Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 5, No.14, May : 2024

A LITERATURE REVIEW ON "AUTOMATIC ENTRY GATE ALARM SYSTEM"

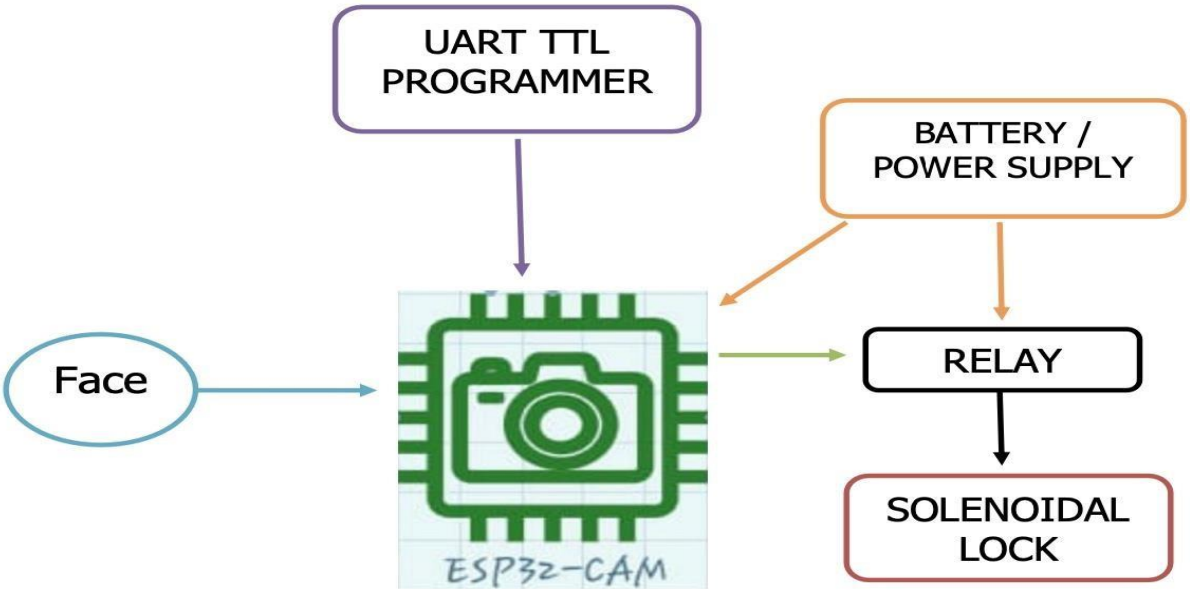
Prasann Gaurav, Pankaj Singh, Prashant, Final year B.Tech, Department of Electronics and Communication Engineering, ABES Engineering College, Ghaziabad, U.P., India
Rakhi Kumari, Assistant Professor (Sr. Scale), Department of Electronics and Communication Engineering, ABES Engineering College, Ghaziabad, U.P., India

Abstract:
Automatic Gate Entry Alarm System is an innovative security solution designed to enhance access control and perimeter protection in residential, commercial, and industrial environments. This system integrates advanced sensor technologies with intelligent alarm features to provide real-time notifications and deter unauthorized access. The core components of the Automatic Gate Entry Alarm System include motion sensors, The alarm can take various forms, including audible sirens, visual signals, or notifications sent to a designated mobile device or security monitoring system. The flexibility of the system allows for customization based on specific security requirements. In conclusion, the Automatic Gate Entry Alarm System represents a cutting-edge solution for securing gated premises, combining advanced sensor technologies and intelligent alarm capabilities to provide a comprehensive and user-friendly access control system. We propose a project named "Smart Door Security System" that integrates Android and Internet of Things (IoT) technologies to enhance home security. This system monitors door status and allows for remote control, utilizing advanced digital locks that eliminate the need for physical keys.
The centerpiece of this project is a Door Unlock System that employs Face Recognition technology to ensure high security. A camera sensor captures facial images, and an image matching algorithm verifies authorized individuals. Only those with verified facial matches can unlock the door, resolving issues associated with key management.
This system is especially beneficial for elderly individuals who may struggle with traditional locks. By providing a keyless entry method, it simplifies access and enhances security for older adults. In summary, the Smart Door Security System not only improves home security but also offers a convenient, key-free solution. It addresses the needs of all residents, particularly the elderly, ensuring a secure and user-friendly experience. In this we build a face ID controlled door lock system using ESP32- CAM.
Keywords: Alarm System, Sensor, Controller, ESP 32 -CAM

I. Introduction

Many years ago, the mechanism of manually controlled gates that were operated by human force was used. A gate functions as the exclusive entry point to a defined space, enclosed by walls and a deliberate aperture in the adjacent fence. Its primary purpose is to methodically regulate access, allowing controlled entry and exit as needed. Beyond its fundamental role in access control, a gate can also serve an ornamental function, contributing to the overall aesthetic of the surroundings without compromising its essential functionality. Gates generally prevent entry and exit or control it, but they can be decorative. The sliding manual gates have many challenges, even though they are praised in the gate, a large human force has to be exerted if we talk about manual sliding gates. In the 1st century, "Heron of Alexandria", a Greek mathematician invented his automatic door. The key application involves the utilization of heat recycled from a fire within the city temple. The documented commercial electric gate entry systems were hydraulically powered and intricately designed to prioritize both reliability and user-friendly operation for every individual. In a world where security is an ever-growing concern, the need for reliable and efficient access control systems has become paramount. Automatic entry gate alarm systems stand as sentinels, guarding entrances to properties, be it homes, businesses, or industrial complexes. These systems seamlessly blend automation and security to provide a robust defence against unauthorized access and potential security breaches. We

propose a project to create a Face Recognition Door Lock System using the ESP32-CAM, a relay module, and a solenoid lock. This system is designed to enhance security by using facial recognition as the primary method for door access.
The ESP32-CAM, which features an integrated camera, includes example code for a camera web server that supports both video streaming and face recognition. Utilizing this built-in capability allows us to focus on the hardware integration and overall system functionality.
In this setup, the ESP32-CAM captures facial images and uses an algorithm to verify identity. When the system recognizes an authorized face, it triggers the relay module, which in turn activates the solenoid lock to unlock the door. This keyless entry system not only improves security but also eliminates the inconvenience of managing physical keys.
In summary, this project aims to deliver a modern, secure, and convenient door lock system that leverages the advanced capabilities of the ESP32-CAM for facial recognition, ensuring efficient and reliable access control.



INPUT **CONTROLLER** **OUTPUT**

In this project, we've engineered a Face Recognition Door Lock System utilizing the ESP-32-CAM. It autonomously unlocks the door upon detecting an authorized face, presenting a seamless home automation solution empowered by the ESP-32 camera module.
Our approach implements a cascade method for facial recognition. Through the camera sensor, facial images are captured and processed using an image-matching algorithm to cross-reference them against a database of authorized faces. This effectively eradicates the need for physical keys and introduces a keyless entry system, thereby elevating security measures.
Our survey of existing literature delves into various digital-based automated solutions, encompassing thumbprint, iris scan, and facial recognition systems. While smart door implementations with smart cards, thumbprints, and iris scans are prevalent, face-based solutions remain relatively less explored, despite their considerable potential.
Despite inherent challenges such as lighting discrepancies and varying brightness levels, our system's core strength lies in its ability to unlock doors through facial recognition, promising heightened security.
By extracting attributes from facial images, our approach empowers the smart door model to fortify security measures. This endeavor holds promise in revolutionizing the security industry, rendering everyday objects more interactive and secure.

II. Literature

1] "Automatic Gate Control System Using Number Plate Recognition With OCR"
Authors: - The individuals contributing to this work are Chethan G, Rahul R Nadig, Supriya V, and Praveen Andrew.
Affiliation: - Final year students pursuing Bachelor of Engineering in the Electronics and Communication Engineering Department at K.S Institute of Technology, Bangalore, India
Abstract: - This paper explores cutting-edge techniques for detecting vehicle license plates and introduces an automatic gate control system aimed at enhancing security and convenience at critical locations. Operating autonomously, the system employs Raspberry Pi, a video camera, and Python-based Optical Character Recognition (OCR) to process license plate images. This advanced technology enables the system to autonomously make decisions regarding vehicle entry, eliminating the need for human intervention.

2] "Design and Construction of an Automatic Gate"
Authors: - Onyinye Florence IKPEZE, Emmanuel Chidiebere UWAEZUOKE, Bola Matan mi SAMIAT, and Kola Michael KAREEM have collaborated on this work.
Affiliation: - The Department of Electrical/Electronics & Computer Afa Babalola University, Ekiti State, Nigeria, Engineering Department, P.M.B 5454, Ado-Ekiti
Abstract: - This study underscores the pivotal role of automatic gates across various sectors, focusing on the meticulous design and construction of an automatic gate at Afa Babalola University. Emphasizing time-saving attributes and a reduction in manual labour, the gate, control unit, and power supply unit underwent rigorous design and implementation. Test results show a very commendable 90% efficiency. The paper suggests further enhancement through the integration of a scanning device for optimized security operations.

3] "Sensor-Based Automatic Control of Railway Gates"
Authors: - Karthik Krishnamurthi, Monica Bobby, Vidya V, and Edwin Baby collaborated on this work.
Abstract: -This work endeavours to automate railway level crossing gates, dropping the need for manual operation by gatekeepers. The proposed system integrates infra-red sensors and Arduino technology to detect train arrivals and departures, addressing issues of prolonged gate closures and traffic congestion resulting from delayed trains. The strategic use of sensor technology enhances overall efficiency by automating the gate's opening and closing processes.

4] "Automatic Railway Gate Controller with High-Speed Alerting System"
Authors: - Vikash Kumar, Prajit Paul, Nishant Kumar, Pratik Kumar Sinha, and Sumant Kumar Mahato have jointly contributed to this work
Affiliation: - Assistant Professor at the Department of Electronics and Communication Engineering, Asansol Engineering College, situated in Asansol, West Bengal, India.
Abstract: - This paper introduces a model designed to prevent accidents at unmonitored railway crossings employing an ATMEGA_16 microcontroller. The model incorporates four laser light sources and LDRs to detect approaching trains, mitigating the risk of collisions on the same track. Strategically placed sensors control gate operations, and an integrated indicator light alerts motorists about approaching trains. This sensor-based solution significantly contributes to heightened safety and efficiency in railway gate control.

2. Hardware Description

The various component description of Automatic Entry Gate Alarm System will be as follows:
Buzzer: A buzzer is an electronic device that produces sound, typically a buzzing or beeping noise, when an electrical signal is applied. Buzzer devices are commonly used in various applications to supply audible alerts, notifications, or alarms. They come in different shapes and sizes, but they all share the common function of converting electrical signals into sound waves. When an electrical voltage is applied to a buzzer, it energizes the internal components, causing them to vibrate and

generate sound waves. The frequency and volume of the sound produced depend on the design and specifications of the buzzer.

Light Emitting Diodes (LEDs): appear as semiconductor marvels, producing radiant light when an electric current courses through them. LEDs (Light Emitting Diodes) are likely used in face detection entry gate alarm systems in a couple of ways: **Illumination for the Camera:** Face recognition cameras often require good lighting conditions to capture clear facial images for accurate detection. LEDs can be used as an illumination source placed near the camera to ensure proper lighting, especially in low-light environments. Infrared (IR) LEDs are commonly used for this purpose as they are invisible to the human eye but provide sufficient illumination for the camera, which can detect infrared light. **Status Indication:** LEDs are also widely used as status indicators to provide visual cues about the system's state. Here are some extended possible applications: **Access Granted:** A green or blue LED might light up to indicate successful face recognition and grant access through the gate. **Access Denied:** A red LED might illuminate to signal that the face wasn't recognized or access permission wasn't granted. **Standby Mode:** The system might use a specific LED color to show it's in standby mode, waiting for someone to approach the gate. **Alarm Triggered:** A flashing LED, often red, might be used to indicate that the system detected unauthorized access or another security breach, triggering an alarm.

Single channel Relay module is an electronic switch that uses a low-power control signal to turn on or off a higher-power circuit. They are essentially an intermediary that allows a low-power control circuit to manage a high-power circuit. A single channel relay has two main parts: **Control side:** This side uses a low-voltage signal from a microcontroller or other control circuit to activate the relay. **Power side:** This side handles the high-voltage or high-current load that the relay is switching. When a voltage is applied to the control side of the relay, it creates an electromagnetic field that pulls in a metal armature. This armature is connected to a set of contacts on the power side of the relay. When the armature is pulled in, it switches the contacts, either connecting or disconnecting the high-power circuit.

FTDI (Future Technology Devices International) chip is a type of integrated circuit commonly used in electronics for USB (Universal Serial Bus) communication. FTDI chips provide an easy way to add USB connectivity to various devices and microcontroller projects. One of the primary functions of FTDI chips is to convert USB signals to serial communication signals (such as UART, SPI, or I2C). This conversion allows microcontrollers and other embedded systems to communicate with computers and other USB-enabled devices. FTDI chips are supported by a wide range of operating systems, including Windows, macOS, Linux, and various embedded platforms. FTDI provides drivers that enable seamless communication between devices using their chips and the host computer. FTDI chips come in various package options, including surface-mount and through-hole packages, making them suitable for integration into a wide range of electronic designs. They typically require minimal external components, simplifying the design process for USB-enabled devices. FTDI chips are often used in USB-to-serial converter cables, which are popular among electronics hobbyists and professionals for programming and debugging microcontrollers, such as Arduino boards. Overall, FTDI chips play a crucial role in enabling USB communication in electronic devices and projects, offering a reliable and widely supported solution for USB-to-serial conversion.

LM2596 voltage regulator, specifically a step-down (buck) converter is a popular voltage regulator integrated circuit (IC) used in electronics to step down (buck) voltage from a higher input voltage to a lower output voltage. It's commonly used in DC-DC converter circuits to efficiently regulate voltage levels. The LM2596 can handle a wide range of input voltages, typically from several volts above the desired output voltage up to around 40 volts, depending on the specific model and configuration. This flexibility makes it suitable for various power supply applications. The output voltage of the LM2596 can be adjusted by external components such as resistors, capacitors, and an adjustable voltage divider network. This allows designers to set the output voltage to a precise level as required by their application. The LM2596 offers high efficiency, typically around 80-90%, depending on the

input/output voltage differential and load conditions. This efficiency is achieved through its internal switching regulator topology, which minimizes power dissipation and heat generation. The LM2596 is available in fixed-output voltage versions as well as adjustable versions, allowing flexibility in design. The adjustable versions require external components to set the output voltage, providing more customization options for different applications.

ESP32 is a series of low-cost, low-power microcontrollers with built-in Wi-Fi and Bluetooth connectivity. They are essentially tiny computers specifically designed to be embedded into electronic devices. ESP32 microcontrollers are made by Espressif Systems. The ESP32-CAM is a popular development board based on the ESP32 system-on-chip (SoC) from Espressif Systems. It integrates a small camera module along with Wi-Fi and Bluetooth connectivity, making it suitable for various IoT (Internet of Things) and DIY projects that involve image capturing and processing. The board is widely used for applications such as surveillance cameras, video streaming, facial recognition, and home automation. It's affordable, versatile, and well-supported by the ESP32 development community.

Switch At the heart of electronic systems, the switch serves as a pivotal part, orchestrating the flow of electric current within circuits. Its fundamental role encompasses the establishment or disruption of connections, affording meticulous control over an array of components like devices and lights. Through its seamless ability to activate or deactivate circuits, the switch grants users precise and efficient control over the intricate pathways of electrical currents.

Power supply adapter, also commonly called a power adapter or AC adapter, is a device that converts alternating current (AC) from a wall outlet to direct current (DC) at a specific voltage and current rating. This DC power is then used to supply electronic devices that require it to function. **Input:** Power supply adapters plug into a wall outlet, which provides AC electricity. The AC voltage typically ranges from 100 volts to 240 volts depending on the region. **Transformer:** Most adapters contain a transformer that steps down the AC voltage from the wall outlet to a lower voltage level suitable for the electronic device. **Rectifier:** The rectifier converts the stepped-down AC voltage into unregulated DC voltage. **Voltage Regulator:** This component regulates the unregulated DC voltage to a specific, stable voltage level required by the electronic device. Sometimes this regulation may involve additional circuitry for filtering out any remaining AC ripple or noise. **Output:** The final stage is the DC output connector that plugs into the electronic device. The adapter provides the required DC voltage and current rating, typically indicated on the adapter itself (e.g., 5V 2A)

Breadboard: A basic tool which supplies a platform for constructing temporary electronic circuits without the need for soldering. A breadboard allows you to quickly and easily test and experiment with different components and circuits involved in your face detection system. You can try out various sensors, cameras, microcontrollers, and software libraries to see how they work together. Breadboards are great for building a basic functional model to prove your concept works. This allows you to refine the design and identify any potential issues before moving on to a permanent circuit board.

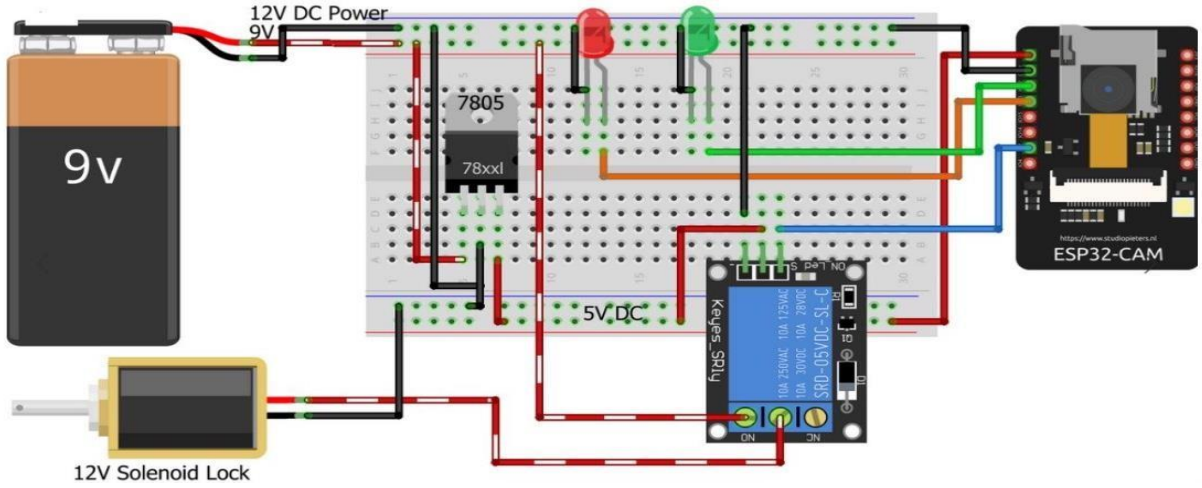
Solenoid lock is a type of electromechanical lock that uses the principle of electromagnetism for locking and unlocking. It's a simpler and lower-cost alternative to electromagnetic locks but might not be suitable for the most high-security applications. It consists of a solenoid coil, a metal armature (often called a plunger), and a mechanical latch mechanism. When the solenoid is not energized (no electrical current), the spring-loaded latch mechanism keeps the lock engaged, preventing the door from opening. When an electric current is applied to the solenoid coil, it generates a magnetic field. This magnetic field attracts the metal armature, pulling it into the coil. The movement of the armature retracts the latch, allowing the door to be opened. Solenoid locks can be designed in two ways: **Fail-safe:** This is the most common type. When power is lost, the lock disengages, and the door unlocks. This ensures a safe exit in emergencies. **Fail-secure:** In this design, the lock remains engaged when power is lost. This might be preferable for high- security applications but could pose a safety risk during emergencies.

Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 5, No.14, May : 2024

UART TTL CP2102 chip from SiLabs is a single chip USB to UART bridge IC. It requires minimal external components. CP2102 can be used to migrate legacy serial port based devices to USB. Hobbyists can use it as a powerful tool to make all kinds of PC interfaced projects. This module help all those who are comfortable with RS232/Serial Communication protocol, to build USB devices very easily.

2. Software Description

Arduino IDE: The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, mac OS, Linux) that is -upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards like ESP32-cam. The source code for the IDE is released under the GNU General Public License, version2. IDE supports the languages C and C++ using special rules of code structuring. It supplies a software library from the Wiring project, which provides many common input and output procedures.



III. Conclusion

We successfully designed internets of things (IoT)- based door lock security system which uses the ESP32Cam to monitor the status of door and boost home security. The communication protocols are used between the smart phone and the door lock system. In this situation, due to the current COVID environment, the smart locking door system is particularly important and applying this internet of things (IoT)-based door lock system without using our hands is necessary. Our proposed model can be extended by integrating temperature sensors, that can be used to trigger the system to open and close the doors automatically as per the variations of the room temperature. The android applications should be able to manage more doors, windows, and basic home electronic equipment. To ensure the system's completeness, a battery backup system must be considered.

IV. Recommendations

In the future scope, the detection system will only accept social media photographs with file protection. Flexibility to work with the camera in a variety of ways and to feel at ease with it. We are not trying to demonstrate student attendance now. We also figure out how we can do it if it does not work out. In some lighting circumstances, the present output system works effectively, but not in others. A different method for face control is recommended: environmental detection devices. Cut off the road. Improve the accuracy and satisfaction of test results. Our proposed model can be extended by integrating temperature sensors, that can be used to trigger the system to open and close the doors automatically as per the variations of the room temperature. The android applications should be able to manage more doors, windows, and basic home electronic equipment. To ensure the system's completeness, a battery backup system must be considered. In addition to this, we also improved the people detection system at the entry gate of a boundary.

V. Acknowledgement

We authors wish to acknowledge all our teachers and fellow classmates for helping us by suggesting small but substantial changes to the system. We also wish to thank the Management of ABES Engineering College for granting us the opportunity of using the campus main entrance as the trial site.

Special thanks to the Department of Electronics and Communication Engineering for their kind support.

VI. References

1} International Journal of Scientific Engineering and Science Volume 2, Issue 5, pp. 25-31, 2018. ISSN (Online): 2456-7361 30

2} A. A. Abidi, G. J. Pottie, and W. J. Kaiser, “Power-conscious design of wireless circuits and systems,” Proceedings of the IEEE, vol. 88, issue10, pp. 1528-1545, 2000

3} E. Bailey, 2010, Lighting Science Group Corp. Folded light path led array collimation optic. U.S. Patent Application 12/523,478.

4} A. J. Brush, B. Lee, R. Mahajan, S. Agarwal, S. Saroiu, and C. Dixon, “Home automation in the wild: challenges and opportunities,” In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, pp. 2115-2124, ACM, 2011.Fast, R., Fast and Ray, (1996). Global security system. U.S. Patent 5,497,149.

5} Norarzemi, Ummi Annisa, et al. "Development of Prototype Smart Door System with IoT Application." Progress in Engineering Application and Technology 1.1 (2020):245-256