

Group 03 BASC - Proposal Summary

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1 Overall Strategy

We have divided the task into six sub-tasks and follow a modular approach.

Line following	Box manipulation and color detection	
Wall following and pillar detection	Ramp navigation	Identified the
Circle navigation	Gate area navigation	

specialties in each subtask in order to come-up with a simple design

2 Sensors

- IR line follower: Raykha S8
- Color sensor: TCS 3200
- Distance sensor: VL530LX TOF sensor
- Gyroscope: MPU 6050 Gyroscope module

3 Processing Unit

Main processing unit: Arduino MEGA 2560
Arm controller: Arduino NANO

4 Actuators

Main gear motor: **Pololu 25D 12V High Power 47:1 Gear Motor with Encoder**

- 210 rpm no load speed
- 300 mA no load current
- 12 kgcm stall torque
- 5.6 A stall current

3 servo motors will be used for the arm.

Two **TowerPro SG90**

One **TowerPro SG5010**

5 Algorithms

Line Following: PID feedback loop control using the front IR panel

Wall Following: Two TOF sensors on each side. The difference of the measured distance will be used to create a difference in motor speeds.

Circle Navigation: We calculated optimal paths for the 4 possible positions of the box. TOF sensors will be used to identify box.

Dotted Line Following: PID algorithm implemented. To cross the gaps, the tangent direction to the last line segment will be followed.

Ramp Navigation: Motor power will be controlled with input from the gyroscope to get a smooth uphill and downhill movements. Will need to be optimized at the testing stage.

Pillar Detection: Using the side TOF sensors, detect pillars and take necessary action.

Gate Passing: Calculated the optimal decision depending on the state of the two gates.

- Gate 1 is Closed: Wait until it is opened, pass through both gates
- Gate 2 is closed (G1 open) : Pass G1, then G2 will open
- Both gates are open: Wait until a gate is closed, choose scenario 1

6 Power Plan

Dual battery setup: 7.4V 2200mAh LiPo and 11.1V 2200mAh Lipo

Average charge consumption for one round: 500mAh from each battery

Average current consumption at the worst case: 2A from both batteries

Regulators: Three **LM2596S**

9V supply for drive motors, Arduino MEGA and OLED display

Two 5V supplies for sensors, servo motors and other components

We have started designing schematic block diagrams in order to make PCBs

Alternatives for 9V regulator: XH-M401 module, XL6009 module

7 Task Delegation

Phase 1: Preliminary Design

Phase 2a: Virtual Implementation

Phase 2b: Actual Implementation

Phase 3: Testing and Optimization

Responsibility of each part is given to one member. We have weekly progress revision meetings online and divide the next week's work among the members.

8 Hardware Design

Robot length: 21.5 cm

Robot width: 18 cm

Robot height: 12 cm

Arm for picking up the box, located at the front of the robot

Low center of gravity design

Minimum disturbance to the symmetry of the robot

Minimum ground clearance during ramp navigation: 2.5 mm