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Face recognition based door unlocking system using Raspberry Pi

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ABSTRACT

Today we are facing security issues in every aspect. So we have to resolve these issues by using updated technology. In this project, we are using the Face recognition module to capture human images and to compare with stored database images. If it matches with the authorized user then the system will unlock the door by an electromagnetic lock. The need for facial recognition system that is fast and accurate that continuously increasing which can detect intruders and restricts all unauthorized users from highly secured areas and aids in minimizing human error. Face recognition is one of the most Secured System than biometric pattern recognition technique which is used in a large spectrum of applications. The time and accuracy factor is considered about the major problem which specifies the performance of automatic face recognition in real-time environments. Various solutions have been proposed using multicore systems. By considering the present challenge, this provides the complete architectural design and proposes an analysis for a real-time face recognition system with LBPH Algorithm. In this algorithm, it converts the image from color to greyscale image and divides into pixels and it will be allocated in a matrix form and those images will be stored in the database. If an image is detected then microcontroller will send power to the motor driver unit then the electromagnetic lock will unlock the door and it will lock again when there is no power supply to that unit. Finally, this paper concludes for the advanced implementations achieved by integrating embedded system models against the convention.

Keywords— Face recognition, Local binary histograms, Keypad password, Electromagnetic lock

1. PROBLEM STATEMENT

In the world of emerging technology, security became an essential component in day to day life. Information theft, lack of security and violation of privacy etc. are the essential components which are needed to be protected. Using smart secure systems for door lock and unlocking became popular nowadays. This system is being adapted by many countries and first grade countries such as USA, Japan etc. already makes use of this system. This system provides either a facial recognition security feature or a keypad is provided to enter the

pass code to unlock the door. Although it provides security to the doors, it also has its own drawbacks:

Firstly, if the system mainly uses a facial recognition module, there might be a slight chance that sometimes the face may not be detected and hence the door cannot be unlocked.

Secondly, if the system uses a keypad to enter the pass code to unlock the door, there might be a chance that the key maybe is recorded or can be observed by others without users consent. Hence, two-step verification is developed which makes use of facial recognition as the first step and pass code as its following step. But the same issues pertain in the newly developed system.

Thus, a new model which rectifies all the above issues is developed.

2. INTRODUCTION

Security deft has suggested various preferred approaches like biometric and password to enhance security. But the technology is developed and growing with the usage of different equipment's. The trend's moved from fingerprint to face recognition. So we prefer a face recognition system for unlocking the door. Facial recognition is widely used in various industries and corporate sectors.

This door unlocking system mainly uses facial recognition. The latest camera is used to detect the images and the images are sending to the database. If the image matches with the admin's image then the door is unlocked and an acknowledgement is sent via Zigbee as "y" if it does not match the image an acknowledgement is sent as "n". A pass code column is shown which takes values from the keypad to unlock the door.

In today's world by using smart devices we are make our needs smart. By following trends and updates we have to consider and remove drawbacks in existing system and add more features and updates. Face detection system is more complex because of unstable characteristics. Example: let us consider glasses and beard will show some impact to detect the faces. So by considering the different angles and multiple images of faces and it will influence on detection process. The study of Open-CV and its inbuilt library functions helps to generate a code will do correct and authentic facial recognition system with

new and more efficient use of hardware. Human body will identified as an input within environment by capturing live video from a web camera and the process will be done on captured video frames. The images will run through raspberry pi3 and check with the stored data base, in this case, used an 8 GB memory card. The compilation process will be performed in VNC Viewer which helps to run Raspbian OS and the response will send to the micro controller which is connected to Zigbee receiver and power is supplied to this micro controller by the transformer and a keyboard is connected to this micro controller and display board is also connected to it. This will control the motor driver to lock and unlock the door. To run this model there are different algorithms in that we took LBPH because it will provide more accuracy results when compared to other algorithms.

By this, we can say that door locking and unlocking by detecting faces is a new model which includes an alternate manual pass code unlocking system by using keypad which helps to gain access to that door in necessary situations.

3. RELATED WORK

This section provides various approaches towards door unlocking system. In previous works, they deal with different algorithms technologies and equipment for unlocking the door. In reference article 8 studies by Somjit Nath, Paramita Banerjee proposed "Arduino Based Door Unlocking System with Real Time Control". This approach implemented with RFID codes to scan for unlocking the door. So when a person wants to enter the door he needs to scan the card then he gains access to that door. If he misplaces that card he cannot access through that door and there is a chance of insecurity that anyone can access to the door with that misplaced card. This stands as a drawback to this system.

In reference article 7 studies by Charoen Vongchumyen, Pakorn Watanachaturaporn, pattaya proposed "Door locking system via web application". In this approach, a web application is designed to monitor the door so that user can easily access door by his mobile and he can also check the status whether it is locked or not. There is a drawback in this system: when someone hacked and got security code then hackers can easily access to that room.

In reference article 2 study by Suchit Shavi proposed "Secured Room Access Module". In this approach a keyboard based door unlocking system is implemented with a micro controller. So the user needs to enter his password to unlock the door. In this approach is secured when compared to the previous models and well used in today's world. Even though this system is secured there might be a drawback: If someone observes your password, they can gain access to that door by using the same password you have entered.

In reference article 1 study by Muhammad Kashif Shaikh, Syedannas Bin Mazhar proposed "Comparative Analysis for a Real Time Face Recognition System Using Raspberry Pi". This approach did an analysis of various algorithms on the face recognition system. This analysis took LBPH (Local Binary Pattern Histogram), Fisher Faces, Eigen Faces Algorithms for comparison and checked with different processors to know time complexity and accuracy of various algorithms. This approach is most secured and without matching face no one can access that door.

Hence this survey work proves that face recognition system is the best to approach for using in present days by referencing

this approach we designed a new type of door locking and unlocking system.

4. SYSTEM ANALYSIS

4.1 System architecture

In this, we are using Raspberry pi for connecting with camera module to capture images continuously through Open-CV platform and compared with stored data and send data to another controller unit through Zigbee. Another Controller unit receives through Zigbee and unlocks the door by using an electromagnetic lock.

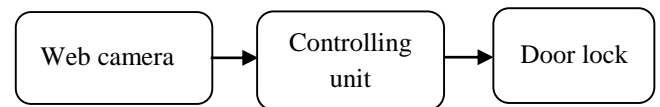


Fig. 1: System architecture for proposed system

4.2 Transmitter

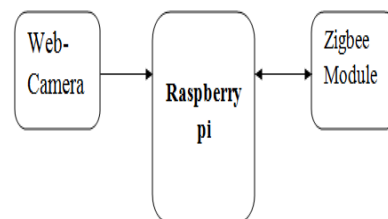


Fig. 2: Block diagram of a transmitter

4.3 Receiver

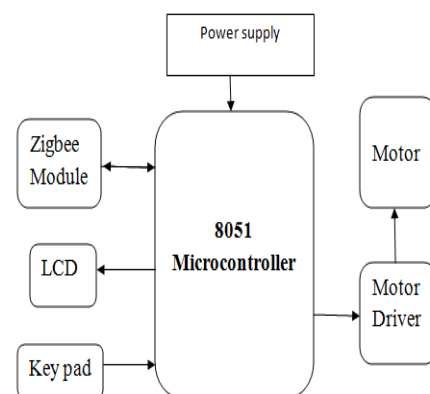


Fig. 3: Block diagram of a receiver

5. EXISTING SYSTEM

In the existing system, we are using password based door lock system which makes the user memorize password all the time. So to overcome this drawback we designing a new system with face recognition.

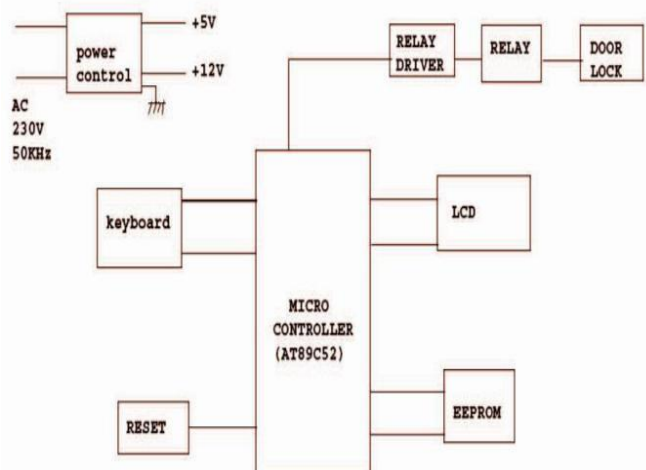


Fig. 4: Block diagram of Secured room access system

5.1 Flowchart

The flowchart operation of the micro controller of 8051 which is used in this module is shown in Fig 5. Until they press the reset trigger, the operation which is performed first and it asks for a new password and that will be stored in the memory of the previous password. The module is then never turn off while performing the operation. Then the micro controller asks for a password every time there will be someone who is trying to access the room. Then it will compare the entered password with the previous password which is set as original password. If the two passwords do not match then it asks that person to re-enter the password, when two passwords match then the door lock is released and the door will unlock and it holds for some time and then it will come back to position.

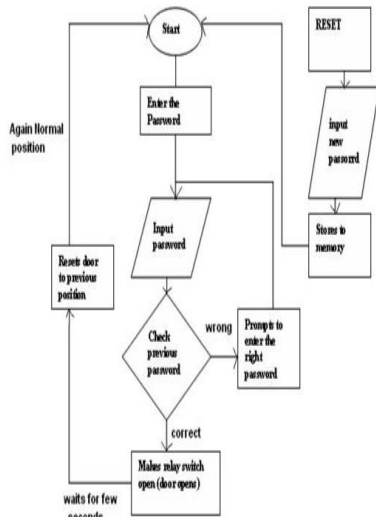


Fig. 5: Flow diagram for an existing system

5.2 8051 Microcontroller

8051 is the IC which is from C51 micro controller family. The AT89S52 is a high performance and consumption is very less the CMOS and Flash memory which is programmable and erasable read only memory (PEROM) having 8-bit microcomputer with 8Kb. The device is manufactured using Atmel’s high density nonvolatile memory and it is compatible with the industry standard of 80S51 and 80S52 instruction set and pin out. The on-chip program memory is allowed by Flash to be reprogrammed by a system or by a nonvolatile memory programmer. By combining a versatile 8bit CPU with Flash on a monolithic chip. The 8051 is a powerful microcomputer which provides cost efficiency and highly flexible solutions too many micro control applications.

5.3 Features

- It is an 8 bit micro controller
- It has 3 timers, one Serial port and four parallel Ports
- It is a 40 pin Dip package IC
- It has 128 bytes of RAM and 4KB of ROM.
- It operates with a frequency of 11.0592 MHZ

5.4 Disadvantages

- It Provides less security
- Every time password entering required for unlocking
- Micro controller cannot interface high power devices directly

6. PROPOSED SYSTEM

In the new system, we are designing a door lock system with the help of the face recognition module. In this, we are using Raspberry pi which has many features that make the user modify use in different smart applications.



Fig. 6: Proposed modules Raspberry Pi with Webcam



Fig. 7: Monitor runs with Raspbian OS

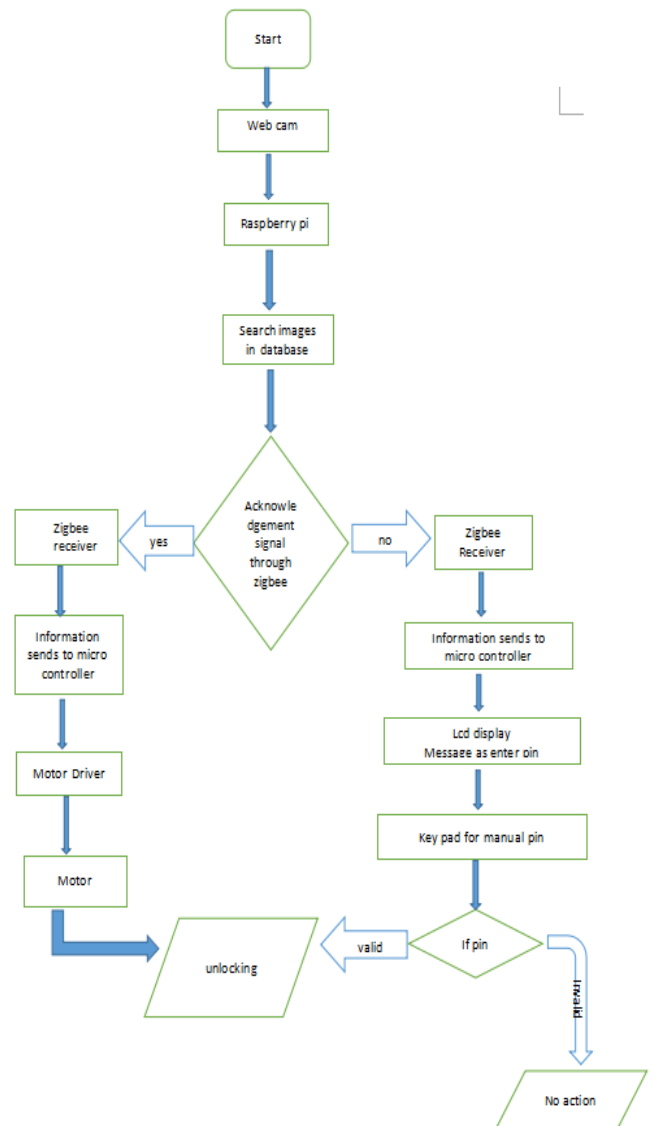


Fig. 8: Flow chart for the proposed system

7. METHODOLOGY

In this, we are using the LBPH (Local Binary Pattern Histogram) Algorithm. This algorithm will give us more accurate results when we compare to other types of algorithms such as Fisher Face, Eigen Faces Algorithms in base paper. This LBPH Algorithm will take number of images as you wish in different angles and check those all images at the time of face no recognition. In our case, we are taking 20 images of a person with different angles and it will be stored in our data base. For this algorithm, we are using VNC viewer to run raspbian os for detecting images from the data base. At first, we have to save images by using data sets and after that, we will train that faces to algorithm then it stores into the data base. At first, it converts color images to gray scale images and then it converts into pixels for detecting this will divides the image into various pieces then it stores the values of each pixel. If pixels are less then it will be represented as 0 and pixels which are high will be 1 then it will be arranged in 3 x 3 matrix format for recognizing the new images on screen compared to data base stored images. Here are some different variations of faces that is capture.



Fig. 9: Data set training images

8. RESULTS AND DISCUSSIONS

In this result we tested in different types of systems to know the accuracy of this system according to the system processing speed performance is depended. This case we captured and shown different machine which is used in testing are listed below with their configurations.

Table 1: Machine for testing accuracy

Machine	Operating system	Processor	Main memory
Dell Inspiration	Window 7	Core i (2 nd gen)	4GB
Acer Aspire	Window 7	Corei5 (2 nd gen)	4GB
HP sleek book 15	Window 10	Corei3 (4 th gen)	4GB
Acer Aspire V5WE2	Window 10	Corei5 (4 th gen)	8GB

This is the graphical representation of the performance and time takes to detect the human face by using the LBPH Algorithm in above listed processors and systems. The system with high configuration takes less time to recognize the face when compared to other processors.

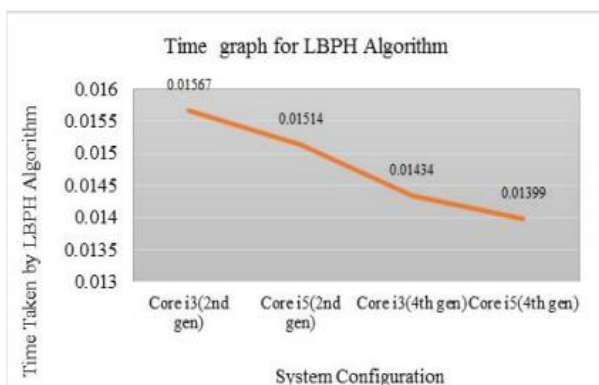


Fig. 11: Graphical representation with time intervals

8.1 Advantages

- High reliability.
- It provides enough flexibility to suit the requirements.
- More secure due to face detection.

8.2 Modules

- **Transmitter section:** This consists of Raspberry pi, camera and Zigbee module. The camera captures images through Open CV and compared with stored authorized images. If it matches the control will send some unique character through Zigbee.
- **Receiver section:** This system consists of 8051 micro controller, keypad, LCD, Motor Driver, Zigbee and DC motor. The controller receives data of unique character and control movement of the motor. Here we are using L293D IC for controlling direction.

8.3 Results

All the modules present in Fig.1 are individually tested and later they integrated into a single main module. Raspberry Pi was programmed successfully using python with open CV and Micro controller was programmed successfully using Embedded C in Keil vision software to achieve face recognition door unlocking system. The individuals who were authorized to access the door he stands in front of the camera and it will capture the image of that person and compare with the data base images. If the images are recognized then automatically door will unlock. When a person image is not detected then it will ask for a manual pin to unlock the door, if that person entered a valid pin the door will unlock. When a person entered the wrong pin then the door will not be opened and denied access to the room. Whereas when recognition of images, the correct pin was detected, relay released the door and access was granted for that person. This was tested with different combinations of faces and pins.

9. CONCLUSION

In this proposed door access system by using face recognition the images are stored in a data base. This system is used door lock access for Residential and Commercial Purposes. Here we have designed a highly secured door locking system by using Raspberry pi

10. REFERENCES

- [1] (2017) "Comparative Analysis for a Real Time Face Recognition System Using Raspberry Pi" Muhammad Kashif Shaikh, Syed Annas Bin Mazhar.
- [2] (2017)"Secured Room Access Module" Suchit Shavi.
- [3] (2017) "Automatic Semantic Face Recognition": Mark S. Nixon University of Southampton Southampton, United Kingdom
- [4] (2017) "Real-Time Implementation of face recognition system" by Neel Ramakant Borkar and Sonia Kuwelkar, India
- [5] (2017) "IoT based Home security through Digital Image Process Algorithms" by A. Beatrice, Dr S. Britto Ramesh Kumar and J. Jerlin Sharmila, India
- [6] (2017) "Secured Room Access Module" by Suchit and Shanvi, India
- [7] (2017) "Door locking system via web application" Charoen Vongchumyen, Watjanapong Kasemsiri, Kiatnarong Tongprasert, Aranya Walairacht, Pattaya.
- [8] (2016) "Arduino Based Door Unlocking System with RealTime Control" Somjit Nath, Paramita Banerjee, Rathindra Nath, Biswas, Swarup Kumar, Mitra.

- [9] (2014) K.Gopalakrishnan, V.Sathish Kumar “embedded image capturing system using the raspberry pi system” international Journal.
- [10](2014) “Development of Intelligent Automatic Door System” Daiki Nishida, Kumiko Tsuzura1, Shunsuke Kudoh1, Kazuo Takai, Tatsuhiro Momodori.
- [11](2012) “Face Recognition Based on Magnetic Door Lock System Using Microcontroller” Harnani Hassan, Raudah, Abu Bakar Ahmad Faculty of Electrical Engineering.
- [12](2005) “Real-time Embedded Face Recognition for Smart Home” by F. Zuo and P. H. N. de.
- [13](2000) “Automatic Door Opener” Pik-Yiu Chan, John D. Enderle.