

Smart Door Lock System Using Facial Recognition

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Abstract- In today's world, face recognition is an important part for the purpose of security and surveillance. Hence there is a need for an efficient and cost effective system. We are building a system which would unlock a door using facial recognition. There will be a sonar sensor which will turn on the camera whenever it detects an object in front of it. Then if the person's image is stored in the computer only then it will unlock the door. When there is not sufficient light, the LDR will turn on the bulb and the same procedure is followed. With the use of the Arduino Uno, we aim at making the system cost effective and easy to use, with high performance.

Keywords- Arduino, Sonar Sensor

I. INTRODUCTION

The information age is quickly revolutionizing the way transactions are completed. There is a need for a faster and accurate user identification and authentication method. Face recognition has become one of the most important user identification methods. Literature survey statistics shows that research work in face recognition system is in its booming era, and in the past forty years, the research in this field has increased exponentially. Face recognition technology emulates the capabilities of human eyes to detect faces [1].

Technology is developed and growing with the usage of different equipment. The trend has moved from fingerprint to face recognition. Nowadays, we prefer a face recognition system for unlocking the door. Facial recognition is widely used in various industries and corporate sectors. In the face recognition approach, a given face is compared with the faces stored in the database so as to recognize the individual. The reason is to find a face in the database, which has the most accuracy with the given face. In the field of biometrics,

facial recognition innovation is one of the quickest developing fields. 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 OpenCV 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.

The steps of proposed work as given below:

1. An object is detected in front of the sonar sensor
2. Camera is turned on captures the video
3. Person's image/video is sent to the computer
4. Computer checks whether it matches with the saved images and sends signal to Arduino
5. If the image matches, the door unlocks
6. If there is not sufficient light, a bulb is automatically turned on
7. Then the process from step-1 is followed

II. MOTIVATION

Being a student of engineering, we have had experience in programming but we haven't had experience in working real time solutions using our knowledge of programming. We think people shouldn't have to settle when it comes to home security. Technology can deliver both quality and convenience in door lock hardware. And the strongest insights come from understanding the people who use it. The need for using keys to unlock a door can be completely eliminated. We

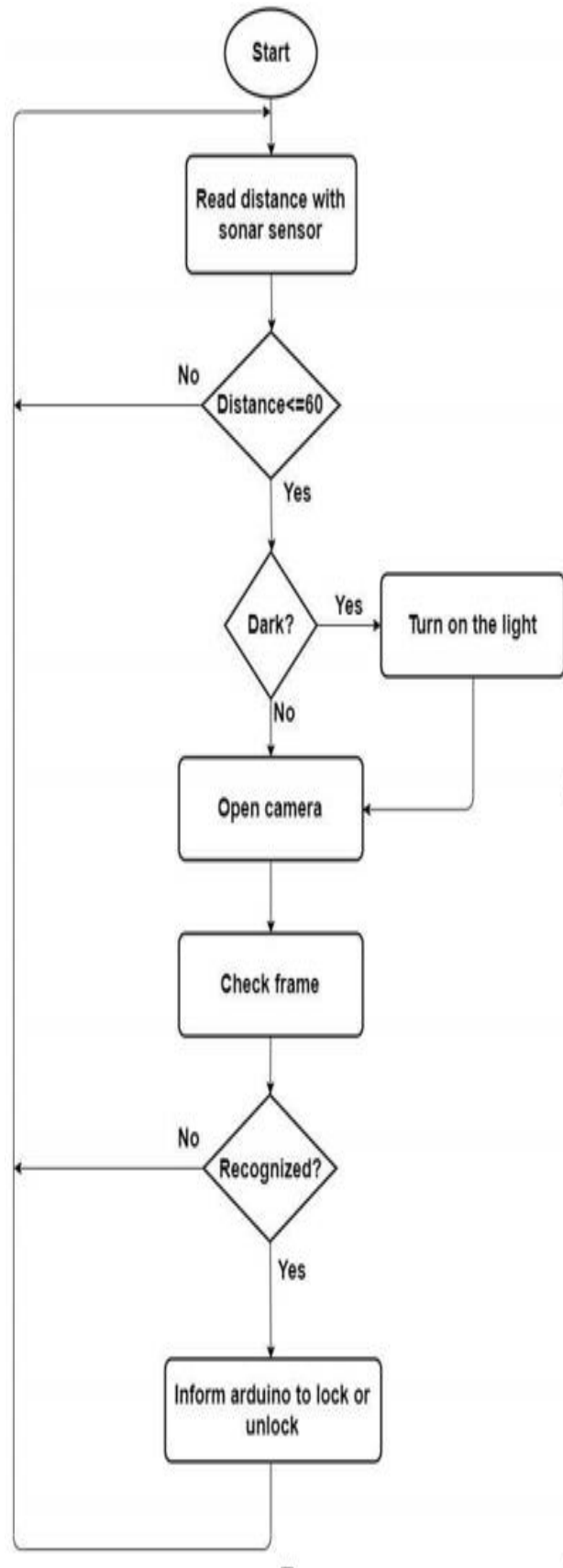
can Replace PC with low-cost processors which make the administrators to get parameters of all the remote devices and to send control information to all the equipment at all the time.

III. LITERATURE REVIEW

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 [2] 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 [3] 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 [4] 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.




IV. FLOWCHART







V. Proposed System

First, we trained the recognizer with the following folder of photos, with help from cascade classifier. The arduino is constantly taking data from the sonar sensor, to know if someone is present in front of the camera. If at any time, it detects that some object is present, it sends a notification through the serial cable to the computer, where a python script is continuously checking for a data. If the script gets the data it was waiting for, it turns on the camera that is connected to a USB port; and captures a frame. Then it turns the frame into an N-dimensional array, with the help of the numpy library. Then the script matches the new array with the old arrays it got from the training script, and if it can find a match, it sends a signal through the serial cable to the arduino, and the arduino then uses the motor driver to lock or unlock the latch. If there were no match, the whole process is repeated. The arduino is also taking values from the LDR. It has a variable called "state" that keeps track of whether it's dark outside or lit. If at any given time, it finds that the state is dark and there is someone in front of the camera, the relay is used to turn on the light bulb, which helps the camera to get a better frame. There is also a push switch connected to the arduino, which sends a value "0" if it's been pressed. The switch is used to control the latch from the inner side from the house. The confidence level used by the python script to make sure about the match is limited, to avoid photos. Due to being still, the photos tend to get a confidence level over 100. Which will be ignored by the script, thus making sure that the system cannot be cheated and it is secured.

A.Components

LDR 5mm	
Gear Motor	
Relay	

Arduino UNO R3	
Webcam/Camera	
Sonar Sensor	
L928N Stepper Motor Driver	
Push switch	

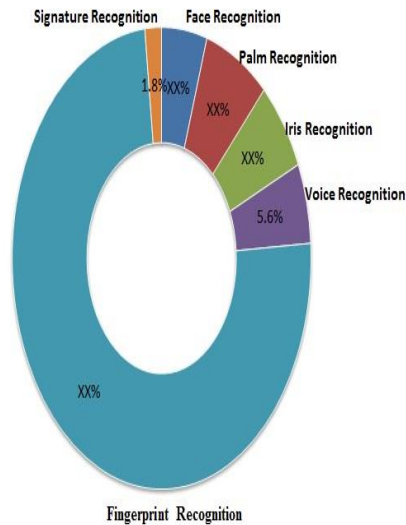
Vi. Experimental Analysis

A. Cost Analysis

No.	Name	Price
1	Arduino UNO R3	420 tk
2	Webcam/Camera	2500 tk
3	Sonar Sensor	100 tk
4	Push switch	5 tk
5	L928N Stepper Motor Driver	250 tk

B. Market Analysis

Fig. 2: Global Smart Door Lock Market Share (%), By Biometric Locks-2016



Source: Industry & Primary Sources, Research Nester

Fig. 1: Global Smart Door Lock Market Share (%), By Region-2021



Source: Industry & Primary Sources, Research Nester

Vii. CONCLUSION

The purpose of the facial recognition system was to make life easier and more secure. Which it does perfectly. It provides us hands-free and secured door-lock system that is hard to cheat and easier to use. Due to being only active when user is present, our system also becomes energy efficient. The use of light bulb and LDR, makes it easier and more convenient. By properly utilizing the confidence, we were able to achieve the ability to detect when someone is trying to cheat the system with a photo. Lastly, due to having all it processing done in a distant server or computer, it doesn't need any extra processing unit, which brings the cost to a very low price while also bumping up the efficiency. The future upgrade of gsm module and cloud computing is going to help us achieve goals we didn't even expect for. With proper planning and use of resources, it could be possible to produce and provide this product in our country for everyone.

A. Limitation

We know that there are some limitations in our system. Firstly we know that the image we are taking from the web camera it needs to be processed in desktop or laptop computers. So it needs to be remain all the the time for processing.

B. Future Work

As convenient as our facial recognition system is, there are still sides to work on and improve. And we have already made some prototypes for the upgrades that needs a little tweaking to make the system even better. First of all, with a cable, there is too much hassle to management. We are planning to introduce a server that will be powered with a raspberry pi. We tried pickle with python and also a php server, and we are still trying to decide which one can make it more convenient and simple. Our idea is to wirelessly send the frames to the main computer from the raspberry pi. Even though raspberry pi is a powerful computer on its own, there is no denying that a complete cisc computer will obviously offer a better result for our system. We are also planning to introduce deep learning into the system. The OpenCV library does give us a huge benefit with the simplicity, but the deep learning system will help us make our system work even better and more confidently. There has also been an idea floating to include a door alignment sensor that will detect break-ins and notify the user through a text, using a GSM module. We are planning to connect a small battery

with the system that will help the system work even when there is a power outage.

Viii. REFERENCES

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