MONO-WHEEL EV

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Introduction:

Industrial mobility and transportation systems are evolving toward compact, efficient, and sustainable solutions. Electric vehicles reduce emissions, improve energy efficiency, and provide cost-effective alternatives to conventional systems.

This project focuses on a Mono-Wheel Electric Vehicle (EV) that uses sensor-based control instead of traditional mechanical throttles. An Inertial Measurement Unit (IMU) continuously monitors tilt and orientation, allowing real-time control of vehicle motion.

The system integrates embedded electronics, control algorithms, and mechanical design to create a compact and responsive personal mobility solution.

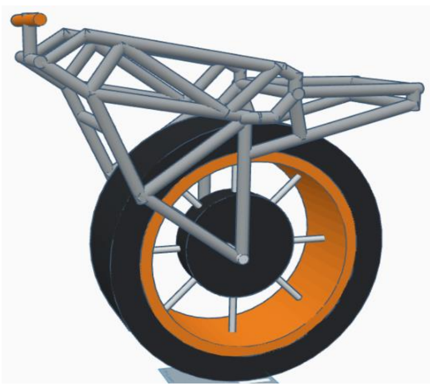

Figure 1: 3D rendering of the model

Objectives:

1. Study and analyze electric vehicles and sensor-based control systems
2. Design and fabricate a compact mono-wheel vehicle structure
3. Implement IMU-based sensing for tilt detection and motion control
4. Develop embedded control logic for smooth and stable motor operation

Methodology:

The project is implemented using a combination of hardware and software subsystems:

1. **Sensing:** IMU (MPU6050) detects tilt and motion
2. **Processing:** Arduino microcontroller processes sensor data
3. **Control Logic:** Filtering + dead zone + tilt mapping
4. **Signal Generation:** DAC converts digital signals to smooth analog throttle
5. **Actuation:** Motor controller drives hub motor
6. **Battery Pack:** A 20s5p, 74v 14.5aH. Li-ion battery pack to power the entire system.

Steps:

1. Acquire sensor data
2. Apply filtering to remove noise
3. Compute tilt angle
4. Apply control logic (dead zone + limits)
5. Generate analog voltage via DAC
6. Drive motor accordingly

Result and Conclusion:

The system successfully demonstrated gyro-based speed control using tilt input. Key outcomes:

1. Smooth acceleration and deceleration achieved
2. Reduced motor jerks using DAC instead of PWM
3. Stable and predictable control behavior
4. Reliable sensor readings with filtering

The project proves that sensor-driven control is feasible for compact EV systems, though full self-balancing was not implemented.

Figure 2: Working model in Environment.

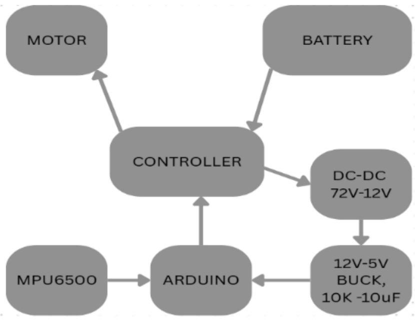

Figure 3: System Flow Block Diagram.

Future Scope:

1. Implement full self-balancing using PID or state-space control
2. Improve sensor accuracy using advanced filtering (Kalman filter)
3. Integrate wireless monitoring and mobile app control
4. Upgrade motor controller for torque-based control
5. Add safety features like emergency shutdown and braking systems.