



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 13, Issue 5, May 2024

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.423

9940 572 462

6381 907 438

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Smart Prepaid Traffic Fines System Using Arduino

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ABSTRACT: This project aims to create an intelligent traffic system using RFID technology. The system is designed to automatically register fines for traffic violations. Additionally, it features an alert system that announces a warning through a speaker for vehicles parked in unauthorized areas. The same system can detect alcohol consumption by drivers and disable the vehicle's ignition to prevent driving under the influence.

KEYWORDS: Arduino, IR, Speaker, RFID, Tag, LCD, MQ6, GSM.

I. INTRODUCTION

Traffic in India still relies on outdated rules from the early 20th century, despite significant population growth in major cities. Since 2003, the economy has grown rapidly, leading to an increase in imported vehicles, but infrastructure development has not kept pace. Therefore, innovative solutions are needed that differ from those used in developed countries, as India's traffic is unplanned and not lane-based. A smart system could help reduce congestion, detect illegal vehicles, prevent car theft, and manage traffic flow.

Many researchers have explored traffic management solutions using wireless networks for data collection and processing due to their efficiency and low cost. This research proposes a system for fining traffic violators and collecting traffic data. Modern technology continuously advances to simplify daily tasks, but developing cities face significant challenges in traffic management due to rising population density and vehicle numbers without corresponding road expansions. This congestion leads to wasted time and fuel, contributing to environmental pollution. Laisheng Xiao and Zhengxia Wang suggest that the Internet of Things (IoT) could provide a feasible and affordable traffic management system.

Various scenarios for traffic management have been studied, including Vehicular Ad Hoc Networks (VANET), Vehicle-to-Vehicle (V2V), and Vehicle-to-Infrastructure (V2I) communications. These systems use sensors to monitor vehicle speed, direction, location, and parking, providing feedback to the network to prevent congestion. L. Sumia and V. Ranga introduced an intelligent traffic management system that combines IoT with VANET techniques. Their solution addresses congested intersections, minimizes travel time using the shortest path, and prioritizes emergency vehicles with a three-tier system for ambulances, fire brigades, and police cars based on the urgency of the situation, such as accidents or riots.

Other researchers have focused on using radio frequency identification (RFID) in traffic management. W. Wen proposed a smart traffic management system to reduce congestion, track stolen cars, find the shortest path, and improve vehicle flow rates by collecting information from RFID sensors on each vehicle. Rajeshwari Sundar et al. used RFID to count cars and control traffic lights based on road crowding. Freddy Kurniawan et al. developed a signal-timing synchronization system using microcontrollers to coordinate green light intervals.

II. RELATED WORK

Traffic congestion in countries like India is a growing problem due to the rising population and increasing number of vehicles. To tackle this issue, innovative and technical solutions have been proposed to reduce traffic violations and improve road safety.

In Karnataka, the state government has launched a project to manage traffic and monitor road incidents and violations. This project uses high-definition cameras at key traffic points such as signals, intersections, and diversion roads to

capture live traffic data. The system automatically detects and records various traffic violations, which are then stored in a database for further processing.

Although this system has enhanced traffic management efficiency, it has significant drawbacks, particularly regarding the storage capacity needed for the video clips of each violation. The video processing demands a large amount of database storage, making the system challenging to manage and maintain effectively.

Despite these challenges, this system is a major advancement in using technology to solve traffic problems. Addressing its limitations through better storage solutions and improved video processing algorithms is crucial for maintaining its effectiveness and gaining public acceptance.

III. METHODOLOGY

The escalating traffic congestion in countries like India poses significant challenges, compounded by the growing population and increasing vehicle ownership. To address this, innovative solutions and technical methods have been proposed, aiming to mitigate traffic violations and enhance road safety.

In Karnataka, India, the state government has recently implemented a comprehensive project to manage traffic and monitor road incidents and violations. This initiative utilizes high-definition cameras strategically placed at major traffic points such as signals, crossings, and diversion roads to record live traffic data. The system is designed to automatically detect and record various types of traffic violations, which are then stored in a database for further processing.

While this system has undoubtedly improved the efficiency of traffic management, it also comes with notable drawbacks. One major issue is the storage capacity required to store video clips of each recorded violation. The process of video processing consumes a significant amount of database storage, posing challenges in managing and maintaining the system effectively.

Despite its drawbacks, this system represents a significant step forward in leveraging technology to address traffic-related issues. Efforts to mitigate its limitations, such as optimizing storage solutions and refining video processing algorithms, are essential to ensure its continued effectiveness and public acceptance.

IV. EXPERIMENTAL RESULTS

Figures shown here are the components of our project. The figure (a) The Arduino uno, (b) The 16x2LCD (c) The GSM and (d) GSM from an image

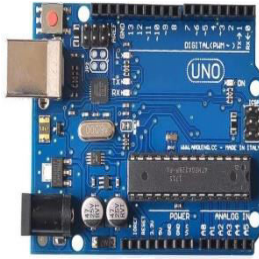
The Arduino Uno is a microcontroller board centered around the 8-bit ATmega328P microcontroller. It incorporates essential components like a crystal oscillator, serial communication interface, voltage regulator, and more to complement the microcontroller's functionality.

LCD modules, such as the popular 16x2 variant, consist of a grid of pixels arranged in rows and columns. For example, a 16x2 LCD has 16 columns and 2 rows, resulting in a total of 32 characters, each character composed of 5x8 pixel dots. This means there are 40 pixels per character, totaling 1280 pixels for all 32 characters. To manage this complexity and facilitate communication with microcontrollers, LCD modules incorporate an interface IC like the HD44780 mounted on their backside.

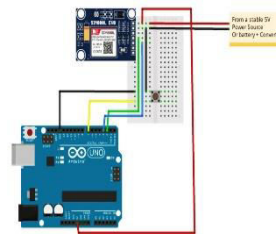
The SIM800L is a versatile GSM module designed to communicate via serial interface. It's capable of sending/receiving texts, making/receiving calls, and connecting to the internet. It's commonly interfaced with microcontrollers like Arduino using UART. It operates based on AT commands, allowing users to perform various functions like checking signal strength, accessing SIM card info, monitoring network connection, and more.

The MQ6 gas sensor is designed with several notable features:

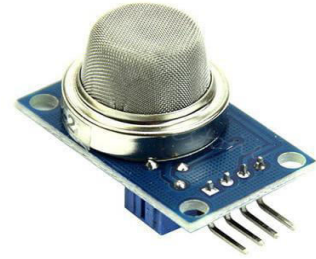
Operating Voltage: It operates at a standard voltage of +5V, making it compatible with most microcontrollers and systems.



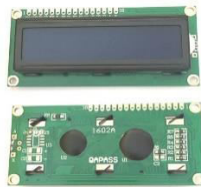
(a)



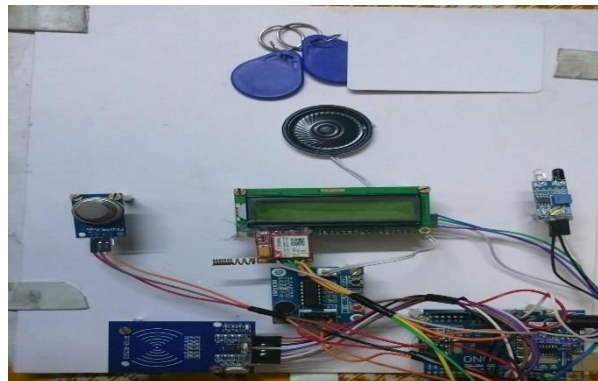
(b)



(c)



(d)



(e)

Fig (e) represents the whole kit of the project. Automatic fine will be deducted from the owner's account if he was found guilty on drink and drive, parking vehicle in not parking zone. The owner is found guilty of drink driving or parking in a restricted area, an automatic fine will be deducted from their account.

In this system, Arduino serves as the microcontroller responsible for gathering data from RFID tags attached to different vehicles. This data includes vehicle numbers, emission status, insurance status, and driving license information. Additionally, IR sensors are placed in non-parking areas to detect vehicles parked in unauthorized zones. Initially, the system issues a warning to the vehicle owner through an alert message stating "this is not a parking area." If the owner fails to move the vehicle despite the warning, an automatic fine is imposed, deducted directly from the owner's RFID tag balance. The owner receives a receipt confirming the deduction.

Moreover, the system incorporates an alcohol detection sensor, specifically an MQ6 sensor, to identify cases of drink and drive. When the sensor detects the presence of alcohol, it sends a signal to the microcontroller. Subsequently, the microcontroller shuts off the vehicle's ignition and imposes a fine for alcohol consumption, utilizing the RFID tag associated with the vehicle. This comprehensive approach aims to promote road safety and deter violations such as unauthorized parking and driving under the influence of alcohol.

V. CONCLUSION

This project introduced a mobile application aimed at aiding traffic police officers in Iraq by implementing a prepaid traffic violation system, enhancing the efficiency of traffic management. The system, tested on a prototype in An-Najaf city, utilized RFID readers connected to an Arduino Uno microcontroller, facilitating communication with a server via the Internet. The mobile app was designed to oversee driver registration, balance management, and vehicle monitoring, allowing fines to be deducted from drivers' balances in real-time, with detailed SMS notifications sent to offenders. Additionally, it provided support for police officers in various tasks, such as registering new drivers and monitoring traffic violations. Future iterations could enhance the system by incorporating features like camera integration for improved violation detection.

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