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Door Unlock by Face Recognition (DUFR)

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ABSTRACT

The proposed paper is proposing a solution and mechanism which is grounded and focused on the security parameter. It is evident that with the passage of time substantial advancements and progressions have been developed in the past decade which is adequately helping and facilitating end-users with a satisfactory level of ease concerning their daily routines and habits. The development and establishments are in tangible and intangible forms such as mobile applications, security devices, and several others. On such stance, the researchers of this paper are focused on the development of a platform which facilitates the people with significant ease factor in their daily routines and habits. Therefore, researchers have proposed and developed a platform or solution that help the people in the attainment of ease factor regarding security. Researchers had a keen focused on usability, feasibility, ease, and usefulness that ultimately help in the attainment of high-quality outcomes. Thus, this paper has proposed and developed a solution concerning the security aspects which is Door Unlock by Using Face Recognition (DUFR) that assists in the accomplishment of security facets within the territory of homes, educational institutions, offices, healthcare units, and various different areas.

Keywords: *IoT, Face Recognition, Security, Safety, Technology*.

1. INTRODUCTION

As per the research of [1], it has been determined that technology is playing a vital role in the advancement and progression that have taken place in the current epoch. [2], has posited in his research that in the modernization era technology is helping people with numerous factors of ease which has not been possible in the previous decades. Similar aspect has also been highlighted in the research of [3], where it is addressed profoundly that in modernization era of technology several platforms have developed in the form of mobile application, web platforms and numerous others which is helping people in the attainment of adequate artifacts that have not been possible previously. Moreover, the predominant aspect behind momentous of the technology has been addressed in the research of [4], where it has been examined that although technology in itself is noteworthy and advantageous; however, the prominence of technology could not be possible if it is not focusing on the POBL (Problem Oriented Based Learning). POBL is a concept in itself that is emphasized on the solution which is helping, facilitating, and providing the people with the platforms, or solution that is helpful in solving numerous problems. [5], has delineated that e-commerce, mobile applications, embedded systems, and several other platforms have one similar aspect that they are aimed towards the provision of sufficient ease factor to their targeted consumers; however, this facet makes technology-based platform on the same page. Therefore, the provision of ease factor is mainly depended on the high level of security, as it is evident in the research of [6] that people are devoted and have trust on such platforms which are helping them in accomplishing ease factors along with the levels of security and privacy. Furthermore, security is major concern of the people either it is related to personal and professional concerns. It has been examined from [7] that the focus of the people on security, privacy, confidentiality, and authentication is one the predominant aspects that have been topic of discussion in technological era especially when technology and its advancements are on peak. It is further inspected from [7] that with time where the technology and other facets have been modified, people's concern about security, privacy, authentication, and confidentiality has also been increased. [8], has articulated that several researchers, scientist, and professionals have developed, proposed, and established the platform which is adequately facilitating the people with sufficient level of ease factor along with privacy and security. Moreover, the researchers of this paper are keenly focused on discussing and developing a platform that is emphasis security along with high-level of ease factor.

Additionally, [7], has defined the significance of IoT and addressed that with the passage of time there has been substantial momentous in the concepts of IoT which are helping the people in the attainment of sufficient ease factor as well as with the ability to become smart. IoT successfully facilitates people with ease and usability facets ubiquitously. According to [9] the concept of IoT is focused on the human to human and human to computer interaction which is making IoT an interrelated system that facilitates the people with a high-level of effectiveness and efficiency which further help in becoming smart. [7], has defined that IoT is integrated with multiple sensors, actuators, and various Internet connectivity programs to

collect, share, and collect data. It is an effective and important global network structure with many self-configured functions that characterize the connection of some "objects", sensors and elements and represent intelligent devices. [7], has also discussed that the security, privacy, and trust in IoT or IoT based technologies is obligatory which further helps end-users to attain high-quality outcomes through IoT. Therefore, it can be stated that through sensors, actuators and the efficiency to provide the ease factor to end-users ubiquitously, IoT is also focused on the POBL phenomena which are supporting the end-users in several domains either in educational institutions, healthcare units, agriculture, and others. Consequently, on such a stance the researchers have evaluated several aspects that could help them in the development and discussion of a platform that is novel in itself and based on the security and ease factor aspects. After several inspection and investigation, researchers have identified that there are some issues regarding the educational institutions, business vicinities, industries, and homes in terms of people's entrance in their area. However, lack of security regarding the people's entrance leads towards several negative consequences that have been further demarcated in this [10] paper profoundly. So, on such stance researchers have developed and discussed a mechanism and solution that is helping the vicinities towards the attainment of high-security level with respect to the presence of people outside the door of any academic institutions, healthcare units, business vicinities, homes and other places. This ultimately helps in managing and monitoring the domains ubiquitously. Therefore, Door Unlock by Using Face Recognition (DUFR) is a platform which is facilitating the people in accomplishing the high-security level along with ease. Thus, comprehensive discussion has been further discussed in this paper with appropriate diagrams, workflow, and activities accordingly.

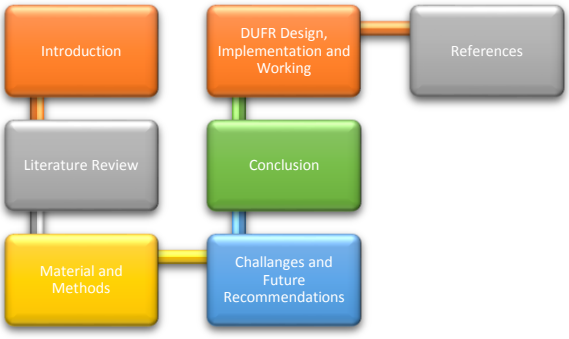

Fig. 1. Outline of DUFR

2. LITERATURE REVIEW

In this section of the paper, a profound literature review has been conducted by the authors, that help in identifying the research gap which highlights the uniqueness of the DUFR. However, using the PRISMA model mentioned in Fig .2 the assimilation of data has been delineated adequately.

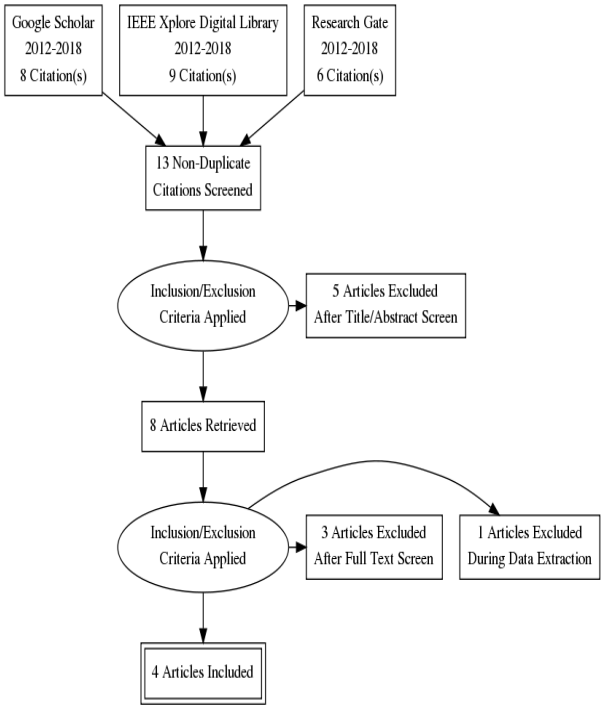

Fig. 2. Inclusion and Exclusion Criteria Using the PRISMA model

As per [11], it has been examined that there is a face recognition approach suggested by the authors; moreover, face object is provided which is further compared with the given dataset in order to identify the object whether the given object is native or not. The objective of [11] is to identify and match the object in the database. On the other hand, the research of [12] discusses that the world is progressing with the technological advancements that have taken place in this epoch adequately; however, individuals are scared about safety of their possessions, information or in other words security, privacy, authenticity, and confidentiality considered as the primary concerns of the populace in the 21st Century. However, by focusing on the objective to facilitate the end-users with a system which is emphasized on the security concern of the individuals. Therefore, authors of [12] have proposed a solution named as SMART DOOR and it is anticipated in the paper that with the passage of time the concepts of smart homes will attain remarkable prominence among the populace; thus, it is necessary to have a keen focused on the security and privacy concern.

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Table 1: Research Gap

No.		Face Recognition	Send Notification	Send Image	Remotely lock/unlock by mobile app	Register person through the hardware	Easy to install
1	**Smart Door with Face Unlock (2019)**	✓	×	×	×	×	×
2	**Intelligent Door Lock (2018)**	✓	×	×	×	✓	×
3	**Smart Door (2017)**	✓	×	×	×	×	✓
4	**Automatic Door Locking System (IJEDR 2016)**	×	×	×	✓	×	✓
5	***Door unlocks By Face Recognition (DUFR)***	✓	✓	✓	✓	✓	✓
Available in DUFR (✓)				**Not Available in DUFR (×)**			

According to [13] it has been examined that the authors have delineated the structure of the system which is aimed at the provision of security concerning homes, banks and similar-related vicinities which include the functionality of sending alerts utilizing GSM-modules. A module naming Raspberry pi has been used to operate the system and controls, the usage of the video camera has also been utilized in order to turn on relay which further help in the door unlock; moreover, the system captures six images to create a database. The Raspberry pi module works in coordination with the system that utilized in comparing the images which are stored in the databases. Lastly, in [14] authors have used the Raspberry Pi module the which is connected or working with the help of infrared system; however, for the model which has been proposed in [14] is although targeted on the security parameters but it is quite difficult in the utilization and implementation because of infrared technology. Therefore, the model which has been proposed in [14] known as smart surveillance monitoring security that can be used as any type of public security using living body detection or spying. Hence, after analyzing relevant data, authors identify the unique factor for the DUFR with the help of functional analysis, which has been further delineated in Table.01 adequately.

3. MATERIAL AND METHODS

DUFR is an amalgamation of hardware and software which is adequately helping in accomplishing the research aim which is designed in order to facilitate the end-users with high-quality security outcomes. Several hardware and software components and platforms have been used in DUFR which has been demarcated in the section. In addition, reflection on how such platforms and components have been incorporated in DUFR has been discussed in this section. Fig.3 illustrates the DUFR block diagram.

3.1 Hardware Material and Methods

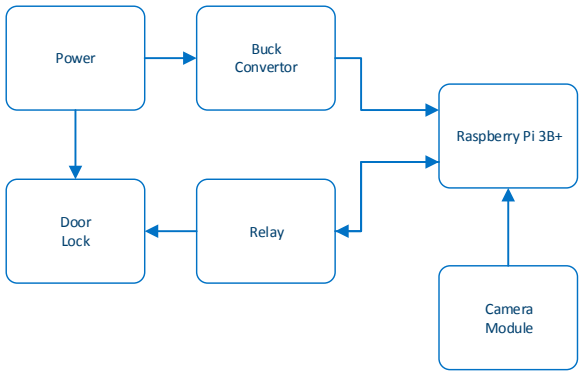

Fig. 3. DUFR Block Diagram

3.1.1 Raspberry pi

As per [15], A Raspberry pi is an all-purpose mini-computer system which can entertain all connection like a regular PC. It uses an ARM processor it does not run like your normal operating system and require a Linux based open-source operating system. The Raspberry Pi is a conventional board, a credit card Size computer that plugs into a monitor and uses a keyboard and a mouse it is a small board that enables peoples of all ages to explore computing. Moreover, the rationale behind using the Raspberry pi in DUFR is because Raspberry pi is all-purpose full-fledge mini-computer costing reasonable

amount of money. It does not require much to run just a 5V volt adaptor is enough and system is good to go. DUFR uses Raspberry as it was better option to run the tasks that are required by DUFR which other embedded devices like Arduino failed to provide. Face recognition requires a lot of computational power which cannot be done on a small it requires a computer with graphic aid or it can be done on signal chip embedded system like Raspberry pi because it does not have many processes like traditional computers that need to be run in background. In addition, along with Computational power Raspberry pi is also providing GPIO control that is one of the parameters of DUFR, which helps in the attainment of quality outcomes.

3.1.2 Pi-Camera Module

[16], has defined that DUFR is using Noir V2 camera that is the official Raspberry pi Camera that is made and released by the Raspberry Pi foundation. It is a High-Quality Wide Angle 8 Megapixel Sony IMX219 custom designed add-on for Raspberry Pi that comes with a focus lens [17]. However, it is an adequate hardware mechanism for face recognition as it captures quality images with a wide-angle that helps in presenting good images to the system for further processing. Pi Noir Gives Everything a normal camera gives, in addition, it comes in varieties like normal camera and night vision which enables you to see at night with a little modification. V2 also has infrared variant that helps see in daylight with a clear picture.

3.1.3 Relay Module

DUFR uses a single-channel switching relay that will be able to operate Door Locking system when an electric current is applied by Raspberry pi through GPIO pins. Relays are switching that open and close circuits in an instance applying required current tin that instance A relay is normally on NO (normally open) state that changes only when current is applied then revert back to old state [18]. Simply put Relay can be seen as electrically operated switch. They also have electromagnetic and mechanically operated switch. Which also abides other operating principles like solid-state relays. Relays are used where it necessary to control high-power machines with low power signals.

3.1.4 Electric Strike (Solenoid)

A 12-volt solenoid Based Electric locking System used in this DUFR. It Functionality is similar to the relay module as they both work on electric pulse a difference is that relay opens a channel for electricity while electric strike strikes the door lock switch from OFF state to ON as long electric pulse is provided. It is the best replacement for fixed plate locking system. This type of electro-mechanical locking mechanism. This type of lock is featured by the use of a solenoid rod to throw bolt. These locks use microprocessor to perform voltage regulation reduce consumption and provide control for access [19].

3.1.5 Buck Converter

A buck converter is a DC-DC converter that steps down voltage and steps up current during the process from input to its output load. Buck Converter provides balance of flexibilities and ease of use. It features a controller with one or more FET ICs. The Buck Converter used circuits for which output DC Voltage needs to be lower than the DC input voltage. It can be rectified to AC or can be proved with AC from Dc supply. It is useful where electrical isolation is not needed between the switching circuit and the output. It is the best possible option to reduce external attachment for power sources like power adapters, external wiring because DUFR contains multiple objects with different power requirements so instead of using different power sources a single buck converter will be used which can convert higher voltages to lower digits. [20]. Fig 4 is representing the Buck Converter.

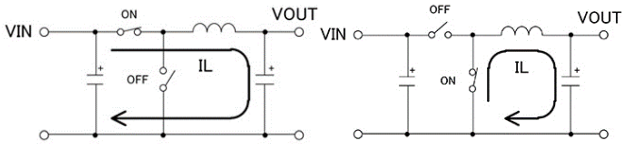

Fig. 4. Buck Converter

3.1.6 Power Source

As a Power source, a 12-volt Dc adapter has been used in DUFR. A Dc adapter is a type of external power supply that includes plug pack, plug-in adapter, adapter block, domestic mains adapter, power line. An Adapter gives replaces a fixed power supply and can be used for portable means.

3.2 Software Material and Method

In order to adequately accomplished the aim of this paper, this section addresses the software tools which have been used in DUFR. However, Table.02 is addressing the software tools which have been adopted by researchers. Therefore, the focus on the researchers is on the "WHY" factor, thus, explanation is delineating the rationale behind the implementation of such software tools in DUFR.

Table 2: Software Tools and Methods

S. No	Software Tools	Explanation
1	OpenCV	OpenCV is an open source library. It is also used as machine learning software. OpenCV was built to provide a structure of computer vision applications. In addition, it supports the use of machine perception, in this library 2500+ optimized algorithms for image processing and machine learning. OpenCV is a package of python bindings that is developed to compute Computer Vision Problems.
2	Operating System	Raspbian is a Debian based computer operating system developed for raspberry pi. There are several versions that are developed till date that has different functionalities and features. Raspbian stretch is one of the most successful variants of the Raspberry operating system line. The Pi OS provides LXDE desktop environment which is good for fair usage as Raspberry Pi has limited processor speed and memory as long user does not run a heavy task Raspberry pi provide the best support
3	Android Studio	Android Studio is an Official Integrated Development environment for Googles Android Operating system built on Java JRE and Intel IDEA Software designed Especially for Android development. It contains a base workplace and an extensible plugin system for customizing and Android Environment It mostly used Java Language But now is converting to Kotlin as well.
4	Firebase	A light weight database this used to store data both online and offline firebase was once called BaaS later grew up in a next-generation development platform on Google cloud Platform. Firebase is you server, your API and your database written in such a way that you can modify and use it according to your need. Firebase worked as backend service whenever there is a change in data it automatically updates the server. Thus, performing real time data base features.
5	Pusher	Pusher is a hosted API with less codes. Pusher is used by developers to make app related to communications and collaboration features. Pusher is the leader in such category. Pusher is used for in-app notification, chats, real-time graphs, geo tracking. Pusher is a hosted web service that it easy to add real-time data and functionality to web applications as well as mobile applications. Pusher can also be called as a layer between server and client
6	Python	Python IDLE is an integrated environment for editing running and compiling python codes of python 2 or python 3 programs

4. DUFR DESIGN, IMPLEMENTATION AND WORKING

This proposed section of the paper is delineating the design and implementation of DUFR that help the readers in understanding how DUFR will be work, what will be the flow of the DUFR, different stances, and conditions as well as several others aspects which are necessary for discussing design and implementation comprehensively.

4.1 Overall Working Flow

Fig 5 displays the Systematic working of DUFR, how does it work, DUFR before implementing will be trained on data sets that comprise of the image containing face feature of the people. DUFR is completely unreachable for users who are unidentified however a button will be provided for exam
ple A Doorbell, DUFR can be trained to auto-detect movement but to overcome wastage of power.
A button is provided as explained, User upon arrival presses the button that will trigger the system to start and the camera attached will captures image if detected else a notification will be sent.in case of detection captured image will be sent further into the system where it will be checked with the stored face IDs. Moreover, on successful match system will trigger the lock to open. but on a false match, a notification will be sent to the mobile device where mobile users can also manual access door lock to lock or unlock based on personal decision.

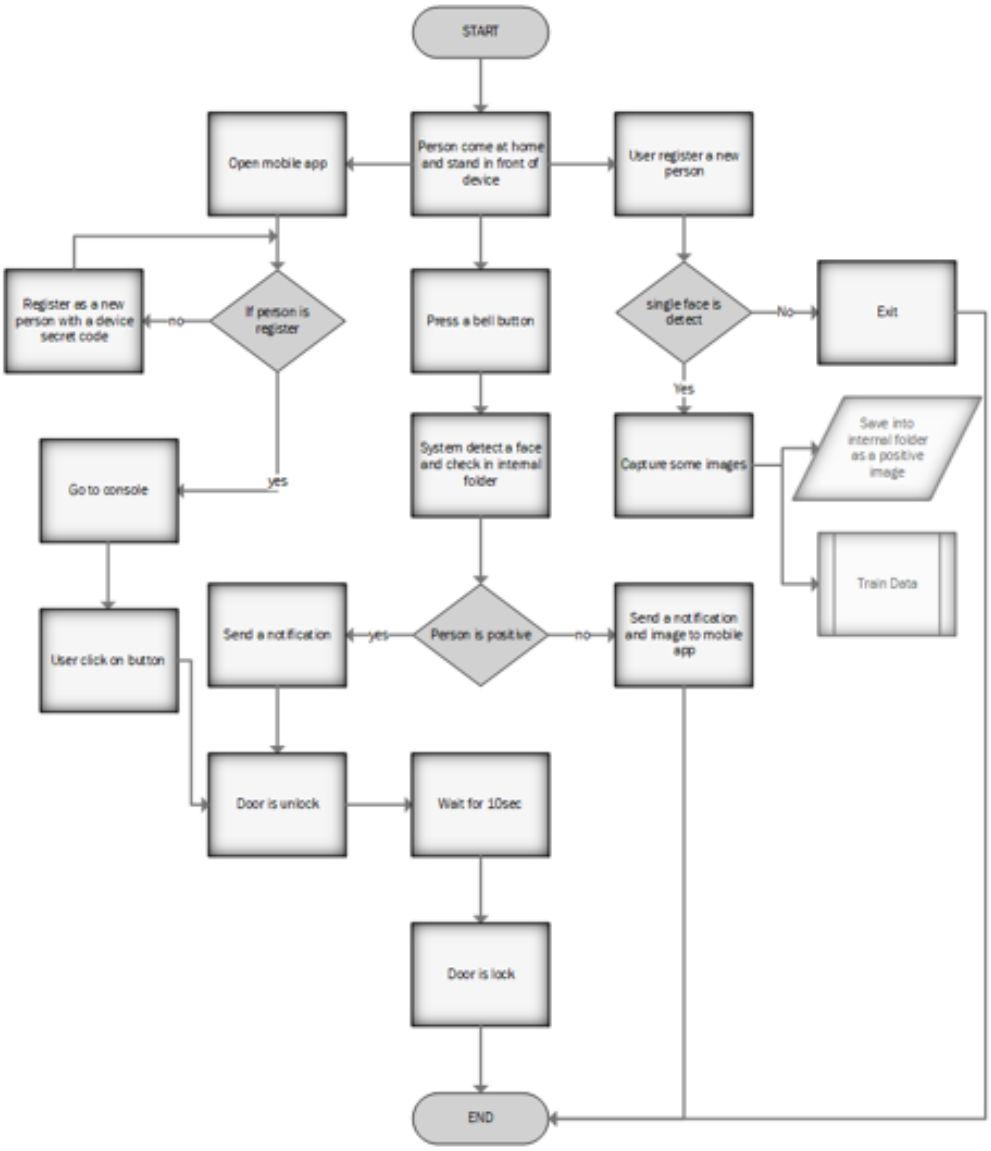

Fig. 5. Overall Flow of DUFR

4.2 System and Architectural Design

In this paper, as discussed earlier DUFR comprised of both Hardware and Software. It contains different layers that perform specified tasks. DUFR is designed to be low cost and effective at the same time. It was developed to provide ease to the user in terms of security. DUFR is basically a system that will ease and a helping hand in securing your home when you are away at work or running errands. It can also provide support to weak old or Handicap as it is hard for them to run to the door by themselves. Fig .6 illustrates an architectural representation of DUFR.

```
haar_faces = cv2.CascadeClassifier(config.HAAR_FACES)


def detect_single(image):
        faces = haar_faces.detectMultiScale(image,
                                scaleFactor=config.HAAR_SCALE_FACTOR,
                                minNeighbors=config.HAAR_MIN_NEIGHBORS,
                                minSize=config.HAAR_MIN_SIZE,
                                flags=cv2.CASCADE_SCALE_IMAGE)
        if len(faces) != 1:
                return None
        return faces[0]

def crop(image, x, y, w, h):
        
        crop_height = int((config.FACE_HEIGHT / float(config.FACE_WIDTH)) * w)
        midy = y + h/2
        y1 = max(0, midy-crop_height/2)
        y2 = min(image.shape[0]-1, midy+crop_height/2)
        return image[y1:y2, x:x+w]
```

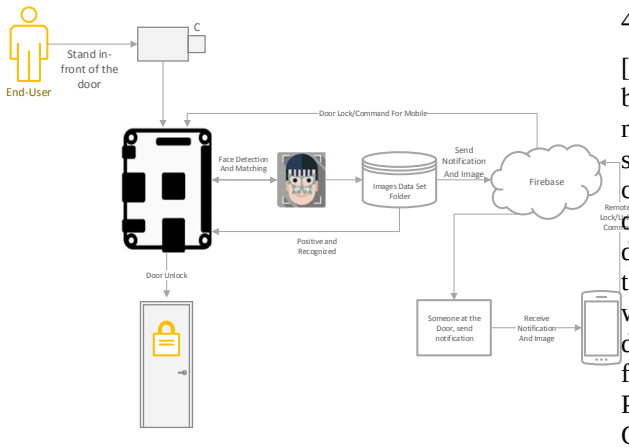

Fig. 6. Architectural Representation of DUFR

The Core Functionality of Face Recognition is based on Haar Cascade Classifier's object detection. Cascade features Detect features like Human Face, eyes nose and mouth for which the machine needs to train first. Fortunately, Haar Cascade is developed as an open-source that makes an application like Face Recognition and related Computer vision program called Open Computer Vision (OpenCV) OpenCV library that helps in various field like Robotics, Image Processing Human-Computer Interaction (HCI), Biometrics, Artificial Intelligence (AI), and some other areas.

4.3 Face Detection

A modern Technique that is used to detect Human Face using some defined algorithm. This technique ignores other objects and focuses on face features or faces. It utilizes encoding and enhances the contrast between different regions. Face detection techniques encode information about images and detect objects accordingly. DUFR utilizes Haar Cascade Classifier and encodes its features in face detection. A face detecting algorithm was run on multiple images to test the detection algorithm.
The Test Code was run using OpenCV that helped in detection. A Version of Haar cascade library was used that is harcascade_frontalface_default.xml whereas for eye detection Haar_cascade_facedefault.xml. On Running the Source Code, the face is detected by the system and detected regions are highlighted, Fig .7 is delineating such aspect adequately.

4.3.1 Haar Cascade Classifier

As per the research of [21], it has been analyzed that the Haar Cascade classifier is a classifier that detects for which it has been trained. Haar cascade provides interaction betw e. The model image is the image that is stored with classifier to check resemblance. Detecting subsection of image is Haar's Features. Cascade is ordered to find region of interaction by source code and then it applies classifier.

Fig .7 Haar_cascade_facedefault.xml.

4.3.2 Face Recognition Process

[22], has defined that Face Recognition is a type of biometric software that detects a person's face features mathematically and saves the data as a face print. The software uses a deep learning algorithm to compare a captured image or a digital image to the stored print in order to acknowledge identity [22]. An Algorithm that is designed to detect human face. The operation is done through different phases First system must detect the face with the help of OpenCV then Face recognition will be done this concept uses Eigen Values. These are the feature that helps to recognize a face. Face Recognition Process is the Core Functionality of the system. Haar Cascade that helps in detection after detection the face will be cropped out. Then the classifier which is trained for face recognition will compare the detected face with stored face. A threshold is set to on the algorithm which will determine confidence of recognition which is used to acknowledge the recognized face. The image could be recognized by checking the key features like eyes nose and mouth. Therefore, the process of face recognition has been illustrated in Fig .8 and Fig .9.

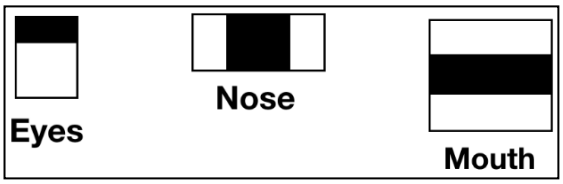

Fig. 8. Face Recognition Elements

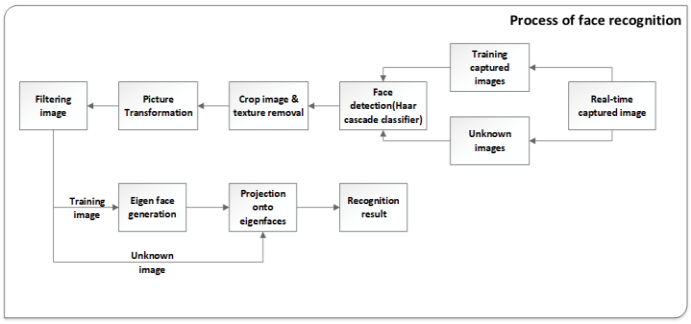

Fig. 9. Face Recognition Process

4.4 Construction and Composition

As per the research of [1], it has been analyzed that due to technological advancements along with progressions that have taken place currently have highlighted significance of the security which is considered as one of the main concerns nowadays. Millions of worth assets are lost from homes, shops, offices and other places due to lack of security [23]. [24] has discussed that due to busy lifestyles and busy schedules, people cannot play a

vigorous role in monitoring and managing the security issues that might occur due to the theft in developed and developing countries. However, it can be stated that it is necessary to know the movement at the door; moreover, it is not possible for the people every time in the modernization era that someone stays at home for security and others go out for work. The world we have today where objects are changing and modifying daily into a smart object. Several applications, products, and platforms have been developed based on POBL which is helping the people with substantial factors of ease. Also, it is not the era where people can blindly trust the old and conventional security specifically speaking our door locks to change and modernize object, it is necessary to eliminate previous errors or wrong deeds. One Possible and easy solution is to install a doorbell with camera. That can keep an eye on every movement as well as informing the end-users. The most recent and most trending techniques used for these purposes is face detection. That demonstrates the fact that computers have reached the point where face detection can be done easily and accurately; however, various techniques are available such as entry-controlled security, door intercoms, etc. The main technical aspect of face detection security is the image captured by camera as like human eye. This makes it easier to determine the situation person time of movement made at your doorstep [25]. Hence, system that allows user to keep an eye for security and run other errands. This thought can no longer be a myth. Therefore, by focusing on such aspects researchers have proposed and developed a system that is aimed towards the security that can be done with regards to the complete surveillance and control to the user of the Door. The objective of this paper is to design a face recognition system. Backed by a database, implement the design, add novelty of being able to send notification via Internet to designated handheld device and to test the face expression lighting effects and face angle that affects the accuracy of face recognition. Fig 10 illustrates the features of DUFR.

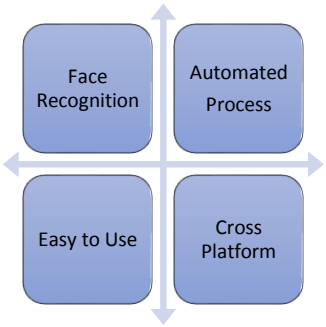

Fig. 10. DUFR Features

DUFR used the Haar Cascade algorithm for face detection and Android app for using remotely lock or unlock the door and receive notifications when person is not recognizable or negative person face. Below mentioned table delineates the comparison of DUFR with other relatable systems; however, this ultimately helps in highlighting the X-factor of DUFR which has been done through a thorough compare and contrast results. Table .01 is illustrating the compare and contrast adequately. Furthermore, DUFR comprises two phases where system utilizes hardware attached and software developed to fulfill the requirement for which the system is designed. DUFR is designed like a plug and play. The developed system is a complete package users just need to do some starting drills and system is good to go. When DUFR is in full working status it will now be able to detect object while a Button is also provided that works like a bell-button when someone is at the door, he/she pushes the bell-button which will trigger the system and detecting mechanism will start. Recognition is the next step after detection system will recognize the detected object this may take 5 to 10 seconds if the object is recognizing door lock will be operated using GPIO Pins, however options stills remain if the object is not recognized next phase that is software will be approached. In addition, before operating the android application, questions arise how it can be used and installed and connected with hardware. The application will be available on app store if not a copy can also be obtained application contains all the libraries and features there is no reason to prepare an environment to operate or connect with the hardware. A Code will be provided that will allow user to connect their android phone with the designated Device. Fig .11 is delineating it profoundly. Simultaneously, after the application is set up and ready to go the hardware that failed to recognize the object sends a notification to the android application that is connected with a picture of the detected object. Android applications can also be able to control the Locking system. The locking code has been delineated in Fig 12. If the detected object is recognized by the user will have option to manually operate the door lock.

```
PAHT_CRED = '/home/pi/mylock/cred.json'
URL_DB = 'https://doorlock-160d8.firebaseio.com/'
REF_HOME = 'Home'
REF_CONLOCK = 'control'

class IOT():

    def __init__(self):
        cred = credentials.Certificate(PAHT_CRED)
        firebase_admin.initialize_app(cred, {
            'databaseURL': URL_DB

        })

        self.refHome = db.reference(REF_HOME)

        #self.estructuraInicialDB() # only run the first time
        self.refconlock = self.refHome.child(REF_CONLOCK)

    def structuralInitialDB(self):
        self.refHome.set({
            'control':False
        })
```

Fig. 11. Connection of Android Devices with DUFR

```
private void controlDoor(final DatabaseReference refdoor, final ToggleButton btn_Toggle) {
    btn_Toggle.setOnCheckedChangeListener((compoundButton, isChecked) → {
            refdoor.setValue(isChecked);
    });

    refdoor.addValueEventListener(new ValueEventListener() {
        @Override
        public void onDataChange(DataSnapshot dataSnapshot) {
            if (btn_Toggle.isChecked()) {
                new Thread((Runnable) () → {
                        img.post(() → {
                                img.setImageResource(R.drawable.unlock);
                        });
                }).start();
                txttoogle.setText("Door is unlock");
                Toast.makeText( context: MainActivity.this, text: "Door is unlock", Toast.LENGTH_LONG)
            } else {
                new Thread((Runnable) () → {
                        img.post(() → {
                                img.setImageResource(R.drawable.lock);
                        });
                }).start();
                txttoogle.setText("Door is lock");
                Toast.makeText( context: MainActivity.this, text: "Door is lock", Toast.LENGTH_LONG).s
            }
        }
```

Fig. 12. Locking Code and Control

On the other hand, before operating the android application questions arises how it can be used and installed and connected with the hardware. Adhering to application availability, DUFR Application will be available on app store which help in the easy installation process as google play store had substantial impact as well as the users globally; in order to connect with the hardware (DUFR) code will be provided that will allow user to connect their android phone with the DUFR Fig 11 is representing the code which help in the attainment of such aspect. Furthermore, after easy installation and availability of DUFR along with the connectivity with the hardware, it is essential to have some time of medium which help the end-users in order to know about the activities such as connection failed, successful, warning, object information which come across the DUFR and others; however, for such concern notification has been generate on the android application of the end-users. The object sends a notification to the android application that is connected with a picture of the detected object. Android applications can also be able to control the Locking system. If the detected object is recognized by the user will have the option to manually operate the door lock. Henceforth, DUFR is intended to facilitate people with ease factor by solving their problem in an effective way, the main agenda of DUFR is to deliver the approach and mechanism which ultimately help in the attainment of the high level of security.

5. CONCLUSION

To conclude the paper, the development of DUFR comprised of DUFR is developed and designed as a Face recognition based IoT Device which works on two cases if an individual is authenticated DUFR will trigger the lock and opens the door allowing the person enter and in case un authentication individual is not allowed however notification is sent to mobile device. DUFR is comprised of face recognition with raspberry pi which makes the system a lot lighter. In addition, DUFR requires less power as compared to PC based face recognition which makes it more convenient. DUFR will also be provided a secondary power source that is power bank which makes it more reliable in terms of power-consuming. It is a low cost highly reliable DUFR. It makes use of resources around it and provides results. However, the system is still low profile and is working on to work on larger scale. A new set of tools can improve its functionality. DUFR is tested with different face ids and it proved to be efficient and effective in terms of face recognition and face detection. The testing is done on both real-time face detection and face recognition. The system shows excellent performance after a lot of testing and modification. This shows feasibility of the system with a low-cost environment. Lastly, the development is cheap highly reliable and fast raspberry pi provides more functionality with less power consumption and enough flexibility that provides that suits the requirement of different people at the same time.

6. CHALLENGES AND FUTURE RECOMMENDATION

Technology is booming very fast around the globe different new invention is being developed and can be seen implemented in daily life but as Pakistan is a third world country which makes things a little hard for technologist to developed latest technologies as the trends are still decades old Generation-X has the lead of the economy that makes new technologies like Artificial intelligence Internet of things less prosper as they do not understand these technologies and people fear what they don't understand. But as the millennials are entering the race, they understand the technologies well and making it possible for technologist to work more. Likewise, we also face the same problems as there is less work is done on the topic that we chose so it hard to gather ideas. The biggest hurdle of all was that the system uses an embedded system like Raspberry Pi which does not have a proper software or pattern for setting environment for Face recognition it took a lot of time to set required environment for system. Secondly Face Recognition was the milestone that eventually achieved choosing between suitable and easy algorithms was another task. DUFR can also be worked on to enhanced further:

- To Handle Large amount of data it can be converted into a web application where it accesses data through a server and work accordingly
- Mobile devices can be modified to directly interact with device and can modify its working like Sleep system, alarm live video feed.
- Register the person through mobile Application.

An objection arose when the security system is used that entertain face recognition is how user's data can protect

from breaching a solution can be proposed that data can be encrypted.

REFERENCES

[1] O. L. De Weck et al., “Engineering Systems : Meeting Human Needs in a Complex Technological World Engineering Systems : Meeting Human Needs in a Complex Technological World.”
[2] E. T. Straub, “Review of Educational Future Directions for Informal Learning,” 2011.
[3] C. A. Norris, “Learning and Schooling in the Age of Mobilism Introduction:” no. December 2011, pp. 3–10, 2015.
[4] D. Upton, D. Brooker, and H. Grove, “PEOPLE WITH DEMENTIA AND THEIR CARERS WITHIN CARE HOME Commissioned by Department of Health West Midlands,” no. December, 2011.
[5] “The Political Power of Social Media.”
[6] “Praise for Cloud Security and Privacy.”
[7] F. Hussain, S. D. Nadeem, and S. Rehman, “Security, Privacy, and Trust in IoT,” no. Ieec, 2019.
[8] J. Heurix, P. Zimmermann, T. Neubauer, and S. Fenz, “A taxonomy for privacy enhancing technologies,” Comput. Secur., vol. 53, pp. 1–17, 2015.
[9] C. Perera, A. Zaslavsky, P. Christen, and D. Georgakopoulos, “Context aware computing for the Internet of Things: A survey [Computación sensible al contexto para el Internet de las Cosas: Un estudio],” IEEE Commun. Surv. tutorials, vol. 16, no. 1, pp. 414–454, 2014.
[10] L. Van Niekerk, “Research methods: Basic concepts,” 2017.
[11] P. Timse, P. Aggarwal, P. Sinha, and N. Vora, “Face recognition-based door lock system using Opencv and C# with remote access and security features,” Int. J. Eng. Reasearch Appl., vol. 4, no. 4, pp. 52–57, 2014.
[12] K. S. Tejas Saraf, Harish Balkhande, Ajinkya Deshmukh, "AUTOMATED DOOR ACCESS CONTROL SYSTEM USING FACE RECOGNITION," International Research Journal of Engineering and Technology (IRJET), vol. 5, no. 4 p. 5, 2018.
[13] R. B. R. Akshay N. Patil, Dayasagar V. Ballal, Asst. Prof. P. P. Kotekar, "RASPBERRY PI BASED FACE RECOGNITION SYSTEM FOR DOOR UNLOCKING," International Journal of Innovative Research in Science and Engineering, vol. 2, no. 3, 2016.
[14] K. Okokpujie, E. Noma-Osaghae, S. John, K. A. Grace, and I. Okokpujie, “A face recognition attendance system with GSM notification,” 2017 IEEE 3rd Int. Conf. Electro-Technology Natl. Dev. NIGERCON 2017, vol. 2018-January, pp. 239–244, 2018
[15] Suchitra, P. Suja, and S. Tripathi, “Real-time emotion recognition from face images using Raspberry Pi II,” 3rd Int. Conf. Signal Process. Integr. Networks, SPIN 2016, vol. 5, no. 9, pp. 666–670, 2016.
[16] M. Pagnutti et al., “Laying the foundation to use Raspberry Pi 3 V2 camera module imagery for scientific and engineering purposes,” J. Electron. Imaging, vol. 26, no. 1, p. 013014, 2017.
[17] Shilpashree, K. S., H. Lokesha, and Hadimani Shivkumar. "Implementation of Image Processing on Raspberry Pi." International Journal of Advanced Research in Computer and Communication Engineering 4, no. 5 199-202, 2015.
[18] "Power System Relaying". 2019. Google Books. Accessed November 10 2019. https://books.google.com.pk/
[19] "Solenoid bolt", En.m.wikipedia.org, 2019. [Online]. Available: https://en.m.wikipedia.org/wiki/Solenoid_bolt. [Accessed: 10- Nov- 2019].
[20] E. Fossas, “Study of chaos in the buck converter,” IEEE Trans. Circuits Syst. I Fundam. Theory Appl., vol. 43, no. 1, pp. 13–25, 1996.
[21] S. Soo, “Object detection using Haar-cascade Classifier,” Inst. Comput. Sci. Univ. Tartu, vol. 2, no. 3, pp. 1–12, 2014.
[22] Y. Zhang and Z. Wang, “Gait recognition using principal component analysis,” Int. J. Adv. Comput. Technol., vol. 4, no. 22, pp. 600–607, 2012.
[23] E. Zeng, S. Mare, F. Roesner, and P. G. Allen, “End User Security and Privacy Concerns with Smart Homes End User Security & Privacy Concerns with Smart Homes,” Proc. Thirteen. Symp. Usable Priv. Secur., no. Soups, pp. 255–272, 2017.
[24] J. Kim, M. Choi, R. J. Robles, E. Cho, and T. Kim, “A Review on Security in Smart Home Development,” Security, vol. 15, pp. 13–22, 2010.
[25] H. H. Lwin, A. S. Khaing, and H. M. Tun, “Automatic Door Access System Using Face Recognition,” Int. J. Sci. Technol. Res., vol. 4, no. 6, pp. 294–299, 2015.