



Smart License Based Vehicle Safety and Security System using IoT

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ABSTRACT

Driving without a valid license remains a significant issue globally, contributing to a high number of accidents, particularly involving unlicensed and intoxicated drivers, as well as non-compliance with seatbelt usage. According to the World Health Organization (WHO), India alone reported 84,674 road accident deaths out of 11.8 lakh worldwide in a given year, with a notable increase to 92,618 deaths in 2004. To address this, a proposed solution advocates for a robust identification method: fingerprint authentication for driving, a popular choice. The system includes an Efficient Two-Stage Authentication process for vehicle ignition. Initially, a license card is scanned via an RFID reader; if valid, the driver proceeds to scan their fingerprint using a sensor. Only upon successful validation of both the license and fingerprint can the vehicle be started via the ignition switch, activating a simulated vehicle motor. If the RFID license is expired, details are displayed on an LCD module, and an alert SMS is sent to a registered email address using an ESP8266 WiFi module. Additionally, an alcohol sensing-based alert system is integrated; if the driver is intoxicated, a buzzer alert activates, and an SMS alert is dispatched via the ESP8266 module. This comprehensive system ensures driving is only conducted by licensed individuals, detects expired licenses, and addresses intoxicated driving by promptly notifying family members of the situation.

Keywords: RFID reader, Fingerprint sensor, Alcohol Sensor, Node MCU

1. INTRODUCTION

Driving without a license poses a significant problem globally, with surveys indicating that accidents primarily involve unlicensed and intoxicated drivers, as well as individuals neglecting seatbelt usage. According to WHO statistics, India alone accounted for 84,674 out of 1.8 million road accident fatalities worldwide, with numbers escalating to 92,618 in 2004, resulting in a high

mortality rate of 8.7 per hundred thousand people. Estimated deaths in India rose to 110,300 in 2005, 105,725 in 2006, and 154,600 in 2014. The traditional method of using keys to start vehicles has proven ineffective in preventing theft and accidents. Implementing fingerprint authentication offers a robust solution, preventing unauthorized individuals, including underage drivers, from operating vehicles and

subsequently reducing accidents. This project aims to introduce an architecture capable of verifying driver licenses and making informed decisions to activate or deactivate the ignition system based on license validity. Its primary objective is to restrict vehicle access based on valid licenses and ownership, effectively reducing unauthorized driving and enhancing road safety.

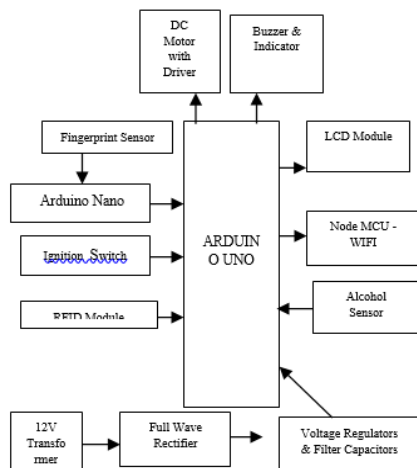
2. EXISTING SYSTEM

Previously, the system relied solely on RFID and WIFI MODULE technology. However, with this limited setup, unauthorized users could potentially exploit it by using another person's or family member's license card to operate the vehicle, such as underage children, thereby increasing the risk of accidents.

3. PROPOSED SYSTEM

The proposed system introduces an innovative approach to authenticate vehicle drivers utilizing RFID, fingerprint, and WiFi module technologies. This two-layer security system prevents vehicle ignition without proper authentication. An alcohol sensor is incorporated to detect if the driver is intoxicated, ensuring the engine remains inactive in such scenarios.

4. BLOCK DIAGRAM:



An efficient vehicle safety and security system utilizing biometric and RFID technology has been devised. This system employs an Arduino-based controller, a fingerprint module, a WiFi module, and RFID as its primary components. The system features a two-stage authentication process to initiate vehicle operation.

Initially, fingerprint authentication is conducted, followed by license verification. Users are provided with RFID card tags for license validation, which must be scanned using an RFID reader. Upon successful validation, the vehicle can be started by activating the ignition switch, triggering the DC motor (to simulate vehicle operation). In case of an expired RFID license, details are displayed on an LCD module, and a notification email is sent to the registered email address. Additionally, the system is integrated with an alcohol sensing-based alert mechanism. If the driver is in an inebriated state, a buzzer alert is activated, and alert email is dispatched to the designated email address.

5. RELATED WORK

A. Arduino Microcontroller

The Arduino Uno stands out as a widely favored microcontroller board, celebrated for its adaptability and simplicity in electronics endeavors. Equipped with an ATmega328P microcontroller, it offers plentiful GPIO pins for seamless integration with sensors, actuators, and diverse electronic elements. Supported by an uncomplicated programming interface and a thriving community of enthusiasts, the Uno enables novices and seasoned creators alike to materialize their concepts effortlessly. Its compact design, cost-effectiveness, and versatility with an array of shields and modules render it a prime selection for both prototyping and educational ventures, nurturing ingenuity within the DIY electronics domain



Arduino Uno

B. RFID Reader

Radio-Frequency Identification (RFID) employs radio waves for the retrieval and capture of data stored on a tag affixed to an item. These tags can be read from a distance of several feet away and do not necessitate direct line-of-sight with the reader for tracking purposes. A typical RFID system comprises two main components:

a tag or label, and a reader. Tags or labels are equipped with both a transmitter and a receiver. Each RFID tag comprises a microchip for data storage and processing, along with an antenna for signal transmission and reception. Additionally, each tag contains a unique serial number assigned to a specific object.



C. Arduino Nano

The Arduino Nano stands as a compact and user-friendly microcontroller board, ideal for crafting electronic projects. Similar to a miniature computer, it efficiently registers inputs from sensors, manages outputs such as lights or motors, and executes programmed instructions. Designed to facilitate the realization of creative concepts, its primary aim is to simplify the construction and management of electronic devices and gadgets, empowering users to transform ideas into tangible creations effortlessly.



D. Fingerprint Sensor(R305 / 307)

The R307 fingerprint module combines an optical fingerprint sensor, a high-speed DSP processor, an advanced fingerprint alignment algorithm, large-capacity FLASH chips, and supplementary hardware and software elements., stable performance, simple structure, with fingerprint entry, image processing, fingerprint matching, search and template storage and other functions.



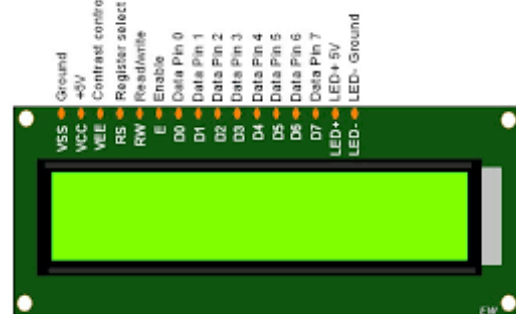
E. Alcohol Sensor

The alcohol gas sensor is capable of detecting gases like ammonia, which may be generated from methane. Upon interaction with the sensor, the gas undergoes ionization into its components and subsequently adheres to the sensing element. This adherence induces a potential difference across the element, which is transmitted to the processor unit via output pins in the form of current.



F. LCD 2X16 Module

LCD, short for liquid crystal display, is a type of electronic display module employed across a wide spectrum of applications including mobile phones, calculators, computers, TV sets, and more. These displays are particularly favored for their suitability in multi-segment light-emitting diodes and seven segments. Utilizing this module offers various advantages such as cost-effectiveness, ease of programmability, support for animations, and the absence of constraints when displaying custom characters, special symbols, or animations.



G. NODE MCU

NodeMCU is an open-source firmware based on LUA, designed for the ESP8266 WiFi chip. Accompanied by the ESP8266 development board or kit known as the NodeMCU Development board, it enables exploration of the ESP8266 chip's capabilities. Being an open-source platform, NodeMCU allows for editing, modification, and building of its hardware design.



6. SOFTWARE REQUIREMENTS

The Integrated Development Environment (IDE) stands as a robust software tool serving as the central platform for programming and application development on Arduino microcontrollers. Arduino, renowned for its simplicity, versatility, and accessibility in hardware prototyping and DIY projects, is an open-source electronics platform. Within the Arduino IDE, users encounter a user-friendly interface facilitating effortless code writing, compilation, and uploading to Arduino boards, catering to both novices and seasoned developers. Supporting various Arduino boards such as the Arduino Uno, Arduino Mega, and more, the IDE proves to be adaptable for a diverse array of projects. Key functionalities of the Arduino IDE encompass a comprehensive code editor with features like syntax highlighting and auto-completion, a compiler translating code into machine-readable instructions, and a bootloader enabling code upload from the IDE to the board via USB.

7. RESULTS AND OUTCOMES



Fig 1: Working Design



Fig 2: License Scanning

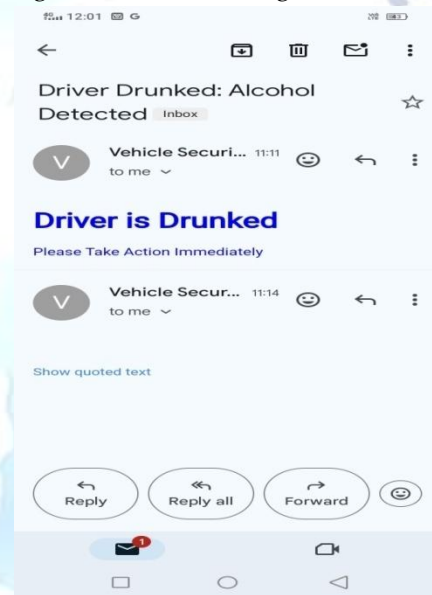


Fig 3: License Expired Condition

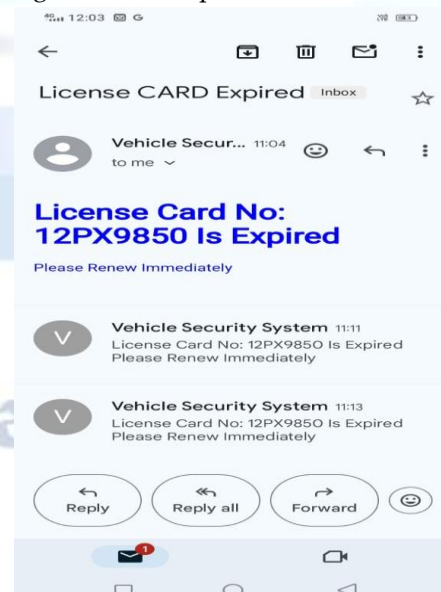


Fig 4: Driver Drunk Condition

8. CONCLUSION

Fingerprint authentication emerges as a secure biometric method poised for widespread adoption in security applications. This system ensures that driving is restricted to licensed individuals only, preventing unauthorized use of licenses. Additionally, it alerts users about the validity period of their driving licenses, enhancing overall safety measures. The proposed hardware system's analysis underscores its efficacy in confirming that vehicles are operated solely by authorized license holders. This model lays the groundwork for future research endeavors aimed at refining and implementing robust real-time fingerprint authentication-based ignition systems in vehicles. Furthermore, integrating the present module with a WiFi module holds promise for enhancing functionality and utility in upcoming developments.

Future Scope

This system can be further implement with Vehicle tracking system to monitor the current location of the vehicle by sending a MAIL and get the real-time GPS Coordinates.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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