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An IoT device: Smart Door Bolt for home security using Face Recognition

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ABSTRACT: Our door is the first and last thing which come across while entering and leaving the home, that's why the home automation in the door lock system enables users more conveniently to control and monitor the home environment. This paper focuses on the prime aspect ofsecurity and easy access of smart door lock can provide rather than traditional method of door locking system. Most people have an idea about digital lockers but smart door bolts are one step ahead of it. Having a lock and key for the door are the issues in the Traditional method of home security, it is easily breakable and quite outdated too. that's a result of a robbery. To tackle this problem, the concept has intelligent door pop up. In Smart door bolt, there aremany methods are used to unlock the door like smart card scanner, biometric (finger, palm, DNA, iris, Face), specific code, etc. from all this the face recognition is one which gives access with the door without touching anything and also gives more safety. Using face recognition in a security system will give good results in multi-face detection and stranger identification which are the most prior requirements that come under our home security.

Keywords: Smart door bolt, security, Face recognition, motion camera, conveniency, IoT.

I. INTRODUCTION

The Security of our home is a crucial issue nowadays. Everyone is looking for a safe, protected, and trustable device for our door locking system. Everyone wants that our home should be safe and protected for us and our loved ones. keeping this in mind many of the countries developing new ideas and devices for home security systems day by day. From the past few days, it is important to have a safe, convenient, and ideal security system for door lock. Instead of using the card, password, key, pattern for lock using the biometric data is safer and also ideal too, because it does the automatic person identification from the inputs such as fingerprint scanner, palm scanner, DNA analyzers, face recognition. From all this, face recognition has the most effective and valuable advantage that's it hassle-free. In a sense, that individual does not need to touch anything to get identified or recognized. This is the reason for the growth of biometric devices of face-recognizing.

Face recognition is a process which first involves face detection, then face alignment, feature extraction, and at last face recognition. In face detection process one or more faces get located in the image and mark with a bounding box. At the stage of face alignment system normalize theface to be consistent with the database, such as geometry and photometrics. Then feature extraction extract features from the face that can be used for the recognition task, and at the last stage facerecognition perform matching of the face against the known faces in a prepared database. Though at the time of the installation of the device, the faces of family members get scanned and store as a fix data. After that whenever the object or person comes in front of the door the motion-triggered camera captures the pictures and the real-time face detection program gets starts by using the Local Binary Pattern (LBP) method. And then if the person's image matches with anyone from the family member the door will immediately get unlock. If the face is not identified i.e. stranger's face comes in front of the door then the doorbell will ring. And the most important that's if someone tries to break or damage the door the alarm will be raised. As a result, we can surely say that face recognition is one of the best security systems.

II. OBJECTIVES

A. To study if a Smart door bolt security system using face recognition provides more protection and safety measures as compared to a regular door bolt.

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C. To analyse how Face recognition is more preferable among other biometric devices.

By using the survey analysis, the following hypothesis is proposed to attain the above objectives:

H1: Individual using smart door lock experience features like: (a). Security, (b). Easy to use, (c). cost-efficiency.

III. RELATED WORK

In [1], the article proposed by the authors explained how the wireless system provides more flexibility and extensibility than the wired one in-home automation security system. keeping the ZigBee module as a backbone of a digital wireless door lock system which exploits the full capacity of the ZigBee sensor network by integrating home security by home automation. There are fewer cases reported by the media of digital door locks are opened by some invalid users to invade homes and offices than regular door bolt, but cases are there is more focusable point and keeping this in the mind Ha, I. [2] proposed a system which provides strengthened security functions that can transfer the recorded images to the user's mobile device when an invalid user/ stranger attempt any illegal operation. This system makes the user enable to remotely access the door lock and increases the convenience to operate it. In paper [3], the authors are focused mainly on the design of the system which is cheap, simple, can be installed easily, and also can be fully customized based on application specific requirements. a real-time live streaming and monitoring system using Raspberry Pi with installed wi-fi connectivity has explained the model which is proposed in [4] by Solanki, V. P., & Deshmukh, S. To overcome the problems like robbery and identity fraud how the face recognition using deep learning and IoT techniques is used in a door lock system is explained in [5], also this article concludes that combination of face recognizer with IoT experimentally gives a successful result. By having the combination of microcontroller esp8266 and smartphone with the respective application the system gets proposed in paper [7] which makes the door intelligent. This system makes the user control the locking and unlocking of the door via a mobile application. By using the IoT and face recognition Pawar, S., Kithani, V., Ahuja, S., & Sahu, S. proposed a system in [8], which deliver a cost and energy-efficient solution for home security. In that, they have explained how the device can send a notification to the homeowner via SMS and email if any stranger gets detected in front of the door and also gives the warning to the stranger via LED display by using real-time face recognition and face detection. In [10], the authors proved that how the IoT is a need of the era in the field of technology of smart doors. In the proposed system they the exposed smart door lock in the integration of sets of devices were keeping the IoT as a backbone of the system and face recognition as one of the tools of a respective security system. In [15] also the system proposed by the author provides a convenient way to control and monitor the door via mobile application.

IV. METHODOLOGY

Using an online survey is held which contains the questionnaires to test the proposed hypothesis. Link of that form was circulated through social media platforms to my target population. From the responses, certain parameters get concluded to obtain the solutionof objectives.

A. PARTICIPANTS:

Based on two conditions i.e. security and convenience the proposed hypothesis gets tested.
A total of 55 respondent data was collected from the target population. Among the 55 population,55% were male and 45% were female.

B. MEASURES:

Gender	Security	Conveniency	Total
Male	18	12	**30**
Female	10	15	**25**
Total	**28**	**27**	**55**

Observed Value

The above-observed table shows the data obtained by the survey form and for calculate the expected data there is a simple formula:

Expected value= (row total) *(column total) / (Grand total)

Gender	Security	Conveniency	Total
Male	15.27	14.73	**30**
Female	12.73	12.27	**25**
Total	**28**	**27**	**50**

Expected Value

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From observed value and expected value, we can apply the formula of the chi-square test

$X^2=\sum\frac{(O_i-E_i)^2}{E_i}$ where, O_i= Observed value, E_i= Expected value

V. EXPERIMENT

After collecting the observed and expected values test score of independent samples was calculated at the significance level of 95% using the chi-square test from the formula of chi-square X^2 is obtained i.e. 2.186909927. the tabulated value for chi-square is 3.84 and after calculation 2.186909927 is the value obtained as a calculated value. So, plotting both the value on a graph, statistics of Chi-square test formed with the degree of freedom 1.

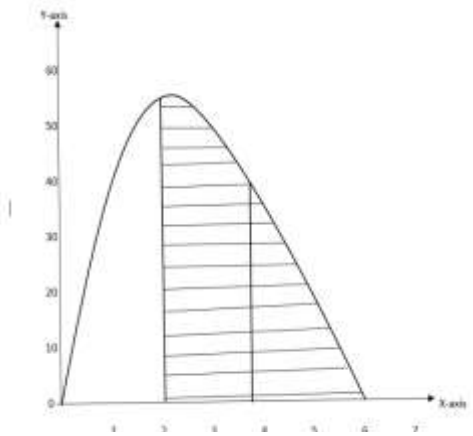

Fig1. STATISTIC OF CHI-SQUARE TEST

VI. RESULT

The score of independent data using the survey analysis and calculated Chi-square value by the experiment resulted that participants experience better security and convenience in an IOT based smart door bolt system using face recognition. The proposed device can fulfill and satisfies all the prior requirements of the user. Hence, "H1" is accepted.

VII. LIMITATIONS AND FUTURE SCOPE

This research study utilized a sample of the target population who were possessive about respective home security. The study only included limited parameters that can achieve the objectives but not enough to complete the implementations happening in the area of security systems. Implementation of face recognition in smart door lock obviously gives secure accessibility but fraud can happen with some cheap devices. Not using the proper software leads to detect 2D images also. So, anyone who knows unlocking face he/she could unlock the door just using a photograph of that person. In the future, while implementation face recognition into the smart door lock there should be a restriction to allow only verified software that can detect 3D and moving objects only.

VIII. CONCLUTION

When it comes to accessibility, security, convenience, face detection in a smart door lock is one of the best security systems. But still only in the huge towers, in high society area, this IoT device gets installed. By increasing the productivity and availability of smart door bolts in the market with some decrement at the starting in the cost a common man can also prefer to use it.The study in this paper, reaches till the prime aspect of it.

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