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Full Length Article

Heart Attack And Alcohol Detection Sensor Monitoring In Smart Transportation System Using Internet Of Things

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Abstract
Road accidents caused by drunk driving and sudden health problems such as heart attacks have become major concerns in modern transportation systems. This project presents an IoT-based smart transportation safety system designed to continuously monitor driver health and vehicle safety conditions in real time. The system uses NodeMCU ESP8266 with built-in WiFi for IoT communication and cloud connectivity. Sensors such as MQ-3 alcohol sensor, heartbeat sensor, HC-SR04 ultrasonic sensor, and TCS3200 color sensor are used to monitor alcohol level, heart rate, obstacle distance, and traffic signal colors respectively. The collected sensor data is processed by the NodeMCU microcontroller. When abnormal conditions are detected, the system automatically activates the buzzer alert and controls the motor through the L298N driver circuit to prevent accidents. The OLED display continuously shows real-time sensor readings and warning messages. The proposed system improves transportation safety through automation, real-time monitoring, and IoT communication.

Keywords
IoT, NodeMCU ESP8266, Heartbeat Sensor, MQ-3 Sensor, Ultrasonic Sensor, Smart Transportation, OLED Display

Introduction

Road accidents are increasing rapidly due to drunk driving, driver fatigue, and sudden medical emergencies such as heart attacks while driving. Traditional transportation safety systems mainly focus on manual monitoring and do not provide continuous real-time safety monitoring. As a result, many accidents occur before emergency actions can be taken.

With the advancement of Internet of Things (IoT) technology, it is possible to develop intelligent systems that continuously monitor the driver and surroundings in real time. IoT-based transportation systems combine sensors, microcontrollers, wireless communication, and automation to improve road safety and reduce accidents.

This project aims to develop a smart transportation monitoring system using NodeMCU ESP8266 and multiple sensors. The heartbeat sensor continuously monitors the driver's pulse rate, while the MQ-3 sensor detects alcohol vapors from the driver's breath. The ultrasonic sensor detects nearby obstacles, and the color sensor identifies traffic signal colors. The system automatically generates alerts and controls the motor during unsafe conditions.

The integration of IoT technology enables remote monitoring and real-time communication, making the transportation system safer, smarter, and more efficient.

Literature Review

(2025) Kumar et al. – Proposed an AI-based vehicle safety monitoring system integrating IoT sensors for driver monitoring and accident prevention.

(2024) Reddy and Sharma – Developed an alcohol detection system using MQ-series sensors and GSM communication for smart vehicles.

(2023) Zhang et al. – Introduced an IoT-based transportation monitoring system with obstacle detection and emergency alert features.

(2022) Lee and Park – Implemented heartbeat monitoring systems in vehicles to detect driver fatigue and medical emergencies.

(2021) WHO Report – Highlighted the importance of real-time monitoring systems for reducing transportation accidents caused by health emergencies and alcohol consumption.

Existing System

Existing transportation safety systems mainly focus on alcohol detection or manual monitoring methods. Traditional systems use standalone breath analyzers or roadside inspections to identify drunk driving conditions. These systems are not capable of continuous monitoring and do not monitor driver

health conditions such as abnormal heartbeat or heart attacks.

Most existing systems also lack obstacle detection, traffic signal monitoring, automation, and IoT communication. They cannot automatically control the vehicle during emergency conditions and do not provide real-time remote monitoring features.

Therefore, there is a need for an intelligent transportation safety system capable of continuously monitoring driver health, alcohol level, and surroundings in real time.

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Proposed System

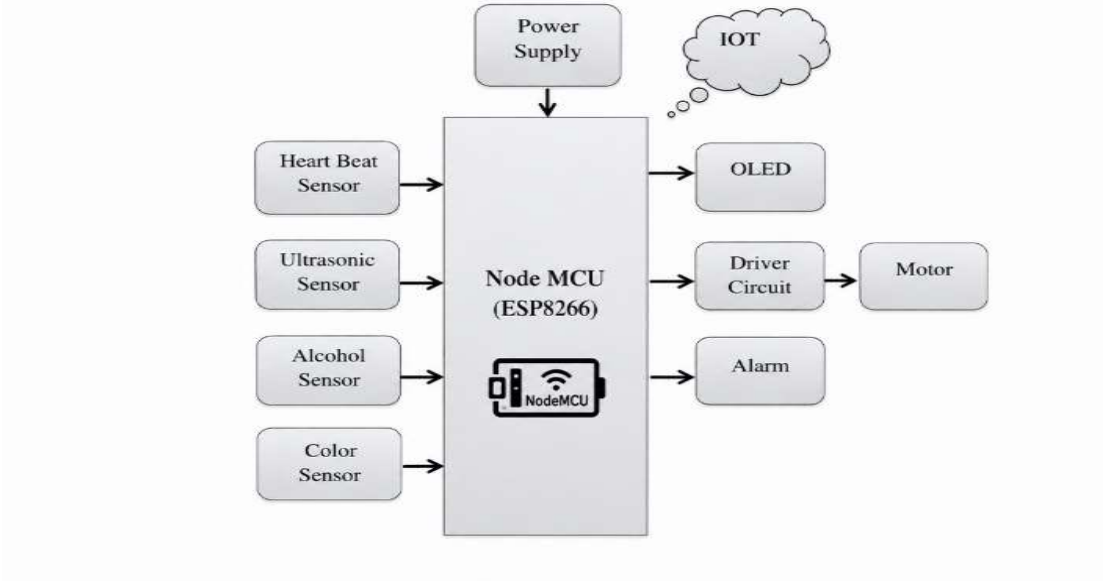
The proposed system uses IoT technology to continuously monitor the driver and surrounding environment in real time. The system integrates heartbeat sensor, MQ-3 alcohol sensor, ultrasonic sensor, and TCS3200 color sensor with NodeMCU ESP8266.

The heartbeat sensor monitors the driver's pulse rate continuously. The MQ-3 sensor detects alcohol vapors from the driver's breath. The ultrasonic sensor measures obstacle distance to avoid collisions, while the color sensor detects traffic signal colors.

All sensor data is processed by the NodeMCU ESP8266 microcontroller. When dangerous conditions are detected, the system activates the buzzer and controls the motor through the L298N motor driver. The OLED display shows real-time sensor values and warning alerts.

Using IoT technology, the system can also transmit sensor data and alerts through internet communication for remote monitoring.

Block Diagram



Working Principle :

The system operates by continuously monitoring driver health and vehicle surroundings using multiple sensors. The heartbeat sensor measures the driver's pulse rate, while the MQ-3 sensor detects alcohol concentration. The HC-SR04 ultrasonic sensor detects nearby obstacles, and the TCS3200 sensor detects traffic signal colors.

The sensor outputs are sent to the NodeMCU ESP8266 for processing. The controller compares sensor values with predefined threshold values. Under normal conditions, the system continues monitoring and displays values on the OLED display.

When alcohol is detected or heartbeat becomes abnormal, the NodeMCU activates the buzzer and controls the motor through the L298N driver circuit to stop the vehicle. Similarly, if an obstacle is detected within a dangerous range or a red traffic signal is detected, the motor is automatically controlled.Using the built-in WiFi capability of NodeMCU ESP8266, sensor data and warning alerts can also be transmitted through IoT communication for remote monitoring.

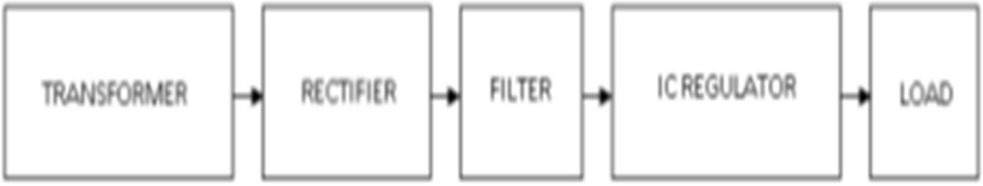
Hardware Implementation :

- Raspberry Pi Pico W (main controller with Wi-Fi)
- NodeMCU ESP8266 (main controller with WiFi)
- Heartbeat Sensor KY-039 / Pulse Sensor
- MQ-3 Alcohol Sensor
- HC-SR04 Ultrasonic Sensor
- TCS3200 Color Sensor
- OLED Display SSD1306
- L298N Motor Driver
- DC Motor

- Piezo Buzzer
- 5V Power Supply
- Breadboard and Connecting Wires

Power Supply:

The power supply section provides the required DC voltage to all components in the project. A regulated 5V DC supply is used for NodeMCU, sensors, OLED display, and other modules. The power supply ensures stable operation of the entire system.



Bridge Rectifier:
A bridge rectifier is used to convert AC supply into DC supply. It consists of four diodes connected in bridge configuration. The rectifier allows current to flow in one direction and provides DC output required for electronic circuits.

MICROCONTROLLER:
NodeMCU ESP8266 is an open-source IoT development board based on the ESP8266 WiFi module. It acts as the brain of the system and processes all sensor data. The microcontroller provides built-in WiFi support for IoT communication and remote monitoring.
NodeMCU receives input signals from sensors and controls output devices such as OLED display, motor driver, and buzzer. It operates at 3.3V and supports GPIO pins for interfacing external devices.
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NODEMCU ESP8266 PINOUT:
NodeMCU ESP8266 contains digital GPIO pins, analog pin A0, UART communication pins, SPI pins, and I2C communication support. It also includes VIN, GND, and 3.3V power pins for interfacing external devices.

OLED Display:
An OLED display is used to show real-time sensor readings and warning alerts. Compared to LCD displays, OLED displays provide better brightness, faster response, lower power consumption, and improved visibility.
The OLED display used in this project is a 0.96-inch SSD1306 display communicating through the I2C protocol.

HEARTBEAT SENSOR :
The heartbeat sensor measures pulse rate using PPG (Photoplethysmography) technology. It detects changes in blood flow and converts them into electrical signals. The sensor continuously monitors the driver's heartbeat and helps identify abnormal conditions.
The heartbeat sensor used in this project is KY-039 / Pulse Sensor Amped. It operates with low power consumption and provides real-time BPM values to the NodeMCU ESP8266. The sensor helps in detecting sudden health emergencies during driving and improves transportation safety.
The normal heartbeat range for adults is approximately 60 BPM to 100 BPM. If the heartbeat becomes abnormal, the system generates warning alerts and controls the vehicle for safety.

MQ3 SENSOR :
MQ-3 is a gas sensor used to detect alcohol vapors. It provides analog output proportional to alcohol concentration. The sensor is highly sensitive to ethanol and is mainly used in drunk driving detection systems.
The MQ-3 sensor operates at 5V supply voltage and provides both analog and digital outputs. The sensor detects alcohol concentration from the driver's breath and sends the information to the NodeMCU for processing.
When alcohol concentration exceeds the predefined threshold level, the system activates the buzzer and automatically stops the motor through the driver circuit. This helps in preventing accidents caused by drunk driving.

ULTRASONIC SENSOR :
HC-SR04 ultrasonic sensor is used for obstacle detection. It works using ultrasonic waves and echo principle to calculate distance between the sensor and nearby objects.
The sensor contains transmitter and receiver sections. The transmitter sends ultrasonic waves, and the receiver receives the reflected echo signal. Based on the echo time, the distance is calculated.
The sensor has a detection range of approximately 2 cm to 400 cm. If an obstacle is detected within a dangerous range, the NodeMCU automatically

controls the motor to avoid collisions and improve vehicle safety.

COLOR SENSOR :

TCS3200 color sensor is used for detecting RGB colors. It converts detected color intensity into frequency signals and helps identify traffic signal colors in the system.

The sensor contains photodiodes with red, green, and blue filters for color detection. The detected color intensity is converted into digital frequency output and sent to the NodeMCU.

In this project, the color sensor is mainly used for traffic signal recognition. When red color is detected, the system automatically controls the motor to stop the vehicle and follow traffic rules.

DRIVER CIRCUIT :

L298N motor driver module is used to control the DC motor. Since NodeMCU cannot provide sufficient current to drive the motor directly, the driver circuit acts as an interface between the controller and motor.

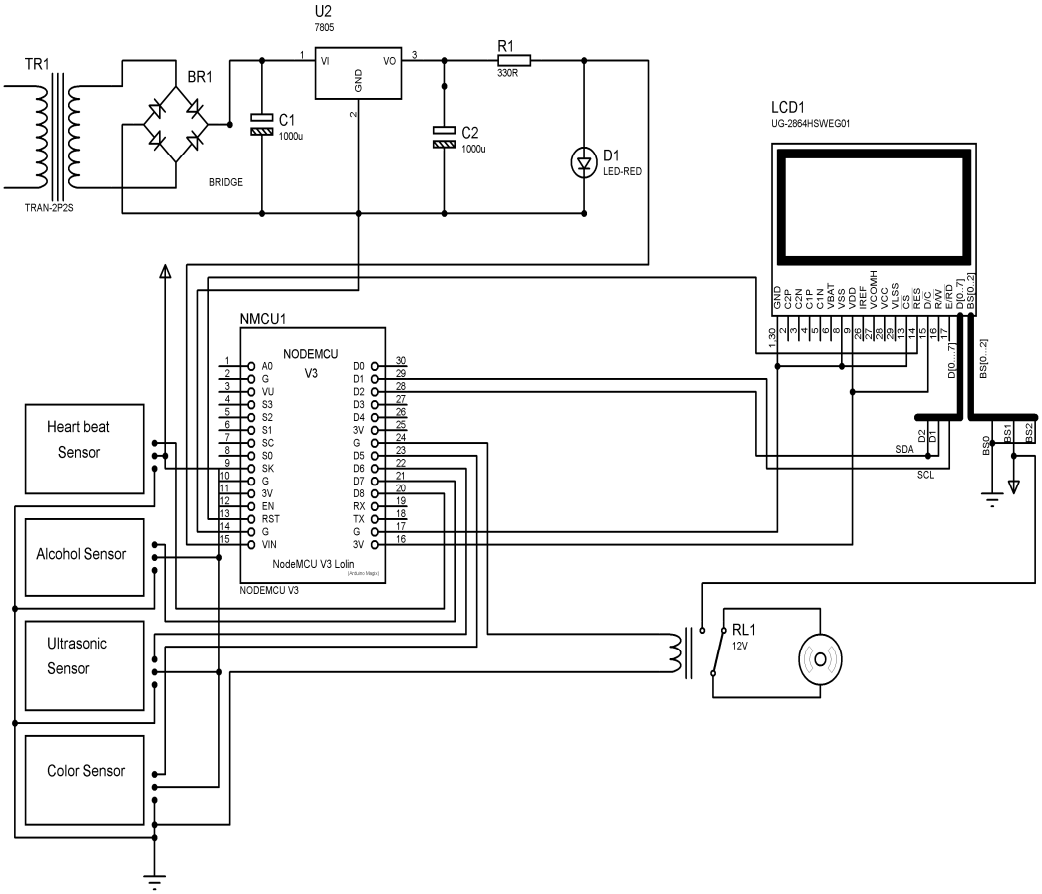
The L298N driver circuit is based on H-Bridge technology, which allows control of motor speed and direction. It can handle higher current and voltage compared to the microcontroller output pins. The motor driver receives control signals from the NodeMCU ESP8266 and accordingly controls the operation of the DC motor. During dangerous conditions such as alcohol detection, obstacle detection, or abnormal heartbeat, the driver circuit stops the motor automatically.

BUZZER:

The buzzer is an electronic signaling device used to generate warning alerts during dangerous conditions such as alcohol detection, obstacle detection, or abnormal heartbeat.

A piezo buzzer is used in this project because of its simple operation, low power consumption, and compact size. The buzzer produces an audible alert signal whenever the system detects unsafe conditions.

SCHEMATIC DIAGRAM :



RESULTS :

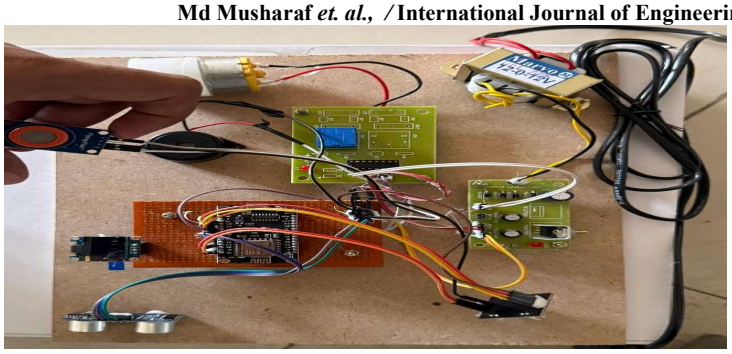


Fig.1: Hardware Kit in OFF Condition

The figure shows the complete hardware setup in the OFF or idle state. In this condition, the power supply is connected but the system is not actively processing or displaying sensor data. The microcontroller remains in an initial standby mode, and no signals are sent to the output devices such as the OLED display, sensors, or buzzer.

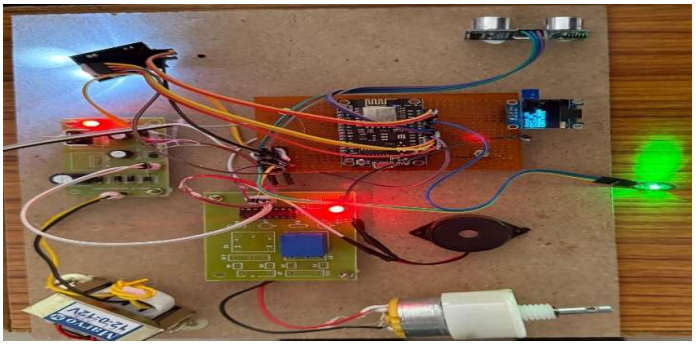


Fig.2 : Hardware Kit in ON Condition

All sensors and components are active. The system begins collecting and processing environmental data.he Node MCU initializes all connected sensors and begins real-time data acquisition. The sensors start detecting environmental parameters. Output devices such as the OLED display and IoT module become active

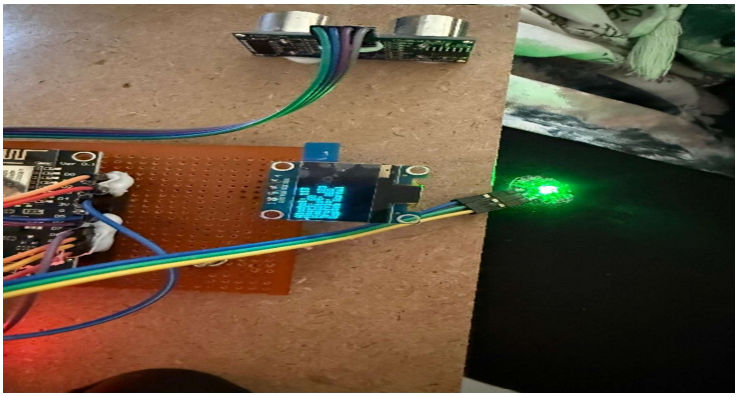


Fig.3 : Display shows Heart Beat and Alchol values

The OLED display in this figure shows real-time heart beat and Alchol readings obtained from the sensor.

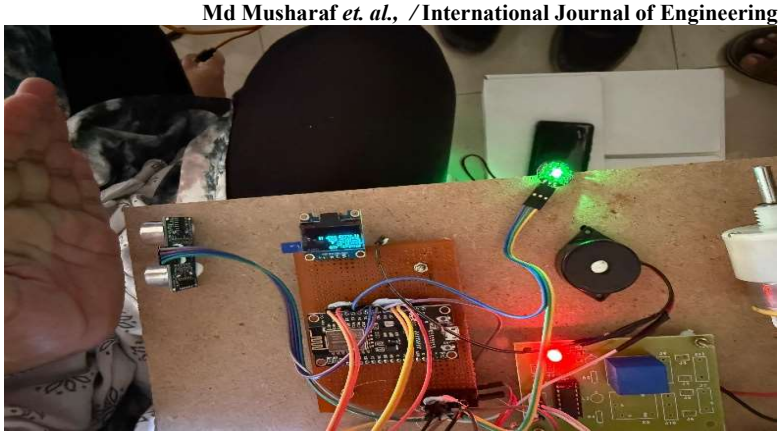


Fig.4: Obstacle Detection

The ultrasonic sensor detects nearby obstacles and controls the motor to avoid collisions.

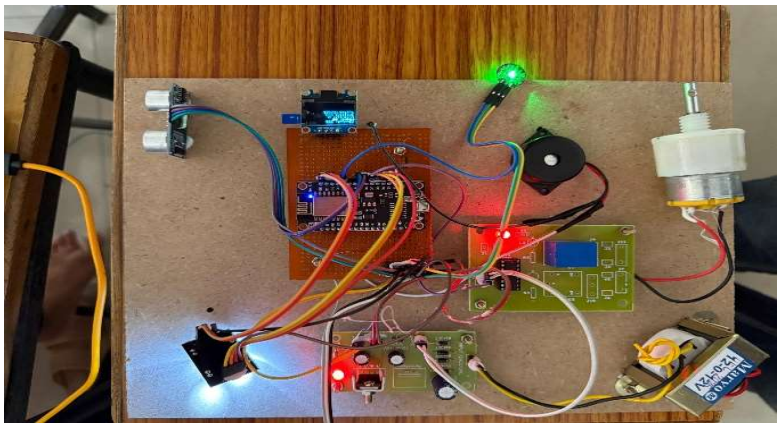


Fig.5 : Traffic Signal Detection

The color sensor detects traffic signal colors and controls the motor accordingl

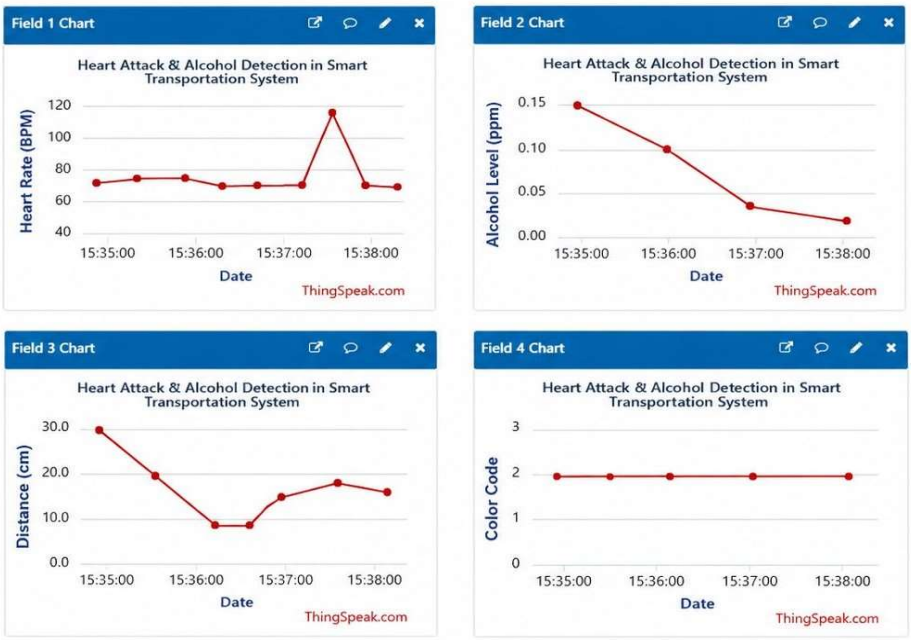


Fig.6 : Displaying sensors data through Thingspeak

CONCLUSION:

The proposed IoT-based smart transportation monitoring system provides an effective solution for improving driver and vehicle safety. By integrating heartbeat monitoring, alcohol detection, obstacle detection, and traffic signal detection into a single system, the project reduces accident risks and improves transportation safety.

The use of NodeMCU ESP8266 enables real-time monitoring and IoT communication, making the system intelligent and automated. Experimental results show reliable operation of sensors and successful automation during emergency conditions.

Overall, the project demonstrates how IoT technology can be used to create safer and smarter transportation systems.

FUTURE SCOPE:

Integration of GPS for vehicle tracking
AI-based accident prediction system
Cloud database integration for data storage
Mobile application for remote monitoring
Advanced medical sensors for improved health monitoring

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