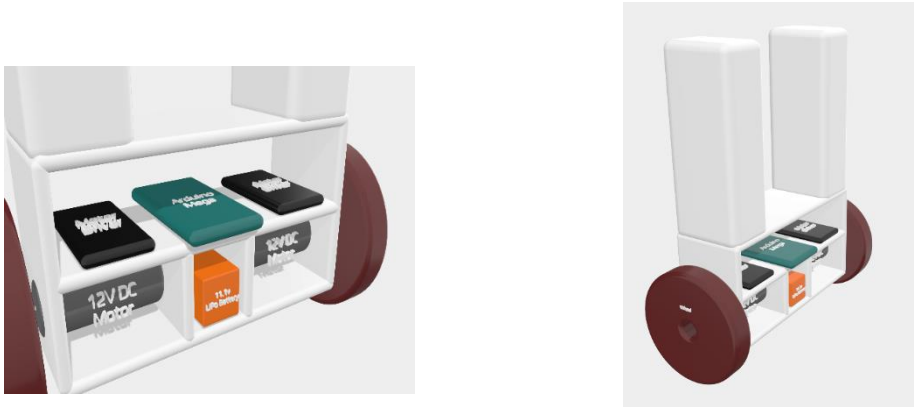
Technical Report for Level-2 Proof of Concept (PoC) Stage for ROBOFEST-GUJARAT 3.0

1. Complete and exhaustive description of all the logical steps in the working of Robot

A. Description of Robot

The two-wheeled self-balancing robot represents a robotic platform with two independently moving wheels and a centre of gravity above the rotation axis. A robot's behaviour is comparable to a traditional mechanical system that uses an inverted pendulum. Unlike a regular robot, a two-wheel self-balancing robot needs two contact points with the floor surface. The robot is distinct from other robots since it requires a unique stability control to stay upright. A self-balancing robot's basic concept is as easy as driving the wheels in the direction the robot tilts. This is comparable to the control theory inverted pendulum concept.

Our autonomous two-wheeled robot consists of three levels of platform balanced over two wheels. The bottom platform houses the motors and battery, while the middle platform holds all the other electrical and mechanical components. The upper platform is used to place the item to be transported by the robot.



(a) (b)

Fig 1. CAD Diagram of the two-wheeled self-balancing robot

B. Electronics Description

The main control component of the robot is Arduino Mega 2560 Rev3, based on ATmega2560, which is programmed with a closed-loop control mechanism to

achieve the desired features of the robot. The angular data collected from Inertial Measurements Unit (MPU6050 module) is fed into the microcontroller. Microcontroller instructs the motor driver to maintain the upright position, which rotates the motor accordingly.

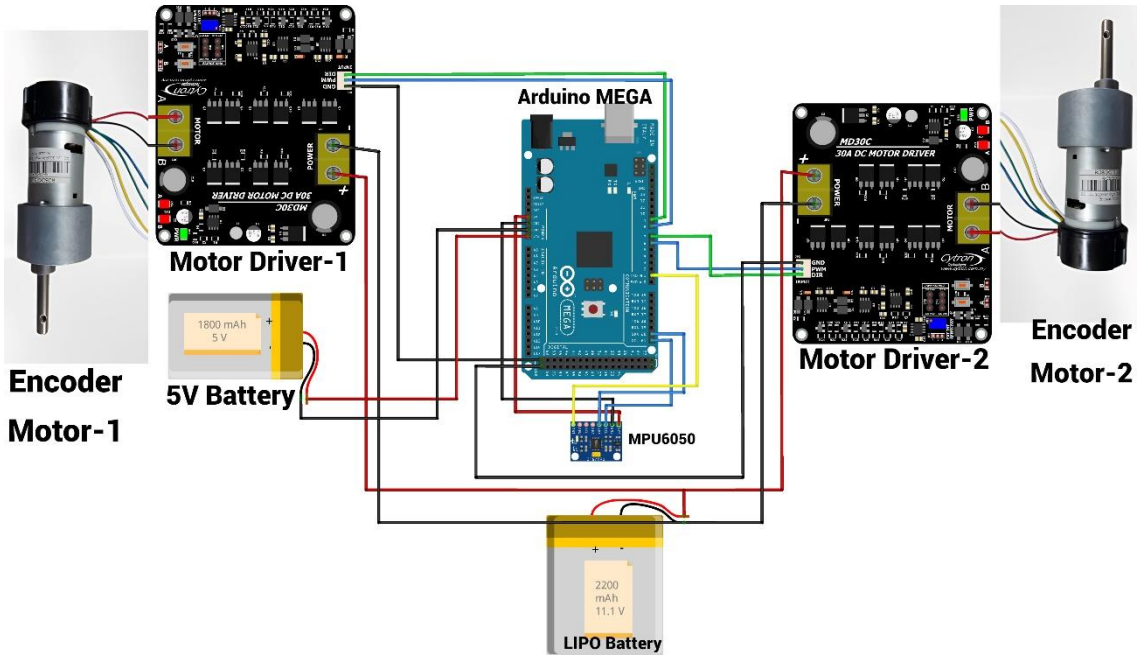


Fig 2. Circuit Diagram of the two-wheeled self-balancing robot

C. Features

The two-wheeled self-balancing robot we made consists of the following features:

- It can maintain its balance and stay upright.
- The robot can move in a straight line without any external control.
- It can carry and transport objects from one place to another, like a container filled with liquid.
- It can navigate tight spaces, which is challenging for other robot types.

2. Complete and exhaustive listing of all the hardware / component / equipment (electronics and mechanical)

A. Electronics component

a) Electronics Modules

1. Microcontroller: Arduino Mega 2560 Rev3
2. Motor Driver: Cytron 10 A Switch Control Potentiometer DC Motor Driver DC 12V

3. Sensors:
   - MPU6050 - Triple Axis Gyro Accelerometer Module
4. Batteries:
   - LiPo Battery 2200 mAh 11.1V
   - 1800 mAh 5V Battery

b) Electronics Components Used for Fabrication

Electronic components are fabricated using jumper wires to form the robot's circuit. A switch is connected to break or complete the electrical circuit.

c) Tools, Equipments Used.

1. Soldering iron
2. Battery charger
3. Multimeter
4. Electrical Drill
5. Arduino Cable

B. Mechanical Components

a) Mechanical Modules

1. Foam sheet
2. Wheels: ROBOT WHEEL 10.5 CM DIAMETER 4.4 CM WIDTH

b) Fabrication Component

1. Philips head Screws
2. Barrel Jack

c) Tools, Equipments Used

1. Mechanical Saw
2. Hot glue gun
3. Fevikwik
4. Screw Driver

C. Electromechanical Component

- Motors: 200RPM HIGH TORQUE QUAD ENCODER MOTOR

3. Complete and exhaustive listing of all the software used in Robo-making

A. Software Used

Arduino IDE

B. Software Developed

NIL

4. Additional Features in Actual Robo-Making

- It can go uphill and downhill over an inclined surface.
- If required, the robot can stay still on an inclined surface as well.
- The robot can move over a small obstacle retaining its stability.

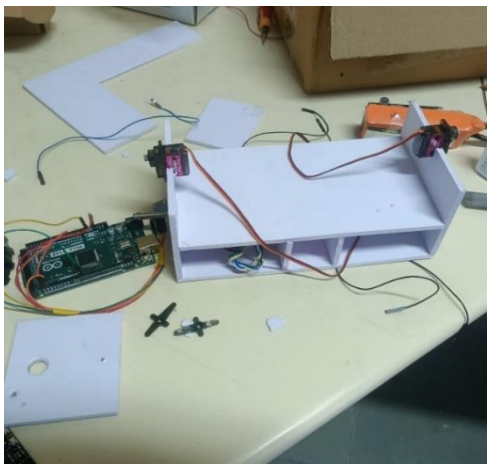
5. Any Other description not mentioned above

NIL

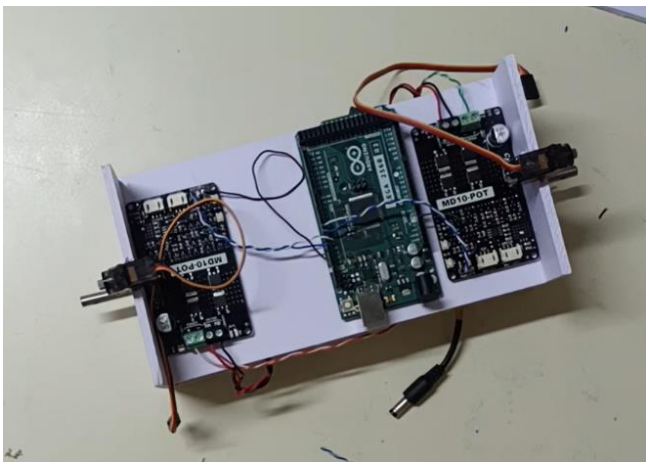
6. Deliverables achieved in terms of final objectives for the prototype

- The two wheeled self-balancing robot can stand free and maintain its balance.
- The robot balances on two wheels and uses two sensors, a gyroscope, a accelerometer and feedback for determining the current angular position and speed versus the desired angular position and speed.
- No readymade kits/chassis are used; the entire structure was made from scratch.
- No external controls are given.
- The robot is highly manoeuvrable, physically accessible, and can travel moderately.
- It can carry a load of more than 1 kg over a minimum distance of 200m.
- It is battery-operated only.

7. Photos of Robo-Making



(a)



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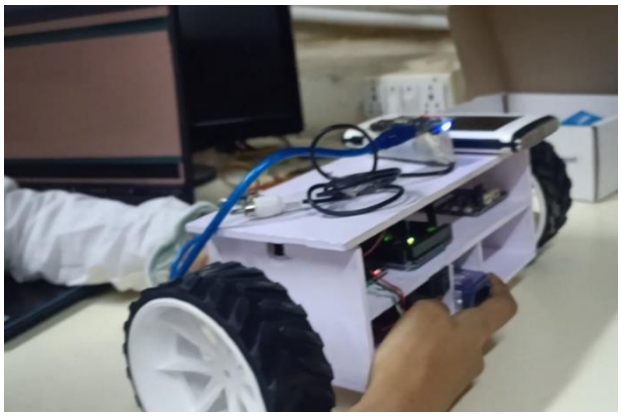

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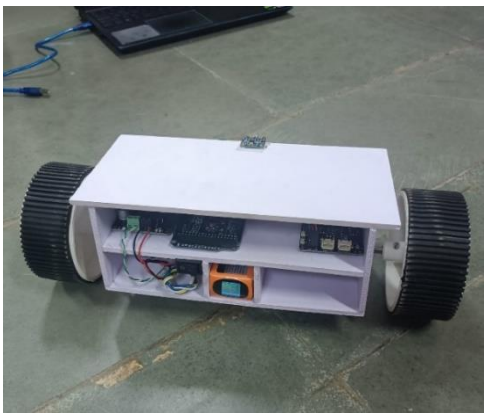

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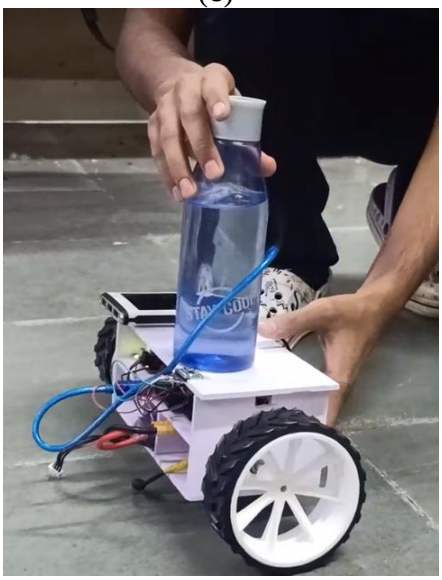

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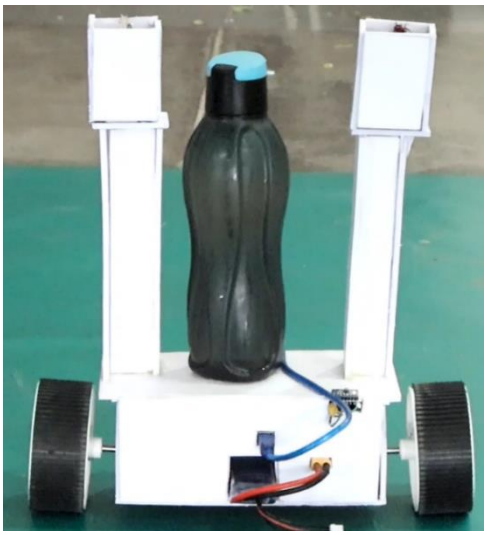

(f)

Fig 3. (a-f) Steps of robo-making

8. Videos (1GB Limit)

Drive Link of the video :

https://drive.google.com/file/d/1LWbINsmUSOUq5xXSzxT94-ViZJy2LPBO/view?usp=drivesdk