TWO WHEELED SELF BALANCING ROBOT

Minor Project Synopsis

Submitted By

Janav Makkar

University Roll no. 1905342

Ankush Bansal

University Roll no. 1905086

Raghav Malhotra

University Roll no. 1905381

GURU NANAK DEV ENGINEERING COLLEGE

LUDHIANA-141006, INDIA

Content

Introduction

The basic working principle behind self-balancing robot is an inverted pendulum concept model in control theory, according to which the robot drives the wheels in the direction in which it tilts. The examples of inverted pendulum in certain real applications includes rockets like MAXUS, Segway the personnel transporter and a self-balancing vehicle.

Two wheeled self-balancing robot is an important type among mobile robots because it requires just two points of contact with the floor surface. The unique stability control that is required to keep the robot upright differentiates it from ordinary robots.

It has great advantages like small size, flexibility, low cost because of these advantages, it can be used in various application in the field of control engineering. The inherent complexity associated with control of this platform finds its application in design and development of control system of automobiles, spacecrafts, transportation facilities including military transport.

The developed hardware is used to develop an object carrying vehicle which can be used to reduce the human efforts in working places, offices, household applications.

This is a cost-effective solution using PID algorithm for these two wheeled vehicles.

Rationale

Because of the previously stated advantages that come with a two-wheeled self-balancing design, a number of consumer products have recently gone mainstream that utilize a similar idea for purpose of convenient human transportation, i.e. - Hover-boards, Segway and self-balancing two-wheelers. Our goal with this project was to demonstrate the balancing mechanism used in these products in a compact, cost-effective prototype of a self-balancing robot

Objectives

1. To balance the whole body on two wheels automatically by designing the best possible structure for the body and obtaining the filtered values from the gyro and accelerometer sensor i.e. – mpu6050.

2. To use inbuilt Wi-Fi or Bluetooth capabilities of ESP32 microcontroller to communicate with the robot in order to deliver the commands to follow.

3. To fine tune custom PID values for the robot to ensure its smooth maneuverability.

4. To generate ability to balance and maneuver with objects placed on its head

Feasibility Study

1) Feasibility of the project

As the name suggests, the self-balancing robot is an automated vehicle that balances itself without any outside help or support. This project is a complex one as it involves using PID Control and involuted programming.

Self-balancing robots are unique among all others, just because of their ability to balance on a given fixed position. Even if the robot is displaced from its position, it is programmed so that it again recovers its position.

Project is intended to explain the design along with the construction and control mechanism of a two-wheel self-balancing robot. To deal with the problem of sudden horizontal movements and gyro drifts in sensors, a complementary filter is implemented[1]. PID (proportional integral derivative), is the feedback mechanism used for this project.

2) Need of the project –

1. It's ability to turn on the spot and sustainable architecture increases its applications in industries.
2. It is essential for the robot to not only balance but also maintain its position, withstanding external forces or unexpected disturbances if any

3. Active research on two wheeled robots have been widely increased since the early versions of the studies on self-balancing robots by JOE [2] and n-BOT [3]

3) Significance of the project -

These robots can be used for

1. Smart gardening purposes.

2. Autonomous trolleys in malls, hospitals, and airports.

3. An intelligent robot for various industrial-military purposes.

4. Currently popularized as “Segways,” these machines are mostly used for travel and tourism purposes and by private security services. It has been put to use by a range of private and military organizations since its invention.

Methodology/ Planning of work

The main objectives of system for Online voting system are:

1. The objective of Online voting system is to help the organization in automating the whole manual processing of the existing system.

2. Test working and compatibility of all electronic components (mpu6050 and motors and it's driver) with ESP32 separately and ensure proper working of each component. a rudimentary prototype using all components with temporary wiring on the breadboard in order to test integrated working of the components with each other (without tuning PID values).

3. Fabricate basic frame of the robot using acrylic sheets, spacers, screws and angle brackets.

4. Mount all electronic components onto the frame.

5. Make wired connections according to planned circuit.

6. Upload code to ESP32 from Arduino IDE.

7. Update PID values.

8. Test performance, balance and maneuverability of the machine, if not satisfied with its performance, go to 7th step in order to fine tune PID values else required development of the robot is completed.

Facilities required for proposed work

Software Requirements :-

1. Arduino IDE

Hardware Requirements :-

1. Arduino IDE
2. ESP32 microcontroller - 1
3. MPU6050 sensor - 1
4. Bo geared motors - 2
5. L298N Motor driver -1
6. 3.7v 18650 Li-ion battery – 2
7. Assorted Jumper Wires
8. 3mm Acrylic Sheet
9. 65mm Nylon Tyres – 2
10. Angle Brackets – 2, Spacers and Screws

References

1. https://sites.google.com/site/myimuestimationexperience/filters/compl filter

2. https://www.sparkfun.com/products/9061

3. https://howtomechatronics.com/tutorials/arduino/arduino-and-mpu6050-accelerometer-and-gyroscope-tutorial

4. https://wiki.sunfounder.cc/index.php?title=Motor$_{D}river_{M}odule-L298N$