MEAM 5100 Final Project

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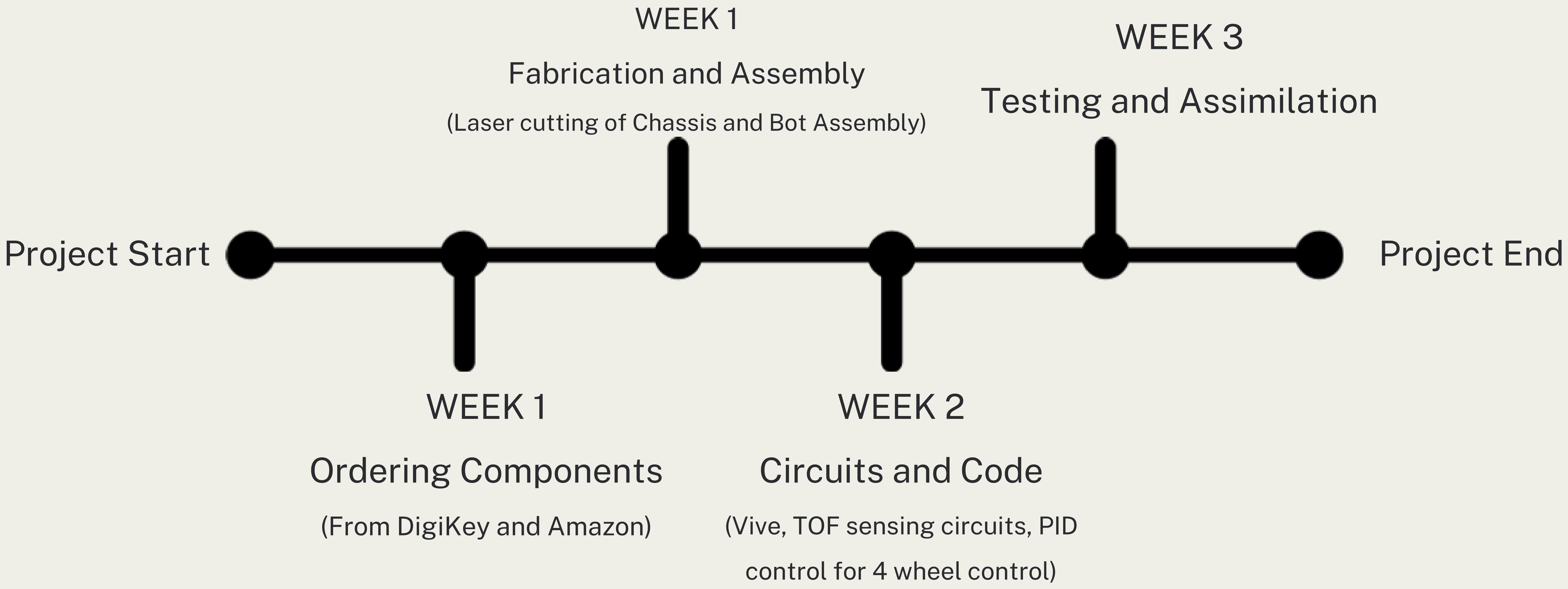
DESIGN REVIEW

OVERALL PLAN

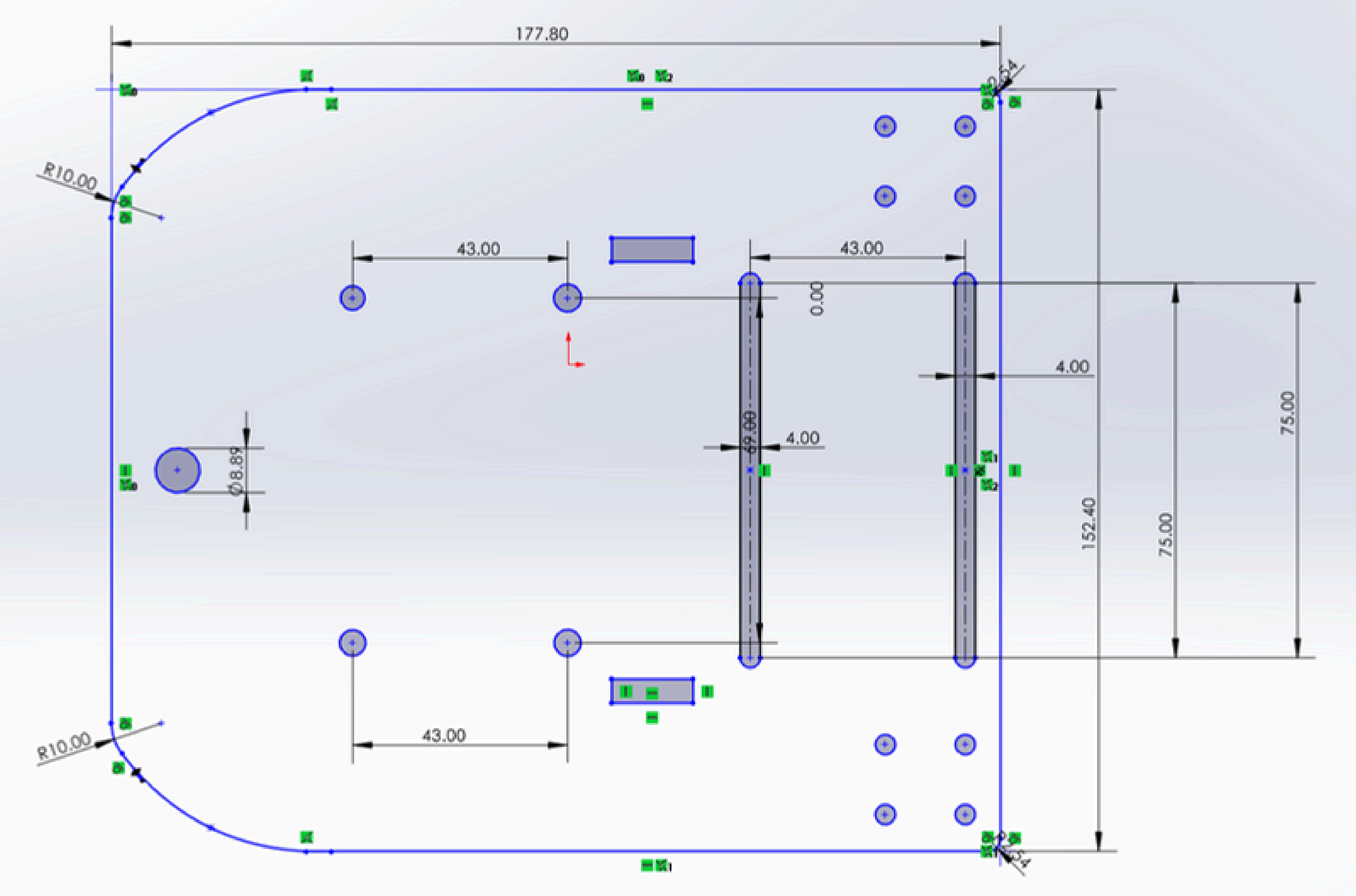
- Mobile Robot Architecture
- Components
- Software Plan

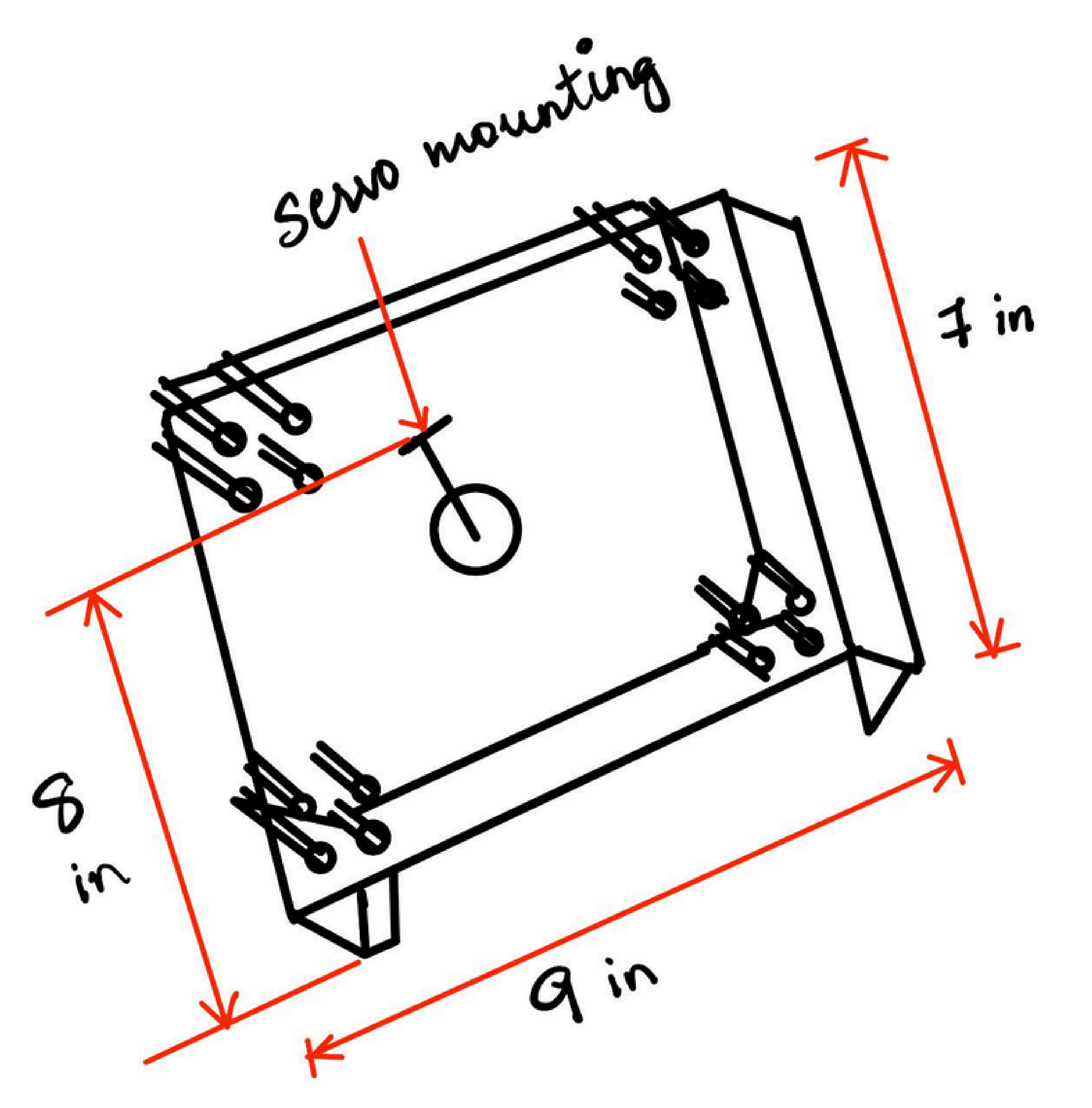
SCHEDULE



WEEK 1
Fabrication and Assembly
(Laser cutting of Chassis and Bot Assembly)
WEEK 3
Testing and Assimilation
Project Start
Project End
WEEK 1
Ordering Components
(From DigiKey and Amazon)
WEEK 2
Circuits and Code
(Vive, TOF sensing circuits, PID control for 4 wheel control)

MOBILE ROBOT ARCHITECTURE





MOBILE ROBOT ARCHITECTURE

Key Components of Mechanical Design:-

Major Upgrades

LAB 4	Final Project
Differential Drive	Holonomic Drive
2 Motors	4 Motors
3 Wheels	4 Wheels
NA	Introduction of servo for Robotic Arm

BILL OF MATERIALS

Serial No.	Description	Material/Component	Quantity
1	Motors	Metal	4
2	Wheels	Plastic + Rubber	4
3	Chassis	Acrylic	1
4	Battery	LiPo	2
5	ToF Sensors	VL53L1X	3
6	RGB Sensors	VEML3328	3
7	Vive Photosensors	PD70-01C/TR7	3
8	Flex Sensor	Adafruit 182	2
9	Whisker Switch	ME-8169	1
10	Servo-Motor	SG90	1
11	Microcontroller	ESP32-S3	2

COMPONENTS

- Localization:-
  - HTC Vive
  - PD70-01C/TR7 IR Photodiode

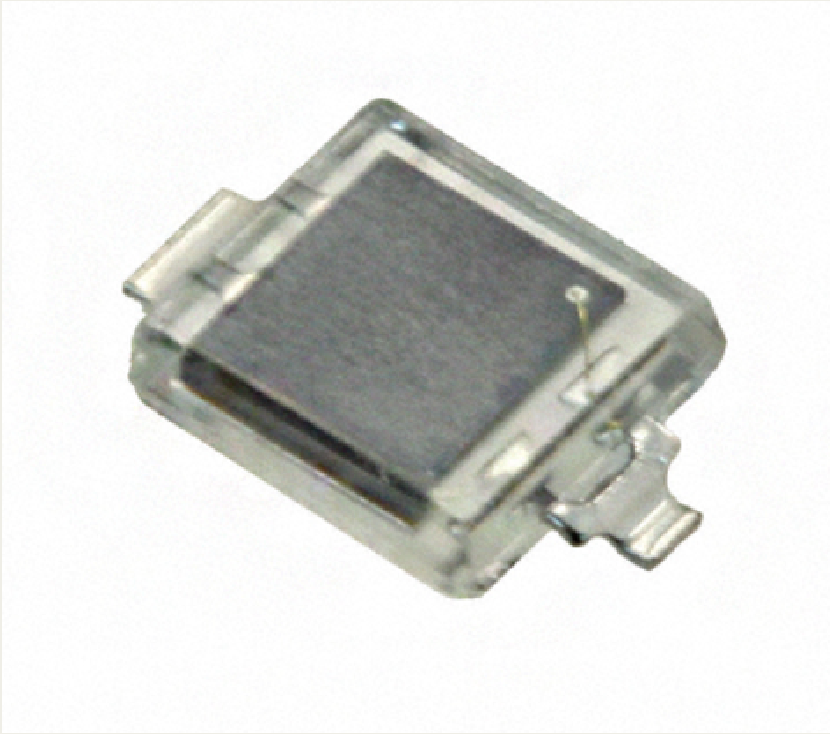


Fig: PD70-01C/TR7 from DigiKey

- Wall sensing:-
  - VL53L1X Time of Flight (ToF) sensor
  - 4m range

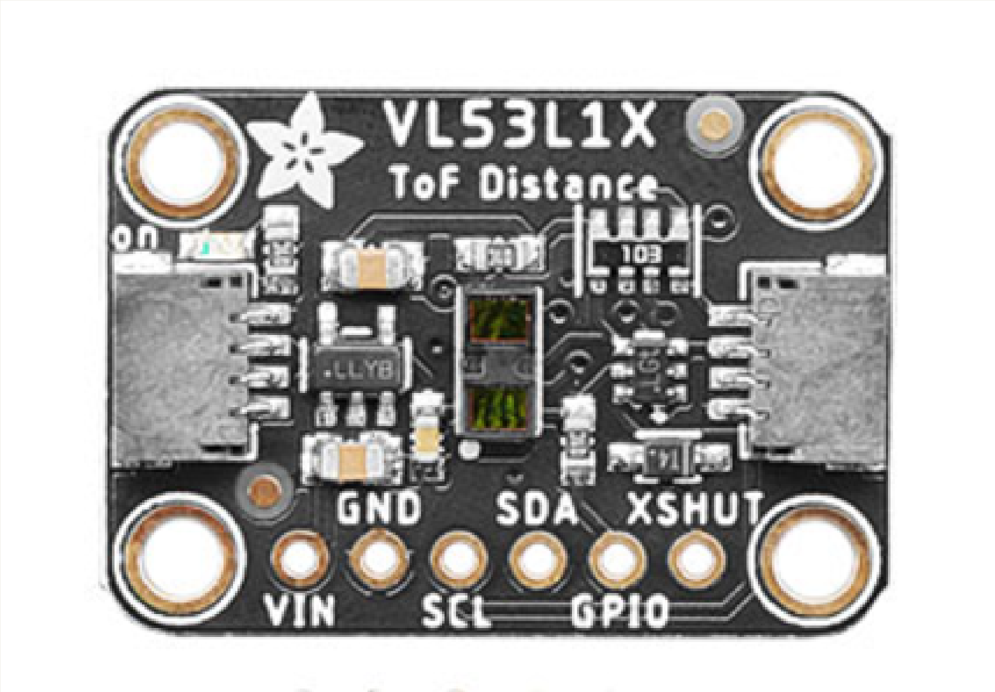


Fig: VL53L1X from DigiKey

COMPONENTS

- Contact sensing:-
  - 4.4in Flex Sensor

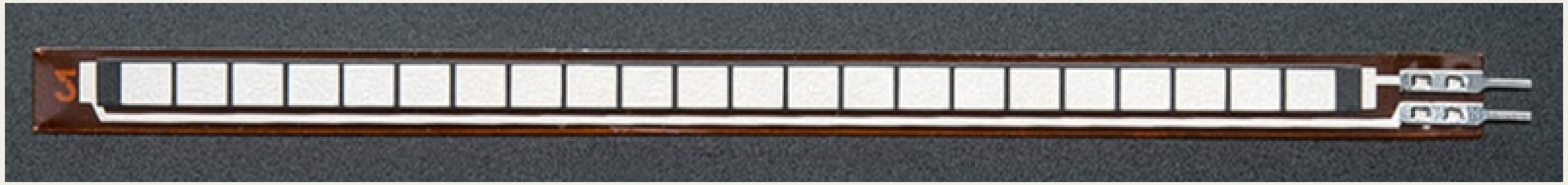


Fig: Flex sensor from Adafruit

- Colour sensing:-
  - VEML3328 RGB sensor

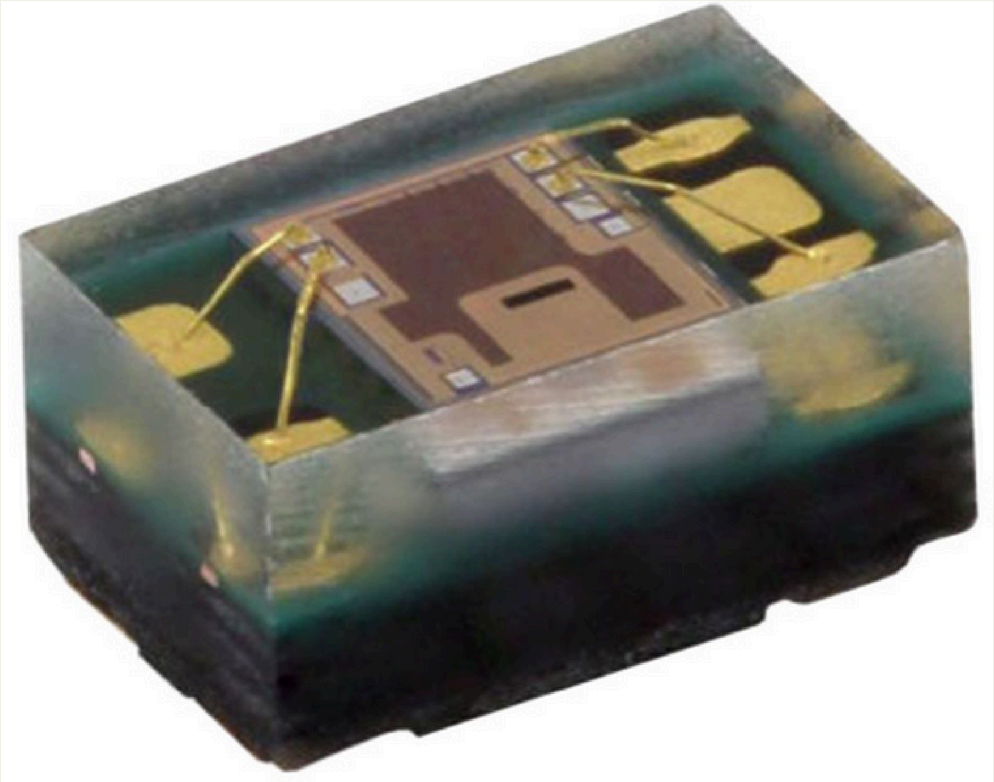


Fig: VEML3328 from DigiKey

SOFTWARE PLAN

Localization

- Using ToF sensors: The robot will continuously adjust its steering based on the difference between the measured and desired wall distance. This will be measured using side-mounted ToF sensors. A front sensor will check for corners or other obstacles. Proportional control will be used to maintain the desired distance from the wall and maneuver away from corners.
- Using infrared sensors: HTC Vive Tracking will be done using the photosensors.

Motor Control & PID

- There will be two aspects to feedback control: keeping the wheel speeds consistent and continuously adjusting the bot's position based on distance error from obstacles.
- Based on the outputs from this feedback, commands will be sent to the motors to control them.

SOFTWARE PLAN

Gameplay

- The ToF sensors will be used to detect obstacles in the path of the bot.
- If another robot is encountered, the bot should either slow down or stop based on how far away the opponent is. If a minimum distance between the bots is reached, extend the weapon out using a servo and hit the opponent’s whisker switch.
- When a nexus is reached, use the sensors to avoid the swinging arms of death by slowing down considerably. Wait until the arm is a safe distance away (by using a threshold) and then move towards the button. Keep the button pushed by applying a slow forward motion on the motors.
- Implement a similar button-pushing tactic for the towers.

Communication

- Emergency commands sent via WiFi packets can include a motor stop command, a weapon stop command, and safe speed command.
- Via I2C, send the number of packets transmitted to the Top Hat and receive a recalculated health value. The ESP will act as the master in this scenario.

CRITICAL PARTS OF THE PROJECT

We expect to spend the most time on the following aspects of the project:

- Testing out sensor circuits
- Integrating PID with sensor outputs
- Executing efficient movement of the weapon based on ToF sensor values
- Debugging the system, due to the number of components that could potentially fail
- How to decide between tasks (would be finalized after seeing how tests go)

Thank You