BOT BRAINS ROUND – 2

Question 1:

What are the parameters that should be considered while calculating maximum angle of inclination in Two wheeled self-balancing robots (TWSBR)?

Solution:

If we want to figure out the maximum angle our TWSBR can handle without tipping over, there are a bunch of things we need to take into account:

1) Center of Gravity (CoG): The height and position of the CoG play a big role in how stable your robot is. Generally, having a lower CoG means you can handle a steeper angle, and vice versa.

2) Wheelbase (Distance between the Wheels): A wider wheelbase can make your robot more stable, but it might affect how easy it is to maneuver.

3) Wheel Radius: The size of your wheels matters too. Bigger wheels can handle larger inclinations, but they need more torque to keep things balanced.

4) Mass of the Robot: The weight of your robot is important. Heavier bots need more torque to stay upright and are less likely to tip over. This is also a major factor that determines the speed of the robot.

5) Torque of the Motors: The maximum torque your motors can produce determines how well your robot can correct itself when it starts tilting. More torque is required for robots with higher mass.

6) Friction Coefficient of Wheels: Having high friction on your wheels helps prevent slipping, which means you can handle steeper inclines.

7) Sensor Accuracy: You need to make sure your gyroscopes and accelerometers give you accurate readings. They're crucial for maintaining balance.

8) Control Algorithm: The balance control algorithm you use, like PID or Kalman filter, affects how well your robot responds to inclines. So, you want to pick one that's efficient.

9) Payload: If you're carrying any extra weight, you need to consider how it's distributed. It affects the overall balance and the maximum angle you can handle.

Question 2:

What is the core concept of the Two wheeled self-balancing robots (TWSBR)?

Solution:

So, the basic idea behind TWSBR is all about staying balanced on two wheels by using sensors to control the motors. The way it works is that the control system keeps adjusting the speeds of the wheels to make sure the robot doesn't tip over. It does this by using fancy algorithms like the **Proportional-Integral-Derivative (PID) controller** or even more advanced methods like the **Kalman filter combined with PID.**

To figure out its orientation and how much it's tilting, the robot relies on **gyroscopes** and **accelerometers**. Based on that information, the control system makes sure the wheels move in a way that counters any weird movements and keeps the robot nice and upright.

Question 3:

What is the additional thing/component that you can add to make it unique and explain the same by giving its proof of concept?

Solution:

Proof of Concept:

Idea: I brought together a cool modular parcel handling system and an automated gripping mechanism with dynamic weight balancing.

Components:

1. **Automated Gripper:** We've got this awesome robotic arm with a gripper that can easily pick up and drop off parcels.
2. **Dynamic Weight Distribution System:** We're talking about some fancy sensors that can detect the weight and position of the parcel, and with the help of actuators, they can adjust the center of gravity (CoG) on the fly.

Implementation:

1. **Automated Gripper:** So, we've got this robotic arm chilling on top of the TWSBR. It's got sensors that can locate and handle parcels like a pro. It uses super smart vision systems (cameras) and distance sensors (ultrasonics or LiDAR) to find the parcel and secure it.

2. **Dynamic Weight Distribution System:** This bad boy incorporates load sensors to measure the weight of the parcel, and it's got a clever mechanism (think sliding weights or an adjustable platform) to keep things perfectly balanced by adjusting the CoG in real-time.

Advantages:

This setup takes TWSBR's delivery game to the next level.

No matter the size or weight of the parcels, this system can handle it all without sacrificing stability.

We're talking about a super smooth and efficient delivery process with the ability to autonomously pick up and drop off parcels.