MEMORANDUM

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From:	Rees Verleur rverleur@calpoly.edu	Jack Ellsworth gjellswo@calpoly.edu
Team:	Hippotronics	
Date:	April 15, 2023	
RE:	**Preliminary Project Proposal**	

I. Design Description

Our design consists of two drive motors which control the motion of the robot using two main wheels with additional idler wheels as required. This two-motor drive allows the robot to easily track its position based on encoder positions for both motors. The chassis of the robot contains a reservoir which can store captured balls, an intake system at the front which can capture additional balls, and a sorting system to reject balls of the incorrect color. This sorting system works with the camera mounted on the front of the robot to provide redundancy for incorrect colors. **Attachment 1** shows a schematic of the proposed robot.

II. Component Selection

Encoded Brushed motors were selected for the main drive motors for their low cost and ease of use. We have selected the Pololu 4824. These motors have a no-load speed of 180 RPM, a no-load current of 120mA a stall torque of 3.9 Kg*cm, and a stall current of 2A. The motors fit inside of the size limitation of 25 x 32 mm neglecting the attached gearbox and encoder. The encoders will allow the robot to know its current position in the ring. This will be assisted by a camera which can be used to recognize any landmarks in the ring. These motors were sourced from Digi key and seem to present a good balance between speed and torque. A motor driver circuit will be required to drive the motors and has not yet been selected.

For a camera we have chosen an Ov7670 module which has a 640 x 480 resolution and interfaces with I2C. The module is inexpensive and widely available.

For the intake motor we have selected a brushless DC motor with an accompanying bidirectional electronic speed controller. These parts are already owned by one of the group members so cost of use is low.

The sorting mechanism will consist of two components, a color sensor, and a servo. The color sensor is the VEML3328 made by Vishay semiconductor and sourced from Digikey. This color sensor is extremely low cost and has a 16-bit resolution for each of red, green, blue, and white. The servo is once again owned by a group member.

In the case that the ring is demarked with lines we have selected an infrared emitter/receiver made by SparkFun Electronics: the ROB-09454. This is an extremely low cost part and will be easy to interface with the STM32 microcontroller.

The system will be run off two-cell lithium polymer batteries, again donated by a group member.

Table 1.0 shows a summary of the selected components and their sources and prices.

Part Description	**Quantity**	**Price**	**Source**
Laser Cut Components	1	$30	Home Depot
3D Printed Components	1	$20	-
Battery	1	$0	-
Drive Motor	2	$47	Digikey
Intake Motor	1	$0	-
Sorting Servo	1	$0	-
Color Sensor	1	$2.77	Digikey
Line Sensor	1	$3.50	Digikey
Camera	1	$5	Amazon
Total		$156.17	

III. Manufacturing Plan

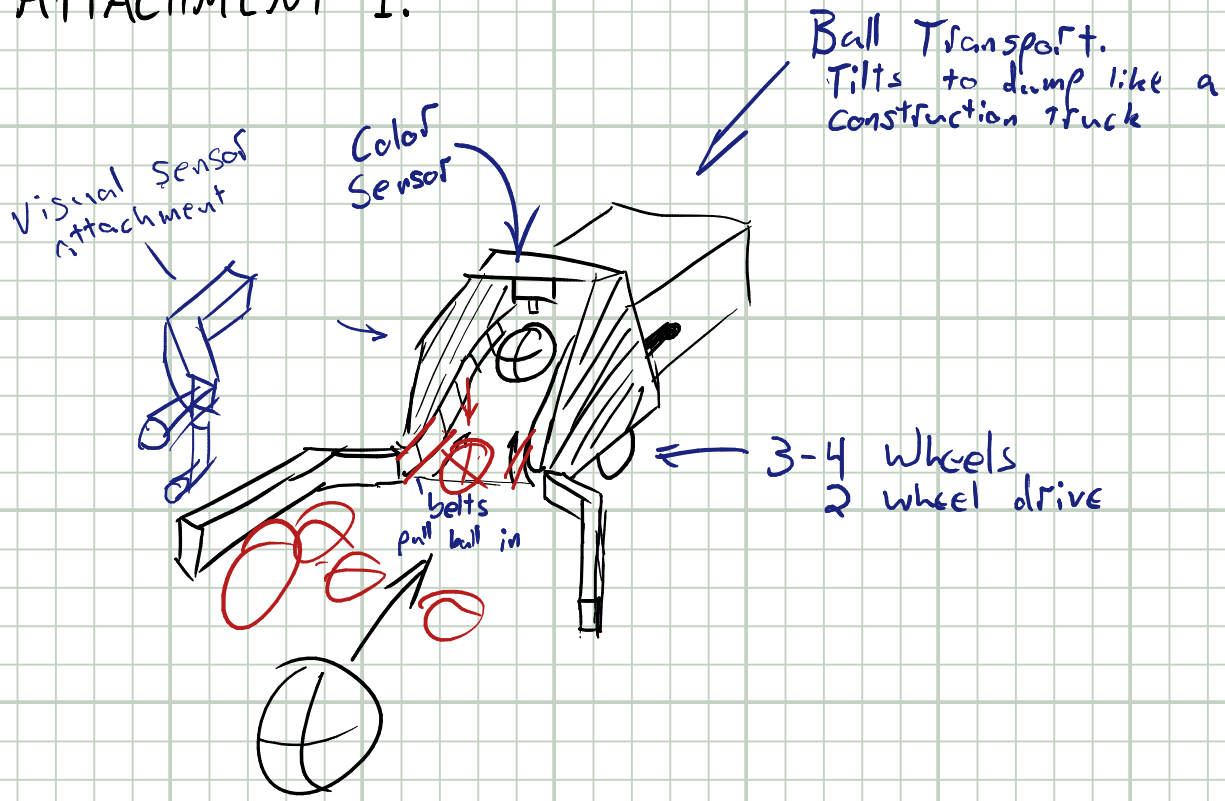
The main flat structural members of the robot will be laser cut out of acrylic using the innovation sandbox laser cutter; if more strength is required, sheet metal parts from a waterjet may be substituted. Where more complex geometries are required (i.e., mounting electronic components at specific locations), 3D printing will be used. 3D-printed parts will be manufactured in Mustang 60, innovation sandbox, or with team-owned printers.

Circuit boards will be designed in Fusion 360 and manufactured with PCBway. The circuit boards will contain all signal and power traces shown in the wiring diagram, making it the hub for the full project. Power will be provided to the circuit in one location.

IV. Wiring Diagram

All our project electrical components will either be mounted on (for ICs) or wired to the main circuit board. This includes our microcontroller and any component drivers, as well as all our motors and sensors. **Attachment 2** shows a simplified wiring diagram.

ATTACHMENT 1.



ATTACHMENT 2.