Self-Balancing Robot with Gesture controls

Title : Self Balancing Robot with Gesture controls

Group Number : 21

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Motivation :

In the present world, there are a several vehicles for short-distance travelling. We want to build something similar to a Segway scooter. So, we decided to build a self-balancing robot that can be controlled by hand gestures to demonstrate the working principle behind Segways. This is our team's first step towards learning the technology of robots by applying the concepts of Control Systems. This way, we would learn the concept behind these vehicles and also learn about PID Controllers in Control Systems.

Aim :

The aim is to build a self-balancing robot which runs on two wheels and can balance itself without falling under the influence of gravity. The robot can be controlled with user hand gestures.

Working principle / Implementation :

The system is a self-balancing robot. We balance the robot by moving it in the direction of its fall, trying to keep the center of gravity of the robot above its pivot. To keep the robot balanced, we should know the direction and the

acceleration with which it is falling. This data can be measured by an accelerometer and a gyroscope (MPU 6050). The micro-controller will process the data measured by the sensors and according to the PID algorithm it commands the motor driver to drive the robot in the direction of fall which will balance the robot. The user's hand will be equipped with an MPU 6050 sensor connected to an Arduino Nano which will track the motion of the user's hand and signals the robot through Bluetooth to move accordingly. Li-Polymer batteries are used as the power source for the robot.

Challenges Expected :

- Difficult to improve / maintain the steady state of the robot.
- Improving the steady state and performance of the robot on uneven surfaces.
- Learning new concepts such as PID controllers and algorithms.
- Improving the accuracy of the gesture controls and setting the right sensitivity.

Components:

- Stepper motors (x2) – Rs. 1400
- MPU 6050 6 axis accelerometer and gyroscope (x2) – Rs. 800
- Arduino Nano (x1) – Rs. 400
- A4988 stepper motor driver (x2) – Rs. 375
- Bluetooth Modules HC-05 (x2) – Rs.600
- Li-Po battery (x1) – Rs. 600

Net cost : Rs. 4000 – Rs. 5000

Demonstration after 4 weeks :

Working prototype of the robot with self-balancing feature established.

Demonstration after 8 weeks :

Working prototype of the robot with self-balancing and gesture control features (more features if possible).