

INTEGRATED SMART ROAD SAFETY SYSTEM WITH ADVANCED HUMP DETECTION AND WEATHER DATA INTEGRATION

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Keywords:

ESP 32, LCD display, DHT11 Sensor, IR sensor, Buzzer, Ultrasonic sensor.

Introduction:

Our aim of Smart Transportation Innovation is to come up with Facilitates efficient traffic management around accident sites, minimizing congestion and disruptions to the flow of traffic. This can contribute to smoother traffic flow and reduced travel delays. Enhances overall road safety by providing rapid and accurate alerts to both approaching vehicles and emergency services, reducing the likelihood of secondary accidents and fatalities.

Establish a system for continuous monitoring and evaluation of the AALS system's performance, gathering feedback from users, emergency services, and relevant stakeholders to implement improvements over time. It is particularly useful in areas prone to adverse weather conditions (heavy rainfall, fog, storms), where poor visibility and challenging road conditions increase the risk of accidents.

Objectives:

- a) Develop and Deploy sensor equipped infrastructure to identify road humps in real time providing timely alerts.
- b) Traffic information data will be shared to the app/server to suggest crowded region, alternative routes which could save time and fuel.
- c) Utilize weather data integration to provide timely and accurate information to emergency services, enabling them to navigate safely and efficiently during challenging weather conditions.
- d) Develop smart infrastructure solutions that facilitate seamless communication between vehicles, traffic management systems, and other components of the transportation ecosystem.

Methodology:

Integration of real-time weather data into navigation systems allows for dynamic route planning, helping drivers avoid hazardous weather conditions and choose safer paths. Implementing hump detection technologies in residential areas enhances public safety by ensuring that drivers adhere to speed limits, minimizing the risk of accidents and improving overall community well-being.

Materials Used are:

- (a) ESP 32 :ESP32 is a low-cost System on Chip (SoC) Microcontroller from Espressif Systems, the developers of the famous ESP8266 SoC. This makes designing hardware around ESP32 very easy as you require very few external components
- (b) LCD display: LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications.
- (c) DHT11 Sensor :This DHT22 is a temperature & a humidity sensor with a digital signal output.
- (d) IR sensor :Active infrared sensors work with radar technology and they both emit and receive infrared radiation.
- (e) Buzzer: An audio signaling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type.
- (f) Ultrasonic sensor : An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal

Conclusion:

In this integrated system, the DHT11 sensor continuously monitors the humidity levels in the surrounding atmosphere, allowing for real-time adjustments to brightness levels. Meanwhile, the ultrasonic sensor serves a crucial safety function by detecting any irregularities such as bumps or potholes on the road, promptly alerting the user via a notification on their mobile application. Additionally, the LDR sensor plays a pivotal role in optimizing energy usage by adjusting brightness levels based on the prevailing weather conditions. This ensures efficient utilization of resources while also enhancing user experience. Moreover, the IR sensor provides valuable insights into traffic flow on specific roads, aiding in the detection of congestion and facilitating smoother navigation for commuters.

The mobile application acts as a central hub for users to access all relevant data and receive timely alerts. To ensure security and personalized experience, users are required to register before gaining access to the system. Once registered, users can conveniently access sensor readings, receive alerts, and stay informed about the prevailing road and weather conditions in their vicinity.

Overall, this sophisticated system not only enhances safety on the roads but also promotes energy efficiency and provides users with valuable insights to make informed decisions while commuting. With its seamless integration of various sensors and user-friendly mobile interface, it represents a significant advancement in smart infrastructure technology.

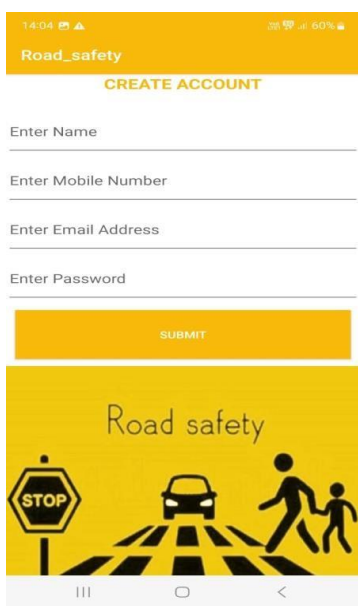


Fig 1: Create Account Page

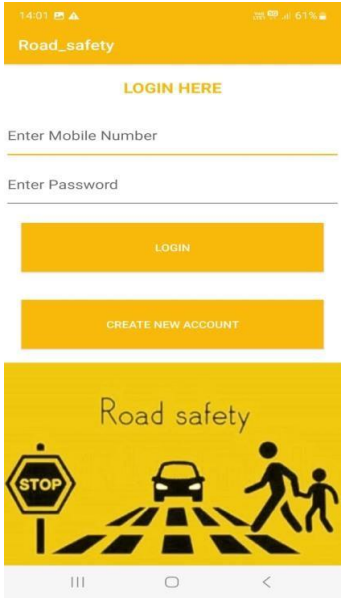


Fig 2: Login Page

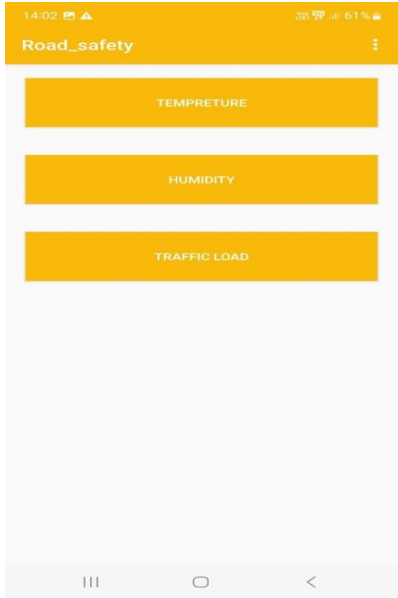


Fig 3: Home Page

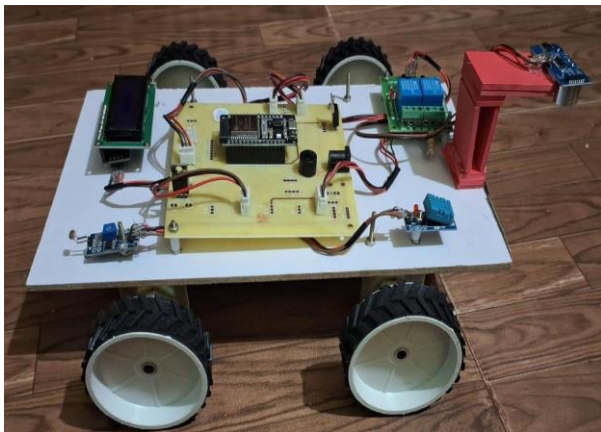


Fig 4: Vehicle View

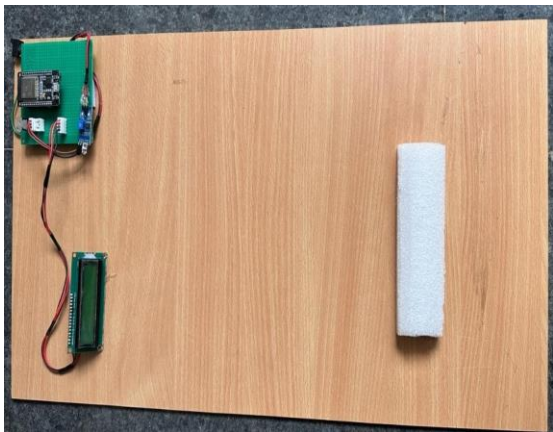


Fig 5: Vehicle View

Scope for future work:

Integrating advanced sensors like LiDAR and radar promises heightened precision in hazard detection. Moreover, the infusion of Artificial Intelligence (AI) can enable predictive analytics, revolutionizing traffic management and safety measures through data analysis. Expanding Vehicle-to-Infrastructure (V2I) communication enhances traffic flow optimization and navigation. Additionally, integrating with autonomous vehicles holds promise for real-time data exchange crucial for safe autonomous navigation. Collaboration with city authorities for smart city integration can optimize urban planning and infrastructure. Leveraging crowdsourced data provides localized insights, while environmental monitoring supports eco-friendly transportation initiatives. Participation in global standardization efforts ensures interoperability and scalability. Engaging the public fosters awareness and active participation in data collection. Policy collaboration aids in regulatory frameworks supporting smart transportation deployment. Ensuring resilience and security safeguards public trust. Continued infrastructure investment, including sensor-equipped roads, is vital for maximizing smart transportation potential.