VEHICLE ACCIDENT DETECTION AND RESCUE SYSTEM

M. Dharani, D. Geetha Kumari, B. Sreelatha, M. Veera Keerthi, D. Sumanth Reddy
UG Students, Department of Electronics & Communication Engineering, Sai Rajeswari Institute of Technology, Proddatur, Andhra Pradesh – 516360
S. MOHAMMED RAFI M. Tech, (Ph. D), Associate Professor, Department of Electronics & Communication Engineering, Sai Rajeswari Institute of Technology, Proddatur, Andhra Pradesh – 516360
Email: dharanimadem587@gmail.com, geethakumaridudyala@gmail.com, lathabadiginchala@gmail.com, sumanthreddyndp@gmail.com, veerakeerthi4436@gmail.com, rafisrit@gmail.com

Abstract-

The "Vehicle Accident Detection And Rescue System" project is a cutting-edge endeavour focused on revolutionizing road safety standards. It leverages a combination of sophisticated components, including Arduino Nano microcontrollers, nRF24L01 transceivers, GPS sensors, and SIM800 modules, to create a robust communication network among vehicles. This network enables real-time exchange of crucial information such as accidents and road conditions, empowering drivers with timely insights to navigate safely. Moreover, the project integrates an automatic accident detection system that swiftly responds to collisions by triggering emergency calls to predefined numbers like 100 for police and 108 for medical services. Through this seamless integration of technology, the project aims to mitigate accident risks and enhance overall road safety.

Furthermore, the project addresses the challenges associated with overtaking manoeuvrers by introducing a feature that allows drivers to request passage through a simple button press. This functionality facilitates smooth communication between vehicles, ensuring safer overtaking experiences for all road users. By amalgamating state-of-the-art technologies with real-time communication capabilities, the project presents a comprehensive solution to optimize traffic management, reduce accident rates, and ultimately enhance road safety standards.

KEY WORDS: Arduino Nano, nrf24L01, GSM Module, GPS Module, OLED

I. INTRODUCTION

In an era marked by technological advancements, the quest to enhance road safety has evolved into a dynamic intersection of innovation and necessity. Addressing the pressing need for proactive measures, the “Vehicle Accident Detection and Rescue system" project emerges as a beacon of ingenuity, poised to revolutionize the landscape of traffic management and accident prevention. Grounded in the fusion of cutting-edge technologies such as Arduino Nano, microcontrollers, nRF24L01 transceivers, GPS sensors, and SIM800 modules, this initiative embodies a holistic approach towards fostering safer road environments. By fostering seamless communication channels between vehicles and deploying automatic accident detection
mechanisms, this project endeavours to transcend conventional safety paradigms, ushering in a new era of
proactive risk mitigation and real-time intervention. This introduction sets the stage for an exploration into the multifaceted dimensions of the "Vehicle accident Detection and Rescue System" project, illuminating its core objectives, innovative methodologies, and transformative potential in reshaping the future of road safety standards and vehicle to vehicle communication.

II. PROBLEM STATEMENT

Limited vehicle communication and response mechanisms coupled with the absence of real-time accident updates exacerbate road safety concerns, leading to increased driver risk and delayed emergency responses. Additionally, insufficient communication during overtaking manoeuvres poses further safety

hazards. Addressing these challenges necessitates a holistic solution integrating advanced components to reestablish a seamless communication network and implement automatic accident detection systems, thereby enhancing road safety standards through proactive measures.

III – METHODOLOGY

The "Vehicle Accident Detection and Rescue System" project adopts a comprehensive methodology aimed at revolutionizing road safety standards. Initially, it leverages cutting-edge components such as Arduino Nano microcontrollers, nRF24L01 transceivers, GPS sensors, and SIM800 modules to establish a robust communication network among vehicles. This network facilitates real-time exchange of critical information, including accident alerts and road conditions, empowering drivers with timely insights for safe navigation. Additionally, the project integrates an automatic accident detection system that rapidly responds to collisions by initiating emergency calls to predefined numbers, such as 100 for police and 108 for medical services. Through seamless technology integration, the project aims to mitigate accident risks and enhance overall road safety by enabling swift communication and proactive accident response mechanisms.

Furthermore, the project addresses challenges associated with overtaking maneuvers by introducing a feature that enables drivers to request passage through a simple button press. This functionality fosters smooth communication between vehicles, ensuring safer overtaking experiences for all road users. By amalgamating state-of-the-art technologies with real-time communication capabilities, the project presents a comprehensive solution to optimize traffic management, reduce accident rates, and ultimately enhance road safety standards.

IV. COMPONENTS USED

A. ARDUINO NANO

Arduino Nano is a small, easy-to-use microcontroller board. Think of it as a tiny brain that can be programmed to control electronic projects like robots, sensors, lights, and more. It's great for beginners because it's compact and has a lot of built-in features, like input/output pins for connecting sensors and actuators, USB connectivity for programming, and it can be powered via USB or an external power source. With the Arduino Nano, you can bring your creative ideas to life and learn about electronics and programming along the way. It can control various electronic projects such as robots, sensors, and lights. With its built-in features like input/output pins and USB connectivity, it's easy to program and experiment with. It can be powered via USB or external sources, making it versatile for different setups. Overall, the Arduino Nano empowers users to bring their creative ideas to life while learning about electronics and programming.

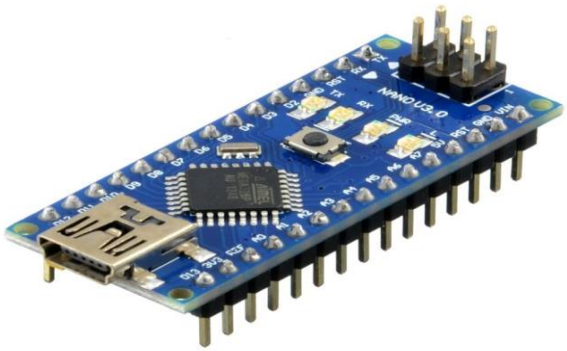

Figure 1: ARDUINO NANO

B. nrf24L01

The nRF24L01 is a popular 2.4 GHz transceiver module commonly used for wireless communication in various applications, including IoT devices, remote controls, and wireless sensor networks. It operates in the 2.4 GHz ISM band and utilizes the GFSK modulation scheme for efficient data transmission. The module provides features such as adjustable transmit power, multiple channels for communication, and low power consumption, making it suitable for battery-operated devices. With its simple interface and low-cost design, the nRF24L01 is widely favoured by hobbyists and professionals alike for its versatility and reliability in wireless communication projects.

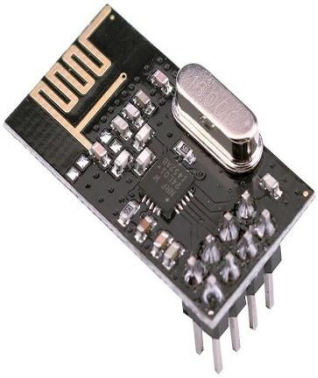

Fig 2: nrf24L01

C.OLED

OLED (Organic Light-Emitting Diode) is a display technology featuring organic compounds that emit light when an electric current passes through them. Unlike traditional LCDs, OLEDs do not require a backlight, allowing for thinner and more flexible displays with better contrast and faster response times. They offer vibrant colours, deep blacks, and wide viewing angles, making them ideal for applications like smartphones, TVs, and wearable devices.

Figure 3: OLED

4. GSM MODULE

GSM module is a chip or circuit for mobile devices to communicate with GSM/GPRS system. Establishes and maintains communication links between devices and GSM network. Handles data encryption and decryption for communication security. Connects to GSM network using SIM and radio waves. Responsible for establishing and maintaining communication link. Handles encryption and decryption for communication security

Figure 4: GSM Module

E. GPS MODULE

Neo 6M GPS Module.56 channels for precise position updates at 10Hz.Protective moulded plastic case suitable for aircraft and quadcopter applications. Seamless integration with Arduino for accurate GPS data.

Figure 5: GPS Module

F. BUZZER

A buzzer is an electromechanical component commonly used for generating audible alerts, notifications, or alarm sounds in electronic devices. It consists of a small metal or plastic housing containing a piezoelectric element or an electromagnetic coil. When an electric current is applied to the buzzer, the piezoelectric element vibrates or the electromagnetic coil moves, producing sound waves in the audible range.

Figure 6: Buzzer

H. MPU 6050

The MPU-6050 is a sensor module that combines a three-axis accelerometer and a three-axis gyroscope. It measures linear acceleration and angular velocity, communicating with a microcontroller through I2C or SPI interface. Widely used in motion sensing applications, it offers high precision, low power consumption, and compact size.

Figure 7: MPU 6050

V. Block Diagram

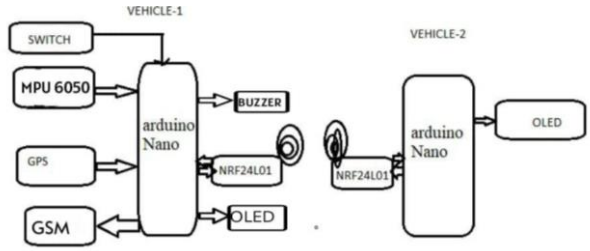

Figure 8: Block Diagram

CONCLUSION

In conclusion, the vehicle accident detection and rescue system represent a significant advancement in road safety technology. By leveraging sophisticated components such as the Arduino Nano microcontroller, nRF24L01 transceiver, GPS sensor, and SIM800 module, the system establishes a robust communication network among vehicles, facilitating real-time exchange of crucial information. The integration of an automatic accident detection system ensures prompt response to collisions, potentially saving lives by triggering emergency calls to predefined numbers. Additionally, features likeovertaking manoeuvre assistance further enhance road safety by promoting smoother communication between vehicles. Overall, this comprehensive solution holds immense potential to mitigate accident risks, optimize trafficmanagement, and usher in a new era of road safety excellence.

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