

Self-Balancing Robot
12/18/2024

PROJECT GOALS:

Design and build a self-balancing robot that can maintain its upright position using feedback from sensors. The robot will use an STM32 microcontroller, a GY-91 IMU (for orientation and motion sensing), and a SparkFun Hobby Motor Encoder Kit (for precise wheel control).

Key Components:

- **STM32** microcontroller: The central controller for motor and sensor management.
- **GY-91 IMU**: Provides accelerometer, gyroscope, and magnetometer data for tilt and balance control.
- **SparkFun Hobby Motor Encoder Kit**: Provides feedback on motor position and speed for precise control.
- **Motor Driver**: Controls the DC motors based on signals from the STM32.
- **Wheels and Chassis**: The physical structure to support the robot.

Required Communication Protocols:

- **I2C**: Used for communication between the STM32 and the GY-91 IMU module (accelerometer, gyroscope, and magnetometer). The I2C bus allows the STM32 to read sensor data for motion and balance calculations.

Control Algorithm:

- **PID Control**: A **PID (Proportional-Integral-Derivative) controller** will be used to adjust the motor speeds and maintain balance. The robot will use the data from the IMU to determine its tilt angle, and the PID controller will adjust the motors to keep the robot upright.

Parts:	Part #:	Manufacturer:	Man.Product #:	Vendor	Link:	Quantity:	Price:
Microcontroller (STM32) NUCLEO-64 STM32F070RB EVAL BRD	497-15095-ND	STMicroelectronics	NUCLEO-F070RB	DigiKey	Link	1	\$11.04
IMU (Inertial Measurement Unit(GY-91	701715530362	QCCAN	701715530362	Amazon	Link	1	\$12.99
Hobby Motor and Encoder kit [(2) wheels]	ROB-13260	-	ROB-13260	Sparkfun	Link	1	\$21.50
Battery							
3D Printed robot body frame							