High Security Electronic Door Lock System Using Arduino Uno

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Abstract

A high-security door lock system using an ESP32-CAM, keypad, GSM module, and gas and fire sensor is an effective solution for home or office security. The ESP32 CAM serves as the central controller and surveillance device, capturing live footage of anyone attempting access. A keypad is used to input a passcode, allowing authorized entry. If an incorrect passcode is entered, the system triggers an alert through the GSM module, sending a text message to the owner's phone to inform them of potential unauthorized access. To enhance safety, a gas and fire sensor is included. In the event of a gas leak and fire, it detects the hazard immediately and activates both an alarm and the GSM module, alerting the owner and possibly initiating safety measures like door unlocking for escape. Together, these components provide a layered security approach, offering surveillance, access control, real-time alerts, and fire and gas hazard detection for robust home or office protection.

Keywords: ESP32-CAM, Arduino IDE

INTRODUCTION

Security is important for everyone, everywhere in the world. Due to emerging technologies, the risks have increased, making improvements in safety measures a necessity. Home automation is quite a hot debate and has a high demand due to the helping nature of the technology for handicapped, paralyzed and elderly individuals [1]. In this present work, the main focus is to develop smart security system using components that function independently of internet connectivity, suitable for remote areas. The main idea was to use the ESP32-CAM module with a camera to monitor the surroundings of the house for security purposes. The proposed system includes a camera module, gas sensor, fire sensor, keypad, GSM module, and buzzer connected to the ESP32 CAM. It is used to unlock and lock the house in the case of emergency situations because of sensors

In this project, we will make a password-based door lock system using Arduino, a keypad, a servo motor, an LCD, and a buzzer. With rising concerns about security, this digital password-based lock can be an effective way to safeguard homes [2]. This system will unlock the door only when the correct password is entered. It's a simple and effective way to keep our home.

The High Security Electronic Door Lock System Using Arduino UNO is designed to address the limitations of existing security solutions by integrating ESP32-CAM for real-time monitoring, GSM for instant alerts, and gas and fire sensors for hazard detection into a single, efficient system [3]. The proposed system enhances security and safety through seamless automation and remote access control. Key Features of the Proposed System:

ESP32-CAM for Video Surveillance – Captures real-time images and transmits them to authorized

users, enabling remote monitoring of the door entrance. GSM-Based Alerts and Notifications – Sends SMS alerts to the homeowner in case of unauthorized access, fire, or gas leaks.

Gas and Fire Sensors for Hazard Detection – Continuously monitors for hazardous gases and fire threats, triggering alarms and sending alerts when necessary. Arduino UNO-Based Control Unit – Acts as the central processing unit, managing door access based on authentication and sensor inputs. Automated Door Lock Mechanism – Controls the electronic lock based on verification results from ESP32-CAM and sensor readings. Low Power Consumption and Cost-Effective Design – Optimized for energy efficiency and affordability compared to fully Wi-Fi or cloud-based alternatives.
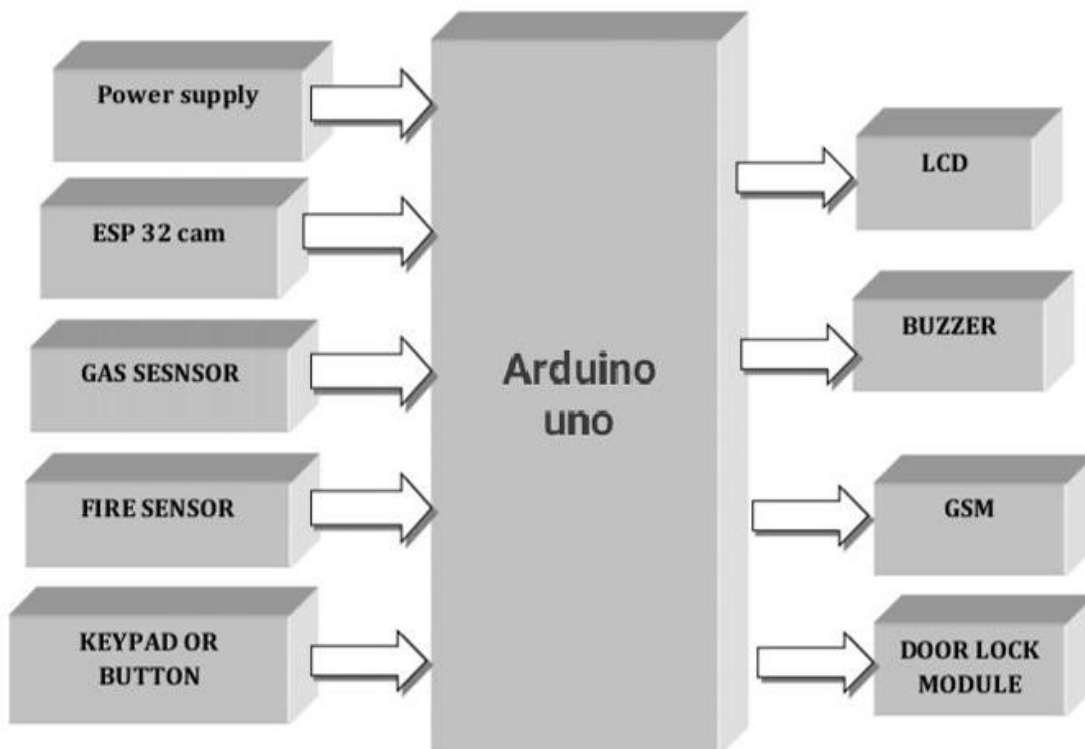

Fig 1: Block Diagram

HARDWARE COMPONENTS
ESP32 CAM

ESP32-CAM is a low-cost, powerful module equipped with a built-in camera and Wi Fi capabilities. It is widely used in IoT-based security applications due to its real-time image capturing and wireless communication features. The module is based on the ESP32-S processor, which supports video streaming, face detection, and remote surveillance applications. The ESP32-CAM communicates with Arduino Uno via serial/UART or Wi-Fi.
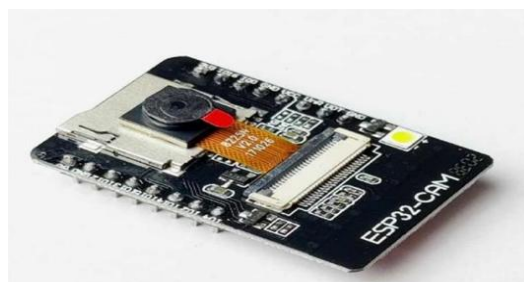

Fig 2: ESP32-CAM

GAS (MQ 2) SENSOR

MQ-2 is a Carbon Monoxide (CO) sensor, suitable for sensing Carbon Monoxide concentrations (PPM) in the air. The MQ-2 sensor can measure CO concentrations ranging from 20 to 2000ppm. This sensor has a high sensitivity and fast response time. The sensor's output is an analog resistance. The drive circuit is very simple, just a voltage divider; all we need to do is power the heater coil with 5V DC or AC, add a load resistance, and connect the output to an ADC or a simple OPAMP comparator.

Fig 3: MQ2 Gas Sensor

FIRE SENSOR

An infrared sensor is an electronic device, which emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received

Fig 4: IR SENSOR

GSM MODULE

GSM (Global System for Mobile interchanges) is a cell system, which implies that cellular telephones interface with it via hunting down cells in the quick region. GSM systems work in the 900 MHz or 1800 MHz groups. GSM likewise spearheaded a minimal effort, to the system bearer, option to voice calls, the Short message administration (SMS, additionally called "content informing"), which is presently backed on other versatile norms also. An alternate point of interest is that the standard incorporates one overall Emergency phone number

Fig 5.GSM MODULE

GSM MODULE Can send/receive SMS messages and make/receive voice calls for remote security notifications. It can Operates efficiently in battery-powered applications.: Uses serial communication (TX/RX) for easy interfacing with Arduino, UART External Antenna Support Ensures strong network reception in low-signal areas.

In Password Based Door Lock Security System, the Arduino controls the whole system. The keypad is used to enter the password, and the LCD shows messages like **"Enter Password"**. The buzzer makes sounds to give feedback, like when a button is pressed or the password is wrong. If the correct password is entered, the servo motor unlocks the door

During normal operation, it checks the entered password against the saved password. If the passwords match, the door unlocks. During password setup, it confirms the newly entered password and saves it. Once the password is set, we can start unlocking the door by entering the right password.

If the password entered is correct, the LCD will show correct password, At the same time, Servo Motor will rotate and open the door. It will display a door open. if password entered is wrong, the Buzzer will Beeps as a wrong password.

SOFTWARE REQUIREMENTS

The ESP 32 Software (IDE) is anything but difficult to-use for fledglings, yet sufficiently adaptable for cutting edge clients to exploit too. For instructors, it's helpfully in view of the Processing programming condition, so understudies figuring out how to program in that condition will be acquainted with how the ESP 32 IDE functions.

ESP 32 is a model stage (open-source) in perspective of an easy to-use gear and programming. It includes a circuit board, which can be tweaked (suggested as a microcontroller) and a moment programming called ESP 32 IDE (Integrated Development Environment), which is used to make and exchange the PC code to the physical board.

Conclusion

The smart surveillance system employing ESP32-CAM project's conclusion may demonstrate the practical application of an affordable and adaptable method for keeping an eye on and safeguarding property. It might go over how the system can record and provide live video, identify motion or particular events, and allow remote access for monitoring via a mobile app or web interface.

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much more effective to make this extended for larger areas as now it is limited to smaller areas and to make the application much more effective. Integrating a 360-degree webcam to view all the angles to reduce monitoring expenses and ensure safety in homes and offices by identifying motion objects. The main goal of this study was to create an intelligent face recognition approach using deep learning for intelligent homes.

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