

## **Phase 2 Executive Summary | Drive System**

Team Mazarine | By Raiyan Ishmam | February 16, 2018

### ***Deliverables***

1. Drive System Design
  - a. Functionality: The Arduino is able to perform drive control logic that can drive two motors, each in either direction and at any speed (between the ranges of speeds determined by the voltage that the Arduino can supply).
  - b. Demonstration: The final iteration of the designed circuit was presented, and it successfully completed all required tasks as stated above.
2. Drive System Implementation
  - a. Functionality: The prototype, consisting of wheels mounted on a chassis, must be able to turn left and right, make a full U-turn, and stop via commands from the Arduino.
  - b. Demonstration: A pre-built and tested prototype was successfully demonstrated to fulfill all required expectations. Forward and backward acceleration/deceleration were also demonstrated.

### ***Timeline***

Phase Start Date: 1/25/18

State Machine Projected Delivery/Demo Date: 02/06/18

State Machine Actual Delivery/Demo Date: 02/06/18

Bot Spec Projected Delivery Date: 02/09/18

Bot Spec Actual Delivery Date: 02/09/18

There were no delays or changes made in original projections.

### ***Conceptual and Design Activities***

Each of the following design activities was performed as a group, and every new design activity was only undertaken once all the preceding designs met expected requirements satisfactorily.

- A schematic of a circuit to control a single motor in one direction was initially designed.
- Schematic was then modified to control the motor in either direction
- The modified schematic formed the basis for the design of the final circuit, that used IC logic chips. Two motors were incorporated into the circuit at this stage.

### ***Technology Summary***

The final iterations of the circuits for each stage are provided in page 3. Gate voltages needed to be adjustable so were connected to the analog Arduino pins. Capacitor, diode, and resistor values were initially estimated based on predicted parameter values but were all finalized through trial and error.

### ***Experiments Performed***

- a. Test to run the motor in one direction - Success
- b. Test to run the motor in either direction – Failure; Error: did not have a small delay between transitions
- c. Test to adjust the speed of the motor at any point – Failure; Error: Speed not properly calibrated based on input voltage range
- d. Test to control a single motor using the IC chip – Success
- e. Test to control two motors with the IC chip – Success
- f. Test to accelerate/decelerate forward then repeat the same backward – Failure; Multiple errors since code involved a few loops

- g. Test to turn the wheels in any direction using the motor – Failure; Multiple errors again, since a lot of calibration was required to precisely turn the wheels a set distance

### ***Work Designations***

James – excellent work on the hardware assembly; the solid chassis proved to be vital to test the various motion requirements

- Designed hardware schematic, and did all the breadboarding for the part B and most of the breadboarding for the A

Raiyan – great job on the software for all of part A, and some of the software for part B

- Designed the code for controlling the speed of a motor in either direction, controlling a motor using the H-bridge, as well as controlling two motors with the IC chip

Harrison – Amazing job on ensuring modularity of the code used for this phase, and made significant contributions to debugging a major concern over the design of the circuit for part A

- Designed the overall code structure for the demonstration of part B
- Designed the code for steady acceleration/deceleration and rotation of the wheels

### ***Cost***

Phase	Item	Cost Expected (\$)	Cost Actual (\$)
1 State Machine and Bot Spec	Arduino Mega (used across all phases)	38.50	38.50
	Various Small Physical Components including but not limited to: resistors, LEDs, potentiometers, capacitors, etc. (used across all phases)	20.00	4.00
	Wire (used across all phases)	10.00	2.00
	Materials for building chassis	8.00	3.00
	Labor (3 people * 8h * 41.32/h/person )	991.68	991.68
	<b>Total:</b>	<b>1060.18</b>	<b>1033.18</b>

### ***Team Stage Assessment***

Our team feels like a strong cohesive unit. We have two weekly meetings besides the studio time we have in class. Everyone is willing to compromise their schedules to accommodate the others should the need arise. James has greatly improved on his scheduling, Raiyan has been slowly but surely contributing to the hardware design, and Harrison has been able to communicate more effectively. James mentioned in the previous executive summary that we are all “yes” people. We have worked on this, by always asking each other questions about the tasks and ensuring that the answers are backed up with proper evidence and logic. Overall, I feel extremely comfortable working with this group. Lastly, our notebooks have shown remarkable improvement from the last phase as well.

### ***Recommendations for Next Leader***

Make sure we are all on par with the deadlines and assignment due dates. The next phase is critical since we need to work on the collision detection spec in parallel with the sensor system. So, it is imperative that everyone works according to plan and maintains good time. Also, further improve notebook neatness to get those coveted check pluses. Here’s to a great phase 3!