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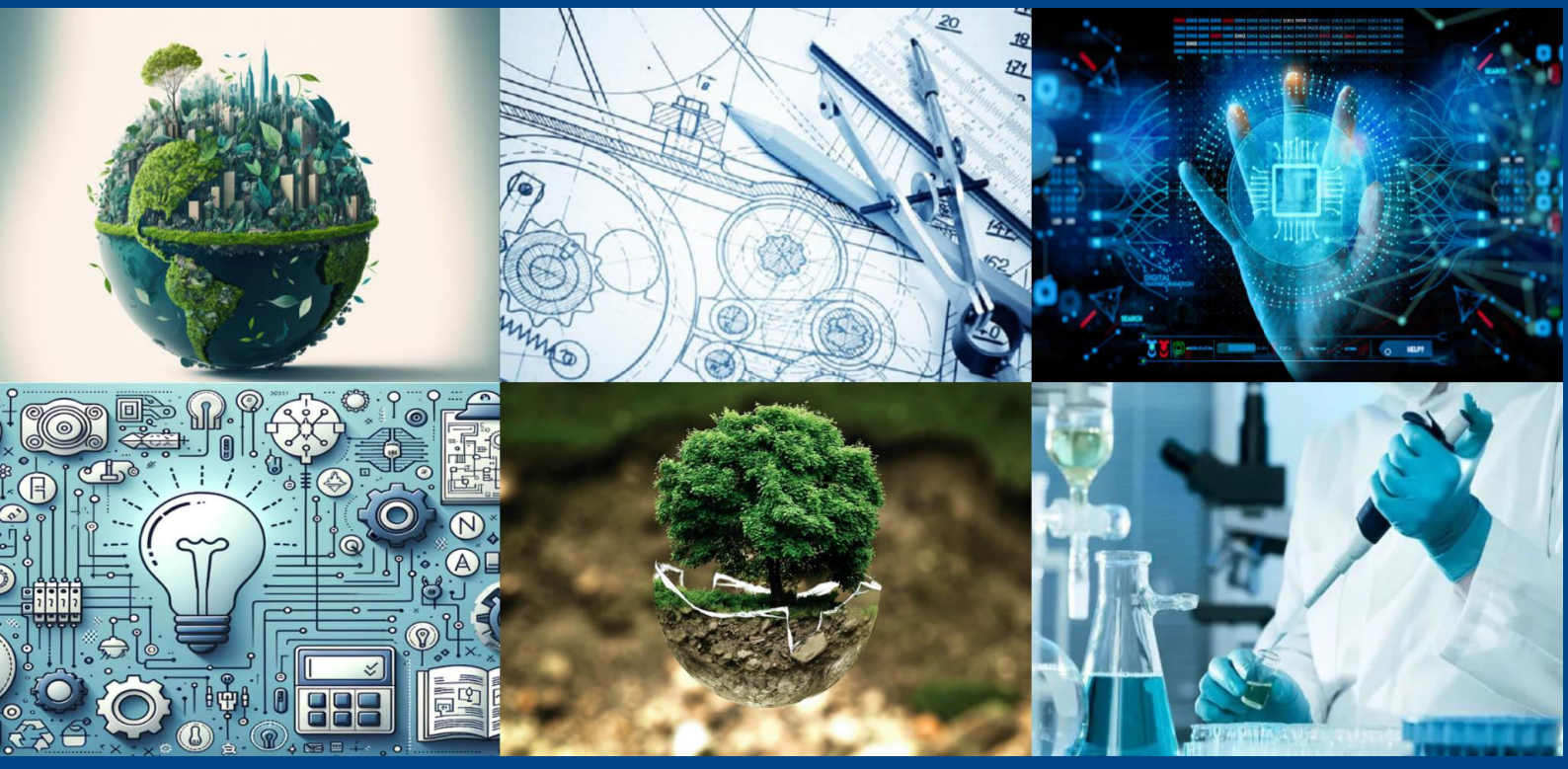

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Automatic Turn Indicator System for Vehicles

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ABSTRACT: Turn indicators play a crucial role in road safety, but manual operation can be inconvenient and sometimes neglected by drivers. This paper presents an Automatic Turn Indicator System that detects motion using an MPU6050 motion sensor and activates LED-based turn signals through Arduino-controlled relay modules. The system eliminates the need for manual switching, enhancing driving convenience and ensuring timely signaling. The MPU6050 sensor continuously monitors movement, and the Arduino Uno processes the data to determine whether a left or right turn is occurring. The system is designed for real-time responsiveness, ensuring precise and visible turn signaling. Experimental results confirm the system's efficiency, accuracy, and practicality, making it suitable for smart vehicle applications.

KEYWORDS: Arduino Uno, MPU6050, Automatic Turn Indicator, Relay Module, Led Signaling, Road Safety

I. INTRODUCTION

Turn indicators are essential for safe driving, allowing vehicles to communicate their intended direction to others on the road. However, drivers may sometimes forget to activate them, leading to confusion and potential accidents. An automatic turn indicator system eliminates the need for manual operation, ensuring signals are activated whenever a turn is detected.

This project uses an MPU6050 motion sensor, which consists of an accelerometer and gyroscope, to detect the change in motion. When the sensor registers a left or right tilt, the Arduino Uno processes the data and activates the corresponding relay-controlled LED indicators. The system aims to provide a hands-free, reliable solution for vehicle signaling, improving overall road safety.

II. LITERATURE REVIEW

Several studies have explored automatic signaling systems using motion sensors, MEMS accelerometers, and gyroscopes. The MPU6050 sensor is widely used in motion-based applications due to its high sensitivity and accuracy.

Previous research has implemented gesture-based controls for turn signaling, but few systems have focused on fully automated motion-triggered indicators. This project integrates motion sensing, real-time signal processing, and relay-based LED control, ensuring an accurate, efficient, and user-independent turn indication mechanism.

III. METHODOLOGY

3.1 Components Used

- The project utilizes the following components:
- Arduino Uno – The microcontroller responsible for processing motion data and controlling relays.
- MPU6050 Motion Sensor – Detects tilt and angular changes corresponding to turns.
- Relay Module – Acts as an electronic switch to activate LED indicators.
- LED Indicators – Display left or right turn signals based on detected motion.
- Power Supply & Wiring – Ensures stable operation of components.

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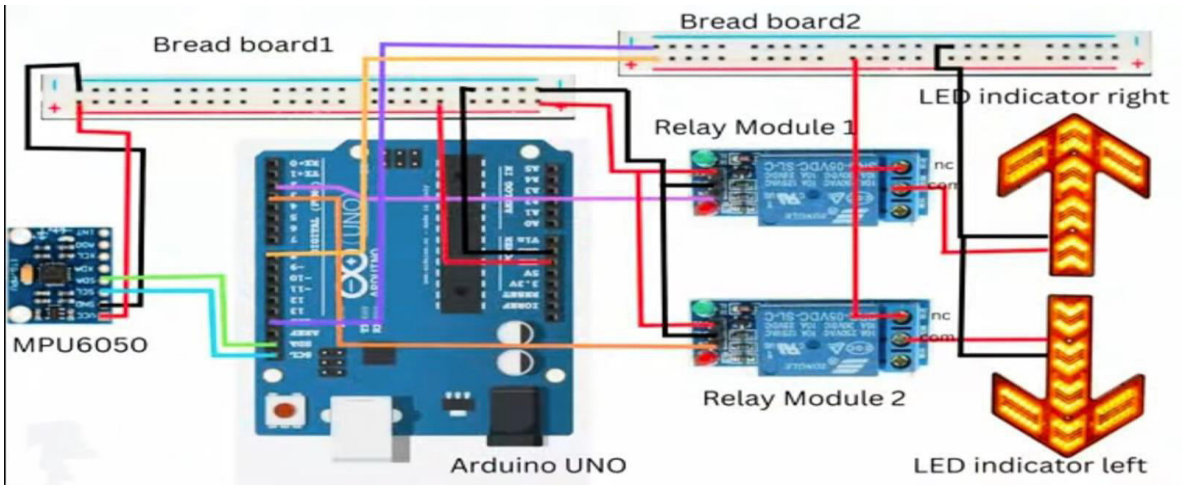
3.2 Circuit Design & Working

- The MPU6050 motion sensor continuously detects movement and transmits data to the Arduino Uno via I2C communication.
- The Arduino Uno analyzes the motion data to determine whether a left or right turn is occurring.
- Depending on the detected motion, the Arduino activates the respective relay module, which powers the corresponding LED turn indicator.
- The LED remains illuminated for a short duration before resetting to avoid unnecessary prolonged signaling.



3.3 Algorithm Implementation

- The system follows a simple yet effective algorithm:
- Initialize the MPU6050 sensor and establish communication with Arduino.
- Continuously monitor motion data (acceleration and angular velocity).
- If a leftward tilt is detected → activate left LED indicator.
- If a rightward tilt is detected → activate right LED indicator.
- Keep the LED ON for a fixed duration and then reset the system. This logic ensures timely and accurate turn signaling, minimizing reliance on manual intervention.

IV. RESULT & DISCUSSION

- The system was tested under various motion conditions, and the following results were observed:
- Motion Detection Accuracy → The MPU6050 sensor reliably detected turns within a ±5° threshold.
- Response Time → The relay activation occurred within 100ms, ensuring near-instant signaling.
- LED Visibility → The indicators were clearly visible up to 50 meters in low-light conditions.
- The results indicate that the Automatic Turn Indicator System functions efficiently and reliably, reducing driver workload and improving overall road safety. Future improvements could include wireless connectivity for remote activation, adaptive sensitivity adjustments, and integration with smart vehicle automation systems.

V. CONCLUSION

This project successfully implements an Automatic Turn Indicator System using an MPU6050 motion sensor, Arduino Uno, and relay-controlled LED indicators. The system eliminates manual operation by automatically detecting motion and activating turn signals. The fast response time, high accuracy, and ease of implementation make it a viable solution for real-world applications.

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Future enhancements could involve machine learning-based motion prediction, Bluetooth connectivity, and integration with automotive safety protocols. With further optimization, this system could be scaled for commercial vehicle automation.

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