SELF BALANCING ROBOT

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Abstract

Self-balancing robot is an effective approach to the development and advancement in the field of robotics. In this particular model, the concept of inverted pendulum is used. Self balancing is a process by which a system achieves stability by internal forces. The basic idea of this project is to overcome the challenge of balancing initially unstable system, by providing control mechanism to the robot so that it can balance on its own. The robot uses sensor values provided by accelerometer and gyroscope to find exact position of itself in three-dimensional geometry and send the values to microcontroller. The microcontroller on the other hand uses programs in it to give proper instruction about rotation of wheels to the motor driver module which in turn helps to balance the robot.

1. INTRODUCTION

The invention of self-balancing robots has been a massive milestone in the history of robotics. These machines are particularly characterized by their ability to balance on two wheels by the implementation of a closed loop algorithm. A self-balancing robot has an unstable dynamic system unlike any other robot which rests itself on either three or more wheels. It works on the same phenomena as that of an inverted pendulum. Its design is more complex, as it needs to maintain its upright (vertical) positispoton, however this design has many advantages which allows it to be used in practical scenarios. It's ability to turn on the and sustainable architecture increases its applications in industries. It is essential for the robot to not only balance but also maintain its position, withstanding external forces or unexpected disturbances if any.

2. RELATED WORK

Segway a motorized personal vehicle consisting of two wheels mounted side by side beneath a platform that the rider stands on while holding on to handlebars, controlled by the way the rider distributes their weight.Two –wheeled or self balancing robot is an unstable dynamic system unlike other four wheeled stale robots that are in equilibrium state. By unstable, here, we mean that the robot is free to fall ahead or backward direction

without any application of force. Self balancing means the robot balancing itself in an equilibrium state, 90 degrees upright position. This project works on the inverted pendulum concept. We are making use of Arduino Uno to build the self balancing robot. We are using the inertial measurement unit MPU6050 for measuring the current tilt angle. A PID controller will be able to control the pendulum angle. The Raspberry pi, pi camera will help us determine the surrounding conditions through live streaming and help in the search and rescue operations. Having a clear idea of the state of devastation prior to sending any human inside a natural calamity struck area is the sole purpose of this project. To provide important information about the surrounding is why we are using a two wheeled robot mounted with a camera and sensors which help him to move.

3. IMPLEMENTATION

The microcontroller ATMEGA328P along with MPU6050 (accelerometer and gyroscope) and L298N motor driver is responsible for balancing of the robot. The sensor module MPU6050 and motor driver L298N are programmed by the help of microcontroller. The position of the robot in 3- dimensional geometry(angle of inclination) and the angular velocity of the wheels(speed by which the robot is falling) is determined by the sensor MPU6050. The microcontroller, by utilizing these values instructs the motor driver module to rotate the motors in order to counteract the falling motion of the robot.

1) ATMEGA-328P [5] It is a high performance 8-bit microcontroller based on AVR RISC architecture. It is a 28 pin microcontroller which has 32KB flash memory and runs on a frequency of 20Hz with external crystal within 1.8v to 5v operating voltage.

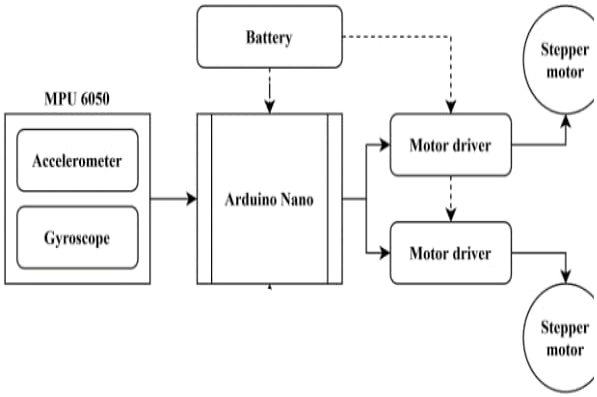
2) MPU6050 IMU [6] It is an Inertial measurement Unit commonly known as IMU, which is used to measure gravitational acceleration and rotational velocity. It is a 6-axis sensor module which contains 3-axis accelerometer and 3-axis gyroscope integrated on a single chip. It is basically used to determine the exact location of the robot in 3-dimensional space. The outputs of the gyroscope are defined in degrees per second. Hence in order to get the angular position integration of the angular velocity is needed. Gravitational acceleration can be measured by the Accelerometer along the 3 axes and thereby by using some sort of math we can calculate the sensor position. So by combining the accelerometer data values and gyroscope data values we can get very precise information defining orientation of sensor.

3) L298N Motor Driver[7] This module is used to drive DC motors. As the module

uses dual H-bridge drive, it is possible to drive two motors at the same time. It supports driver voltage from 5v to 35v.

To keep the robot balanced, the motors must contract the robot falling by rotating the wheels in desired direction as shown in Fig.2. This action requires feedback and correcting elements. The feedback element is the MPU6050 gyroscope + accelerometer, which gives both acceleration and rotation in all three axes. The Arduino used to know the current orientation of the robot. The correcting element is the motor and wheel combination.

4. EXPERIMENTAL RESULTS



Block Diagram

Business Model

5. CONCLUSION

In this project we were able to implement a self-balancing robot by using PID tuning method. The assembled configuration of the robot is shown in Fig. The bot balances itself effectively while leaning in forward or backward directions by the implementation of a closed loop algorithmThe robot should be easy to design, It should be user friendly, The machine should be portable,It should also be an automatic robot

6. REFERENCE

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