testing/troubleshoot									
Testing functionality of both systems and troubleshooting									
Buffer Week for Any Additional Troubleshooting									
Demo and work on final Report									

2. Validation Plan

Test Name	FSR Section	Success Criteria	Methodology	Status	Assignee
Output Voltage Test	3.2.3.3	Correct voltage being outputted to motors, RPI, servo and actuator	An oscilloscope will be used to measure the voltage reading and will be compared to the expected value	Partial Success	Carlos Torres
Battery Management System Test	3.2.3	Battery can charge and discharge properly	An oscilloscope will be used to view voltage of battery while a test motor is run off it.	Untested	Carlos Torres
Wheel Motor Test	1.1.2	Wheel motors can go forwards and backwards	Provide motor with power and send logic to MCU	Partial Success	Carlos Torres
Microcontroller Initial test	1.1	Microcontroller runs basic program	A debugger and LED output will be used to determine correct functionality	Success	Andrew Hunt
PWM Signal	3.2.1.2	Microcontroller generates PWM signal	A logic analyzer and Pulseview will be used to determine correct signal	Success	Andrew Hunt
Motor Control	3.2.1.1	MCU can control motors	MCU I/O will be connected to motor controller	Partial Success	Andrew Hunt
UART Communication	1.1	Raspberry Pi and Microcontroller can communicate	Raspberry Pi will instruct MCU to turn on LED	Success	Andrew Hunt
MCU Network Communication	1.1	Raspberry Pi communicates with multiple MCUs	Raspberry Pi will instruct each MCU to turn on/off LEDs	Success	Andrew Hunt
Sensor Test	3.2.1.3	MCU able to use sensor to detect object	An object will be placed in front of the sensor and the MCU will send a ping and wait for a reflection	Success	Andrew Hunt
Object Detection	3.2.1.3	Successfully identifies ping pong ball and keeps tracking it	Python script uploaded and executed through webcam	Success	Ali Helmi
Path Navigation	3.2.4	Successfully identifies duct tape and maps path in between	Python script uploaded and executed through webcam	Untested	Ali Helmi

Gripper Arm Functionality	3.2.1.2	Assembled and compatible with mounted motors and capable of simple movement	Picks up and drops ping pong ball	Partial Success	Ali Helmi
Housing/Connectors	3.2.2.3	Module Housing easily connects, and resists being pulled apart	Apply force to connected housing and see if it stays together	Partial Success	Cole Butler
Board Functionality	3.2.2.3	No incorrect readings for boards of all modules	Probe board while providing it with power and logic	Untested	Cole Butler
Connection Between Boards	3.2.2.3	Boards successfully connect and can communicate	Probe between both boards for continuity	Untested	Cole Butler

3. Performance on Execution Plan

Most of the execution plan was completed. Tasks not currently complete are due to issues that arose during testing. The project is mostly completed and anything not currently complete will be completed over the break or very early on next semester.

4. Performance on Validation Plan

Most of the validation plan was completed. There are still some issues with the power delivery and motor subsystems, as well as with the gripper arm, but these issues will be sorted out either before next semester or very early in the semester so the subsystems can all be successfully integrated into the entire system.

For further information on Power Delivery Subsystem and Motor Driver Subsystem issues please follow. The Battery Management System (BMS) part of the power delivery subsystem had a copy and pasted issue for all 6 cells where one of the MOSFETs was flipped where the drain and source were flipped and thus causing the external battery charger to not charge the batteries. The Overcurrent and voltage IC on cell 6 ended up exploding the trace so the PCB wasn’t salvageable for other testing.

The buck converter part of the power delivery subsystem was semi working up until I attempted to fix the shorted 12v power line and in the process blew D2 which is the diode for the 12v line along with some other traces connecting to 5v and 3.3v lines so further testing other than validating the 3.3v output voltage was not able to be completed. It was found that the diode was “wired” wrong in the PCB design, and this will be sorted out over Christmas break in time for ecen 404.

The H-Bridge/Motor Driver was able to be validated only in the forward direction but not reverse direction. It turns out that the gate threshold voltage to turn on the two NMOSs were not being met thus they weren't being turned on. Again, this will be calculated and fixed in the PCB design2.0 over Christmas break.