BASC

BATMAN'S ATTEMPT TO SAVE CATWOMAN

PROPOSAL REPORT

EN2053 – Robot Design and Competition

13.06.2020

Overall Strategy

- We have divided the task into six subtasks.
  - Line following
  - Wall following & pillar detection
  - Circle navigation
  - Box manipulation and color detection
  - Ramp navigation
  - Gate area navigation
- We thought of handling each task in a modular manner
- Switching between line following and wall following will be done by firing TOF sensors prior to the wall part *
- Box manipulation is the most crucial subtask in the competition
  - Two color sensors will be used
  - A gripping mechanism for the box
- Ramp navigation will be done using a feedback loop of gyroscope and motors

Sensors

The Raykha S8 IR sensor module

The TCS 3200 color sensor modules

2 sensors

one on the gripper to detect the front face

The other sensor to detect the bottom surface

VL530LX TOF sensor for distance measurement

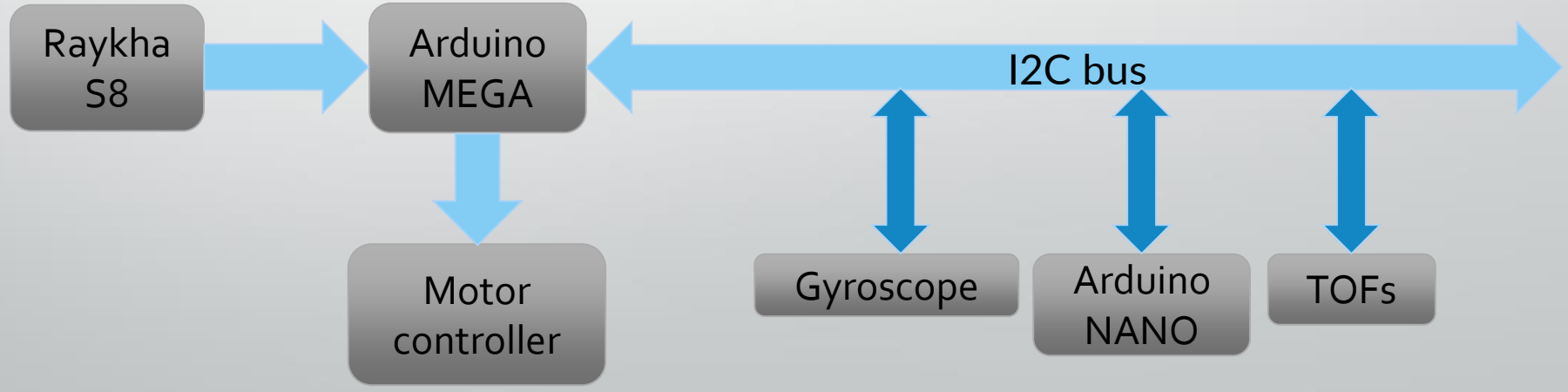
2 sensors on either side for pillar and wall detection

1 sensor in front for the box detection

MPU 6050 Gyroscope

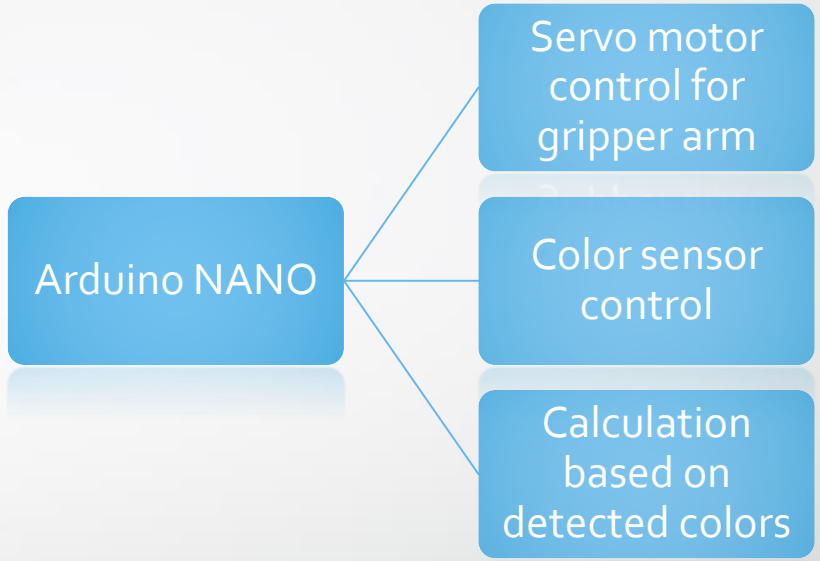
The Processing Unit

- **Arduino MEGA2560**
  - Arduino modules have a wide range of libraries.
  - The clock speed, flash memory, RAM and Interrupt count is higher than UNO/NANO



The Processing Unit

- **Arduino NANO**
  - For Better modularity and debugging, use a separate controller for the box handling mechanism.



- A debugging interface, indicator LEDs are also connected to the main processor.

Actuators – Gear motors

According to our calculations for the worst-case scenario in previous assignment (4)

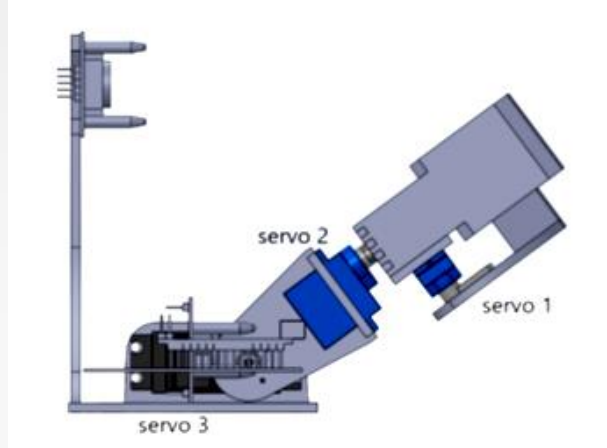
- Total weight – 1.5 kg
- Torque require for a wheel – 0.777 kgcm
- Maximum stall torque - 1.036 kgcm
- Maximum power output – 0.144W
- Power require in climb down the ramp – 0.11W
- Maximum speed need in flat ground – 26.52 rpm

For the above requirements we chose a motor which was **Pololu 25D 12V high power 47:1 gear motor with encoders**

Main specifications

- No load speed & current – 210 rpm, 300 mA
- Stall torque & current – 12 kgcm, 5.6A@12V

Actuators – Servo motors



According to our previous calculations on servo motors,

Servo1 maximum torque = 0.115 kgcm
Therefore we chose **Tower pro SG90** servo for the servo1 & servo2.

Main specifications

- Torque – 2.5 kgcm
- Operating voltage - +5V

Servo3 maximum torque = 2.047 kgcm

Therefore we chose **Tower pro SG5010** servo motor for servo3

Main specifications

- Stall torque – 5.5 kgcm (4.8V)
- Operating voltage – 4.8 – 6V

Power Plan

- The robot will be powered by two Li-Po batteries - dual battery setup
  - 7.4V 2200mAh 25C battery
  - 11.1V 2200mAh 25C battery
- Three voltage regulators – all **LM2596S**
  - 9V supply for drive motors, Arduino MEGA and OLED display
  - Two 5V supplies for sensors, servo motors and other components
- Battery level indicators will be used with both batteries to avoid over-drain of batteries
- Two PCBs would be used to minimize the wiring
- PCBs will be finalized after breadboard testing
- DIP switches will be used to control each component during testing
- Alternatives for 9V regulator: **XH-M401** module or two **XL6009** modules in parallel

Task Delegation

- **Phase 1:** Preliminary design
  - Pamuditha: peripheral components, robot body, coordination
  - Tharindu: box collection, color sensing
  - Yasod: circle navigation, ramp navigation
  - Vidura: gate area, arena
  - Thieshanthan: wall following, pillar detection
  - Yomali: line following, arena

Task Delegation

- **Phase 2a:** Virtual implementations
  - Schematic and PCB: Thieshanthan, Vidura, Pamuditha,Tharindu
  - Coding: Pamuditha, Tharindu, Yomali, Yasod
  - Mechanical design: Yasod, Vidura, Yomali, Thieshanthan
- **Phase 2b:** Actual implementation
- **Phase 3:** Testing
- Task delegation for phase 2b and phase 3 will be decided when the university starts.