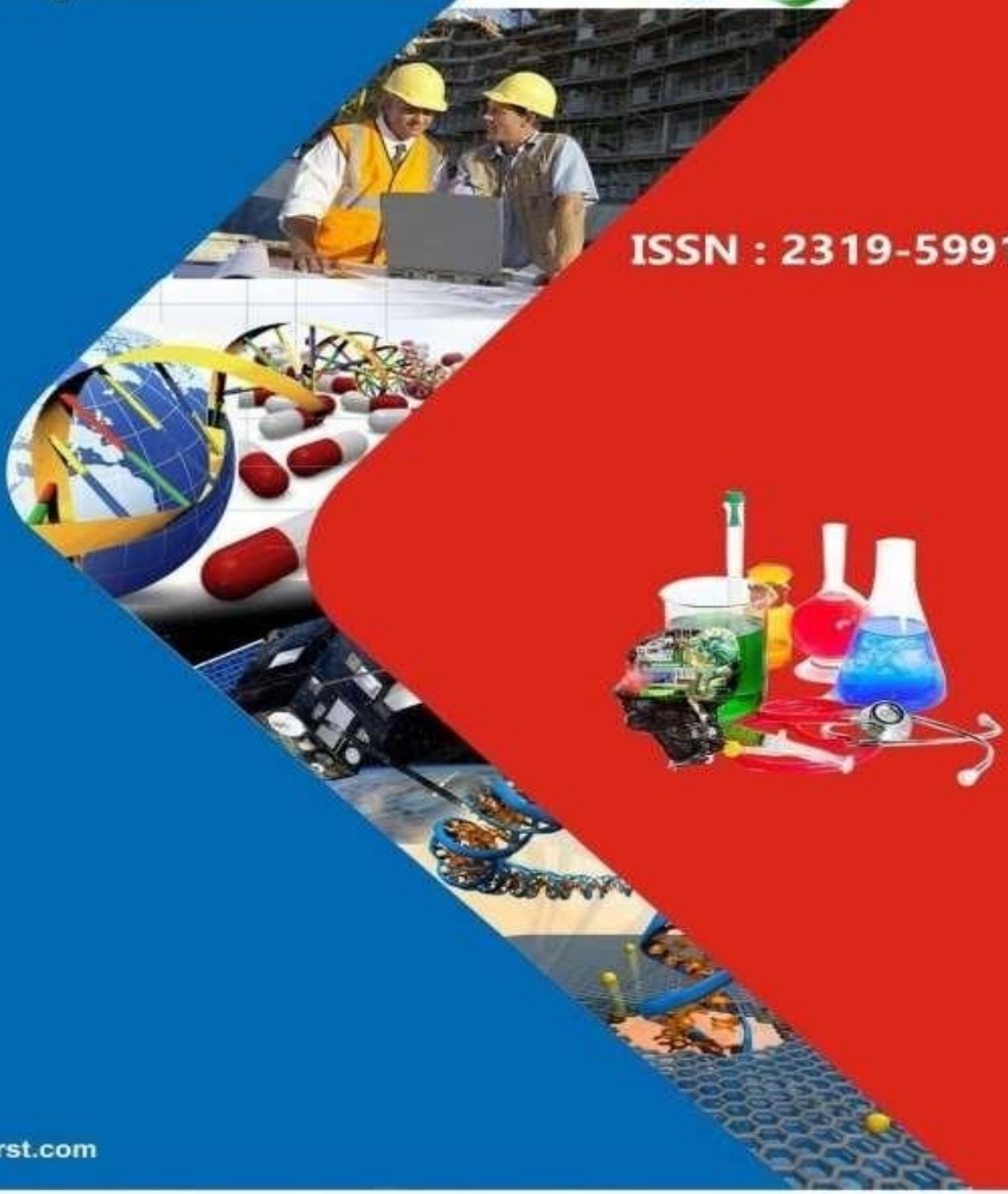
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AI-BASED SMART DOOR FOR ENHANCED SECURITY AND ACCESS MANAGEMENT

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ABSTRACT

Security is at most concern for anyone nowadays, whether it's data security or security of their own home. With the advancement of technology and the increasing use of IOT and AI, digital door locks have become very common these days. Face recognition system is broadly used for human identification because of its capacity to measure the facial points and recognize the identity in an unobtrusive way. The application of face recognition systems can be applied to surveillance at home, workplaces, and campuses, accordingly. The problem with existing face recognition systems is that they either rely on the facial key points and landmarks or the face embeddings from Face Net for the recognition process. Deep convolution neural networks have been successfully applied to face detection recently. Despite making remarkable progress, most of the existing detection methods only localize each face using a bounding box, which cannot segment each face from the background image simultaneously. We implement an IoT-based smart door lock system using an ESP32-CAM and an Android application in this project. Most of the time in our daily life, we forget to lock our doors and later we suffer from confusion about whether we locked all doors perfectly or not. In this project, we implement a smart door lock system, by which the owner can see the visitor's picture and then lock or unlock their doors from anywhere and at any time using the Android application. the design and implementation of an AI-enabled smart door system capable of person identification, with the additional functionality of SMS notification. In today's context of increasing security concerns and the need for seamless access control, this technology offers an innovative and efficient solution for recognizing authorized individuals and notifying homeowners or administrators about entry events. The smart door system harnesses the power of *Artificial Intelligence* (AI) algorithms, particularly Convolution Neural Networks (CNNs), to process live video streams and identify persons approaching the door. The CNN model is trained on a comprehensive dataset comprising diverse images of individuals, captured under various lighting conditions, angles, and poses, ensuring robustness and accuracy in person recognition.

Keywords: Arduino uno, LCD, Camera, Ultrasonic Sensor, Buzzer

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I. INTRODUCTION

1.1 INTRODUCTION

Microcontroller are widely used in Embedded Systems products. An Embedded product uses the microprocessor (or microcontroller) to do one task & one task only. A printer is an example of Embedded system since the processor inside it perform one task only namely getting the data and printing it. Although microcontroller is preferred choice for many Embedded systems, there are times that a microcontroller is inadequate for the task. For this reason, in recent years many manufactures of general-purpose microprocessors such as INTEL, Motorola, AMD & Cyrix have targeted their microprocessors for the high end of Embedded market. One of the most critical needs of the embedded system is to decrease power consumptions and space. This can be achieved by integrating more functions into the CPU chips. All the embedded processors have low power consumptions in additions to some forms of I/O, ROM all on a single chip. In higher performance Embedded system, the trend is to integrate more & more function on the CPU chip & let the designer decide which feature he/she wants to use.

1.2 EMBEDDED SYSTEM

Physically, embedded systems range from portable devices such as digital watches and MP3 players to large stationary installations like traffic lights, factory controllers, or the systems controlling nuclear power plants. Complexity varies from low, with a single microcontroller chip, to very high with multiple units, peripherals and networks mounted inside a large chassis or enclosure

In general, "embedded system" is not an exactly defined term, as many systems have some element of programmability. For example, Handheld computers share some elements with embedded systems such as the operating systems and microprocessors which power them but are not truly embedded systems, because they allow different applications to be loaded and peripherals to be connected. Embedded systems span all aspects of modern life and there are many examples of their use. Telecommunications systems employ numerous embedded systems from telephone switches for the network to mobile phones at the end-user. Computer networking uses dedicated routers and network bridges to route data.

EXAMPLES OF EMBEDDED SYSTEM:

Automated teller. machines (ATMS). Integrated system in aircraft and missile. Cellular telephones and telephonic switches. Computer network equipment, including routers timeservers and firewalls. Computer printers, Copiers. Disk drives (floppy disk drive and hard disk drive). Engine controllers and antilock brake controllers for automobiles.

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Home automation products like thermostat, air conditioners sprinkles and security monitoring system. House hold appliances including microwave ovens, washing machines, TV sets DVD layers/recorders. Medical equipment. Measurement equipment such as digital storage oscilloscopes, logic analysers and spectrum analysers. Multimedia appliances: internet radio receivers, TV set top boxes. Small hand-held computer with P1M5 and other applications. Programmable logic controllers (PLC's) for industrial automation and monitoring. Stationary video game controllers.

1.3 CHARACTERISTICS:

Embedded systems are designed to do some specific tasks, rather than be a general-purpose computer for multiple tasks. Some also have real-time performance constraints that must be met, for reasons such as safety and usability; others may have low or no performance requirements, allowing the system hardware to be simplified to reduce costs. Embedded systems are not always standalone devices. Many embedded systems consist of small, computerized parts within a larger device that serves a more general purpose. For example, the Gibson Robot Guitar features an embedded system for tuning the strings, but the overall purpose of the Robot Guitar is, of course, to play music. Similarly, an embedded system in an automobile provides a specific function as a subsystem of the car itself.

The software written for embedded systems is often called firmware, and is usually stored in read- only memory or Flash memory chips rather than a disk drive. It often runs with limited computer hardware resources: small or no keyboard, screen, and little memory.

1.4 MICROPROCESSOR (MP):

A microprocessor is a general-purpose digital computer central processing unit (CPU). Although popularly known as a "computer on a chip" is in no sense a complete digital computer. The block diagram of a microprocessor CPU is shown, which contains an arithmetic and logical unit (ALU), a program counter (PC), a stack pointer (SP), some working registers, a clock timing circuit, and interrupt circuits.

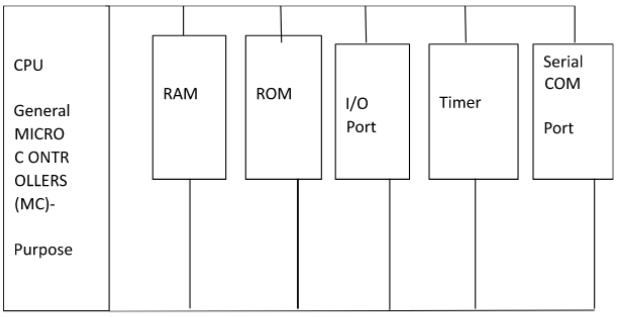


Fig 1.1 Block diagram of microprocessor

1.5 MICROCONTROLLER (MC):

Figure shows the block diagram of a typical microcontroller. The design incorporates all of the features found in micro-processor CPU: ALU, PC, SP, and registers. It also added the other features needed to make a complete computer: ROM, RAM, parallel I/O, serial I/O, counters, and clock circuit.

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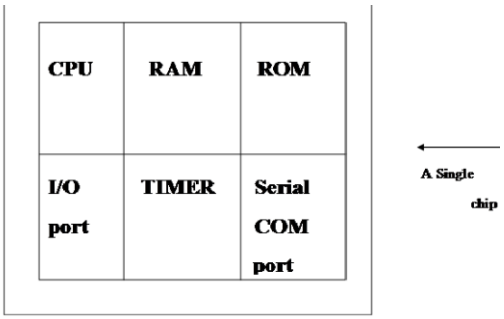


Fig 1.2 Microcontroller

1.6 COMPARISION BETWEEN MICROPROCESSOR AND MICROCONTROLLER

The microprocessor must have many additional parts to be operational as a computer whereas microcontroller requires no additional external digital parts. The prime use of microprocessor is to read data, perform extensive calculations on that data and store them in the mass storage device or display it. The prime functions of microcontroller is to read data, perform limited calculations on it, control its environment based on these data. Thus the microprocessor is said to be general-purpose digital computers whereas the microcontroller are intend to be special purpose digital controller. Microprocessor need many opcodes for moving data from the external memory to the CPU, microcontroller may require just one or two, also microprocessor may have one or two types of bit handling instructions whereas microcontrollers have many.

II. LITERATURE SURVEY

2.1 INTRODUCTION

Human beings are recognized by their distinctive facial characteristics. In the face recognition approach, a given face is compared with the faces stored in the database in order to identify the person. The aim is to search out a face in the database, which has the highest similarity with the given face. In the field of bio science, face recognition technology is one among the fastest growing fields. The need of face recognition in security systems is attributed to the rise of commercial interest and therefore the development of feasible technologies to support the development of face recognition. Major areas of commercial interest comprise of bio science, law enforcement and surveillance, human computer interaction, multimedia management (for example, automatic tagging of a particular individual within a collection of digital photographs) smart cards, passport check, Criminal investigations, access control management.

However, face detection is more challenging because of some irregular characteristics, for example, glasses and beard will results in detecting effectiveness. Moreover, different sorts and angles of lighting will make detecting face generate uneven brightness on the face, which will have influence on the detection and recognition process. To overcome these issues, the system primarily used open CV based face recognition system using Haar classifiers for

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face. The main processing element is Raspberry pi. The pi camera is employed to capture the image and send it to the authorized person for security purposes. The authorized person can remotely control the lock and unlock mechanism of the door using GSM Module by installing Subscriber Identification Module (SIM). The entry log of every unidentified person is captured using pi camera and picture is sent to the email address of the prescribed user..

III. PROBLEM STATEMENT

The history of locks dates back 4,000 years. Even now, there's still no such thing as a perfect traditional lock. Smart locks, which have only been around about ten years, naturally have some technological limitations.

The key is stock or broken inside the lock

This technology is crucial in enhancing security protocols, as it enables early detection of potential threats posed by drones, ranging from unauthorized surveillance to more malicious activities.

The application of DL in drone detection for security not only augments response times but also provides a proactive and intelligent layer of defense against evolving security challenges in the airspace. Your key may be stuck due to misaligned door latch or that some components of the lock are not properly lubricated. If the key is stuck, forcing it to turn may lead to breaking the key inside the locks. Understand that you are low on time and in a hurry to meet up with an appointment. However, if you notice that the key is stuck on the lock, do not force it to open or close; you may end up aggravating the problem

Slow door locks

Stiffened or slow door locks may occur as a result of the accumulation of dirt or grime in your locks. If you notice that the handle of your lock is slow or it is difficult inserting the key into the lock.

Misaligned door latch

In case the door latch does not catch the strike plate, you will find it difficult shutting or locking your door properly. This problem can creep up from time to time, and it can be caused by improper installed or screwed hinges, damp weather condition, or heat

Effects of smart locks

Smart locks can also control the locks of one door. It's one thing to try out new technology on a phone or computer, but this is the key to your house and technological issues can set you back. When you look at the simplest smart locks, they are just an automated version of a traditional lock. The locking mechanism might even be the same, but it's capable of being engaged remotely and electronically. What makes smart locks different is the type of interaction necessary compared to traditional locks.

3.1 Disadvantages of Existing System:

Stiffened or slow door locks. Forgot the keys, key cards. Increasing the burden of managing

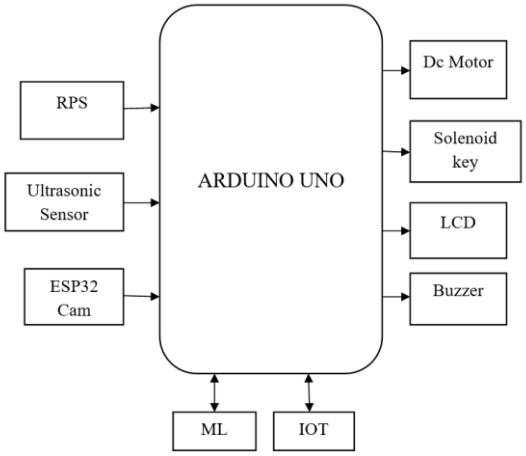
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key cards person. A serious security risk if your kids or pets are locked inside. Accuracy is low. Time consuming process. Fingerprint lock can have problems reading fingerprints due to various reasons such as sensitivity to moisture, lotions, oils, sweat and dry skin. It difficult shutting or locking your door properly

IV. PROPOSED SYSTEM

Authorized access has come a long way from using keys, pin codes, cards, and fingerprints. We now find ourselves stepping into the era of face recognition. When you think of locks, traditional door locks are probably what comes to mind. These locks have a keyhole and a manual latch. Traditional locks have some issues like forgot their keys, door lock get stuck, easily break the lock etc. People feel that traditional lock is not safe so people getss move to smart locks system but even smart lock systems also have some issues like forgot their codes, fingerprint can't get access etc. This project proposed a model Mask R-CNN, named G Mask for accessing the door lock systems. Thus this project designed the method of the face recognition system when an unknown person face is being detected or captured, where in the system will send an SMS link to the owner of the system. Using Mask R-CNN, named G-Mask model, that model detects an unknown person face gets captured then the system will send an SMS link to the owner that link have that unknown or unauthorized person captured face and ask permission for the owner if the owner or user gives permission then only the door gets opened otherwise not.

4.1 BLOCK DIAGRAM OF PROPOSED SYSTEM



V. BLOCK DIAGRAM OF PROPOSED SYSTEM

HARDWARE COMPONENTS

Power Supply, Arduino UNO, Ultrasonic Sensor, ESP32 Cam, Solenoid Key, LCD, Buzzer

SOFTWARE COMPONENTS

The following software tools used in the proposed system

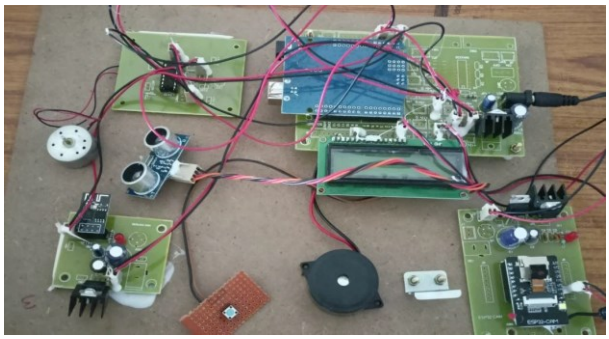
Arduino IDE, Proteus

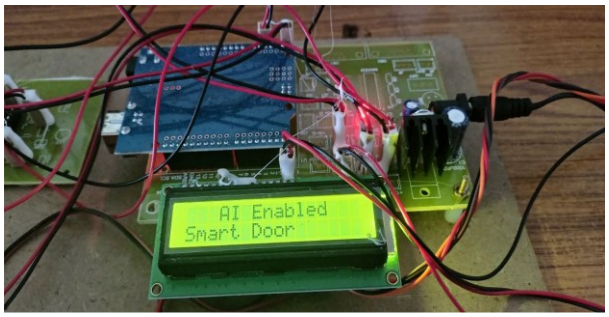
VI. RESULT AND DISCUSSION

6.1 PROTOTYPE (THROUGH KIT

shows the prototype of the project

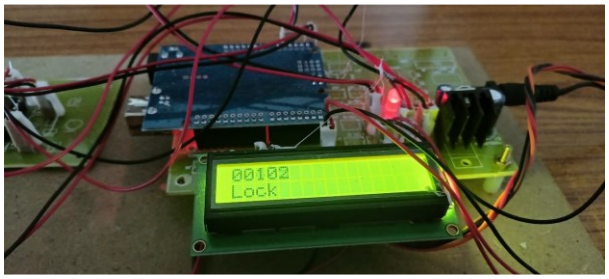
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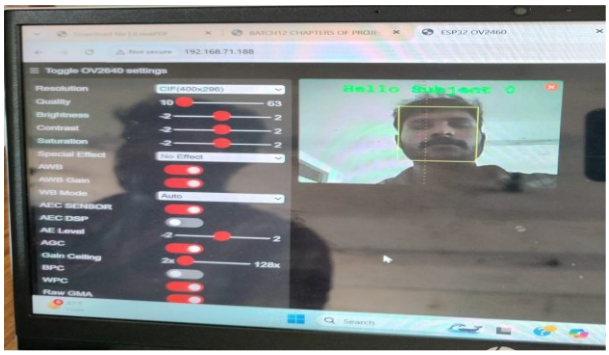


EXPERIMENTAL RESULTS

shows the real-time monitoring of the ESP32 camera



when the door is lock



when the face is authorised

VII. CONCLUSION AND FUTURE SCOPE

This paper presents a solution for Smart Home Security. Models for facial and speaker recognition have been proposed for user authentication. Mask- Region Convolutional neural network with Face Net based on one shot learning is used for facial authentication-processing is done for the captured image of the user. Based on the features extracted, the minimum distance for facial recognition. Using these parameters, the user is classified as either a member in the database or unidentified. Apart from this, the model not only recognizes the identities of unmasked faces but also recognizes masked faces. For a masked user, their eye and nose region should be clearly visible. The proposed model reports a final accuracy of 82.71% for the entire Home Security system.

VIII. FUTURE SCOPE

Facial recognition access control systems can also be integrated with other logistical and system platforms, such as time & attendance, automatic payment systems or building management systems, helping to develop smart building environments.

REFERENCE

1. B. Septian, A. Wijayanto, F. Utaminingrum, and I. Arwani, “Face Recognition Untuk Sistem Pengaman Rumah Menggunakan Metode HOG dan KNN Berbasis Embedded,” Pengemb. Teknol. Inf. dan Ilmu Komput., vol. 3, no. 3, pp. 2774–2781, 2019.

International Journal of Engineering Research and Science & Technology

ISSN 2319-5991 www.ijerst.com

Vol. 21, Issue 2, 2025

2. R. A. Isaac, A. Agarwal, and P. Singh, “Face Recognition Security Module using Deep Learning,” J. Netw. Commun. Emerg. Technol., vol. 8, no. 10, pp. 10–13, 2018.

3. J. Nasir and A. A. Ramli, “Design of Door Security System Based on Face Recognition with Arduino,” vol. 3, no. 1, pp. 127–131, 2019.

4. F. Faisal and S. A. Hossain, “Smart security system using face recognition on raspberry Pi,” 2019 13th Int. Conf. Software, Knowledge, Inf. Manag. Appl. Ski. 2019, no. August, 2019.

5. M. F. A. Hassan, A. Hussain, M. H. Muhamad, and Y. Yusof, “Convolution neural network-based action recognition for fall event detection,” Int. J. Adv. Trends Comput. Sci. Eng., vol. 8, no. 1.6 Special Issue, 2019.

6. A. R. Syafeeza, M. K. Mohd Fitri Alif, Y. Nursyifaa Athirah, A. S. Jaafar, A. H. Norihan, and M. S. Saleha, “IoT based facial recognition door access control home security system using raspberry pi,” Int. J. Power Electron. Drive Syst., vol. 11, no. 1, pp. 417–424, 2020.

7. Meera Mathew, Divya R S, "Survey on Various Door Lock Access Control Mechanisms," International Conference on circuits Power and Computing Technologies (ICCPCT), pp.1-3, 2017. DOI: 10.1109/ICCPCT.2017.8074187.

8. Pradnya R. Nehete, J. P. Chaudhari, et al., "Literature survey on door lock security systems," International Journal of Computer Applications, Vol.153, No.2, pp.13-18, 2016. DOI: 10.5120/ijca2016911971.

9. Neelam Majgaonkar, Ruhina Hodekar, et al., "Automatic Door Locking System," International Journal of Engineering Development and Research, Vol.4, No.1, 2016.

10. Madhusudhan M and Shankaraiah, "Implementation of automated door unlocking and security system," International Journal of Computer A