Smart Door System for Home Security Using Raspberry pi3

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*Abstract —*Nowadays, providing a security system for houses has become a vital research in which the latest technologies are being adopted to serve this purpose. Wireless network is one of the technologies that have been used to provide remote monitor and control for the home appliances. This paper aims to propose a security door lock system based on Raspberry pi technology where cameras, keypad and pi-lids are being utilized to provide an alarming system that has the ability to notify the owner, as well as, recognizing guests by giving them a user-id. In this vein, the authorized individuals are only the ones who will get the permission to access the doors. The system works by taking snaps for the guest through a code and camera pi positioned in the doors then, such snaps will be sent to the owner. The proposed system can be extended to be used for different properties and facilities such as banks and office.

Index Terms— smart home; home automation security ; door system ; Raspberry pi

I. INTRODUCTION

Nowadays, technology plays an essential role in our life in which different domain of interests are taking advantage of technology. Recently, computers and smart phones have significantly contributed our daily life where numerous computations and adjustments are being accomplished by such technologies.

Securing homes has become one of the concerning issues that facing many people. With the expanded duration of leaving the home due to work, study and other duties, homes are being more vulnerable for several threats especially being burgled. Apart from the threats, there are different cases where securing or monitoring the house is very critical such as the existence of elderly individuals or kids with baby sitter. For this manner, home security system or so-called Home OS has been proposed in order to provide more secure arrangements. Such concept aims to turn the home into a smart in which different tasks especially monitoring can be performed remotely. Monitoring and controlling some tasks inside the house would have the ability to provide maximum safety [1].

Home automation system is a computer-based application that has the ability to connect different electronic devices for the sake of monitoring and controlling the home appliances. Home automation system is an area that has caught several attentions by both the academic and business fields. The earliest effort of

home security system was relied on wired home networks however, due to the appropriate planning and construction works required to offer a wired home, such effort tend to be insufficient. As a solution for this problem, wireless communication has been emerged to provide more flexible platform where the installation cost is significantly lower than the wired one. Therefore, it has been applied for different security home systems in order to provide an alarm for critical threats such as intrusions or other environmental risks such as gas leaking or fire [2].

Recently, electronic door lock systems are one of the most popular security systems that is being installed for many residents and business places. The key characteristic behind such systems lies on the reliability in which the authorized individuals can gain the permission to access the doors throughout a secure system that has an interactive interface. A new system has been emerged which is called Near Field Communication (NFC) door lock system [3]. Such system is based on a pattern recognition technology where the individuals' faces are being analyzed in order to identify their personalities [4]. Such analysis takes different forms such as analyzing facial image or video stream. In addition, the size and position of the face's elements are being also considered in the analysis

This paper aims to present a novel security home system based on Bluetooth network. The main goal is to develop a prototype that has the ability to simulate the wireless tasks including monitoring and controlling digital door lock. Such system would have the capability to provide secure and controlled home appliances

II. RELATED WORKS

Several remote systems have been proposed whether for the academic or business domain. Such systems were intended to provide a remote control and monitoring tasks. For instance, a system has been proposed by [5] which is based on Zigbee technology. This system is composed of multiple modules such as the human detection module (HDM) which aims to detect the user at the door. This can be performed using the camera module in which the images or the video stream is being processed. Consequentially, the results of the two-mentioned module will go through the Zigbee module that would identify a verification

tag for each user. Once the user got failure in terms of the zigbee verification tag, a speaker phone will be provided with the owner of the property.

Digital door lock in home automation system provides proper control and home environment monitoring to the user. A system has proposed by [6] based on the RFID technology which provides a touch LCD monitor.

Another system consists of a build in NFC capabilities of a smart phone which would eventually be the key to open the door by means of logical link control protocol, which then matches the user's own set of passwords to verify that user should be given permission or not [7]. Another system has been proposed by [7] which based on an NFC featuring smart phone abilities. Such system uses logic link control to identify the permission of the user's identities.

In addition, a system proposed by [8] based on design of GSM digital door lock system using PIC platform.5-digit password is used to lock/unlock the door. If the user submits an incorrect password the system notifies the owner.

In [9] a system has designed that contains sensors to detect obstacle, touch, heat, smoke, sound. The whole system is controlled by a PIC microcontroller 16F76. It gathers the information from the sensors, makes a decision and sends SMS to a corresponding number by using a GSM modem. If an interruption has been identified, then PIC will send a SMS to the owner and another SMS to the Police Station. Similarly, for environmental threats such as fire interruption a SMS will be sent to the fire brigade and another to the owner [9]. In this system require extra hardware components like Sensors, GSM Modem. Alerts are sent through only SMS.

In [10] an intelligent system for home security using illumination sensitive background model is presented. Such system enables tracking and detection of intruder and it is based on providing home security. For this purpose, a face recognition technique is utilized to identify the intruder and on finding him, an image of the intruder is sent on the owner mail id for further action. The implementation of this system also includes the comparison of different approaches for object tracking and then used an illumination-sensitive background modeling approach for the proposed security system. But this system doesn't use password for identification.

III.   PROPOSED METHOD

In this section, the brief description of proposed system followed by the operation of the Raspberry pi module in our design, the keypad door lock, and the Camera pi module has been provided.

Smart digital door lock is a system to monitor and control several devices in the home. Our smart digital door lock system operates over internet network by using raspberry pi3.

As shown in Fig. 1, the system structure consists of the following three phases: (i) input, (ii) processing and (iii) output.

Input phase aims to input the key by a newcomer and if the key is valid or the image of the newcomer is matching with the image in the database, the door is opened, else the door is not

opened and a photo is taken and sent to the owner of the home by e-mail and then if the owner of the house wishes to allow him to enter, the key and the image of the person is stored in the database. The person is granted permission to enter at any time by approving the authentication of the password in the database or his/her image.
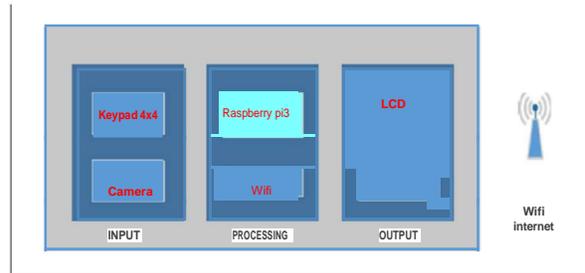

Figure 1. System Structure

A. Communication model

In this proposed smart digital door system, the setup works in two communication modes: Raspberry and email modes, Raspberry Pi is a small computer board working on the Linux operating system which connects to a computer monitor, keyboard, and mouse. Raspberry Pi can be applied to an electronic structure and programming network work, it can also serve as a personal computer and Apache Webserver and MySQL could be installed in the board.

B. Input and output models

The input to the control module is keypad of the user or visitor. Control module then start the camera PI capture image and send the file to the database through Email. The output basically include access to the door for the user at the door by using leds (red and green). It also includes message alarm and also sending proper live feed to the owner and notify the owner about the user when he/she enters and leave the house, in the Fig. 2 represent block diagram for input/output system.
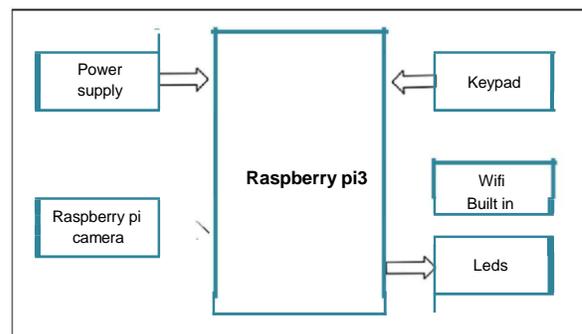

Figure 2. The Block diagram

C. Raspberry Pi Control module

It controls camera pi, keypad and communication between server and all the important processes are done by this module. The control module" Raspberry pi" is the center of the door lock system where all the process cycle is done. This module is the server for verification of the user id and to the microcontroller. Camera is connected to Raspberry pi3 for surveillance purposes. All the operations are done by the control module which includes sending SMS and image to the Email of the owner, check that the guest is authorize to enter the house and the image

IV. OPERATION OF SYSTEM

Keypad is the input module when the guest inserts the code at the door. It then sends signal to control module" Raspberry pi3" which then check the guest id by the database. Control module then sends the guest-id to the server for verification. Server then searches for guest-id and if the id exists in the database then server sends signal back to control module as a response and at the same time activates the camera and take snaps of the user at the door and sends it through Email. Simultaneously the server notifies the owner that guest has appeared at the door "through the message "ACCESS DOOR REQUEST".
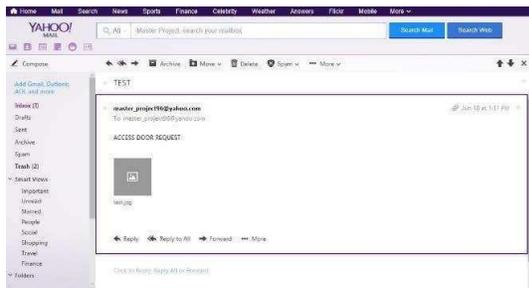

Figure 3. The form of message

The system uses face recognition technique using Fisher method to compare the image with the existing database and in this way the visitor is allowed to enter or not to enter, then later owner can see snaps of guest and send signal to server to register id of that user and update the DATABASE as shown in Fig. 5. Otherwise owner can take appropriate action. Fig. 4 shows flowchart methodology all the steps user trying to access the door with USER-id.
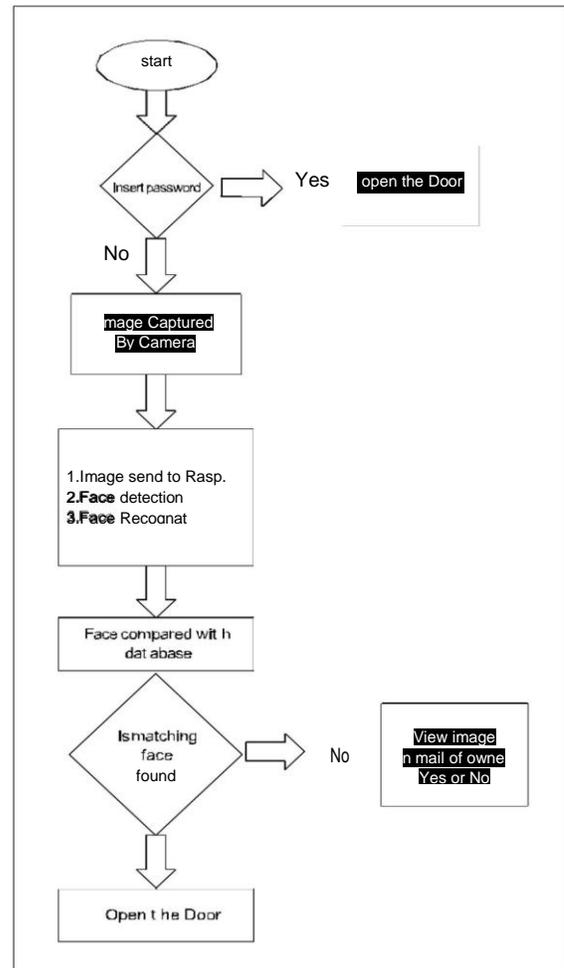

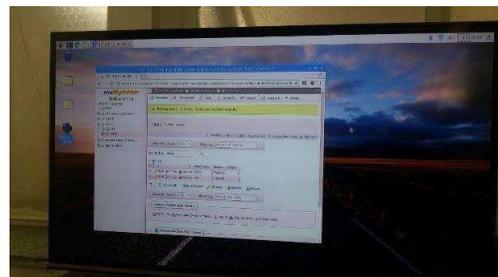Figure 4. Flowchart for Design Methodology

Figure 5. User interface of the database

Fig. 6 shows a user interface. It involves the operations like adding user data, managing the user data, this form represents a database interface designed to grant authorization to the desired people by sending an e-mail.
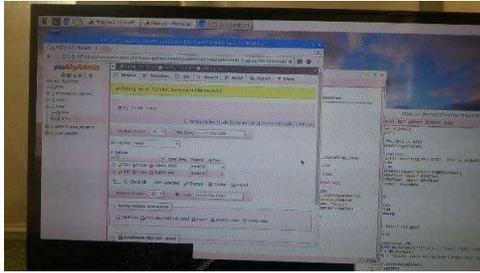
Figure6. Update the database

When the image is taken for the first time through the camera, it is sent to the email. The owner of the house receives a message via the email bearing a picture of the person who wishes to enter the house. The image is uploaded and checked. If approved, a message will be sent via email to the database with entry code follow by "OK" as shown below:

NASER:335OK

In the event of disagreement, a message will be sent via email to the database with entry code follow by "LK" as shown below:

NASER:335LK

The no (335) represent ID user

The Run of the system by using many from steps programming and the system calls a set of necessary libraries that operate in the Python environment:

import MySQLdb

import smtplib import

cv2 import sys import

numpy import os

import getpass import

imaplib

```
import threading a =
GPIO.VERSION
GPIO.setmode(GPIO.BCM);
GPIO.setup(2,GPIO.OUT);
GPIO.setup(4,GPIO.OUT);
```

An interrupt-based Python 2/3 library for reading matrix keypad key presses using Raspberry Pi GPIO pins:

from pad4pi import rpi_gpio new_id="";

lock_timeout=0

Print Key will be called each time a keypad button is pressed:

keypad.registerKeyPressHandler(printKey)

GPIO.output(2,GPIO.LOW) GPIO.output(4,GPIO.LOW)

When the password is entered for the first time or may be stored previously we use:

def   printKey(key):

global   key_buffer if

key=='*' :

get_name(key_buffer)

key_buffer="" elif
key=='#':

save_new(key_buffer)
key_buffer=""
else:

key_buffer += str(key)

To download an electronic file from an attached mail

used: from email.MIMEMultipart import MIMEMultipart from

email.MIMEText import MIMEText

from email.MIMEBase import MIMEBase from

email import encoders

To "Enable" the user the following code is used:

def enable_user(user_id): db =
MySQLdb.connect("127.0.0.1","root","123","naser   ")

cursor = db.cursor()

sqlstmt = "update users set active=1 where user_key = '%s'" % user_id

Define email addresses to use

```
fromaddr = "master_project96@yahoo.com"
toaddr = "master_project96@yahoo.com"
```

To constrain E-mail

```
msg['From'] = fromaddr
msg['To'] = toaddr
msg['Subject'] = "NEW ID : %s" %user_id
```

Reading new email

```
def read_mail():
    global lock_timeout
    M = imaplib.IMAP4_SSL("imap.mail.yahoo.com", 993)
    email = "master_project96@yahoo.com"
    password = "NA123456ER"
    M.login(email, password)
```

The most basic method for watching for a switch is calling **the python code checks the current values of a GPIO input pin at a regular. The GPIO input changing value when the switch was pressed.**

Object Detection using Haar feature-based cascade classifiers is an effective object detection method which is used in this design with the following code:

```
haar_cascade = cv2.CascadeClassifier(fn_haar)
webcam = cv2.VideoCapture(0)
```

Detect faces and loop through each one

```
faces = haar_cascade.detectMultiScale(mini)
for i in range(len(faces)):
    face_i = faces[i]
    # Coordinates of face after scaling back by `size`
    (x, y, w, h) = [v * size for v in face_i]
    face = gray[y:y + h, x:x + w]
    face_resize = cv2.resize(face, (im_width, im_height))
```

Try to recognize the face

```
prediction = model.predict(face_resize)

if prediction[1]>1000 :
    cv2.rectangle(frame, (x, y), (x + w, y + h), (0, 255, 0), 3
```

V. CONCLUSION

Smart door lock is one of the most popular digital consumer devices because of the user convenience and affordable price. In actuality, it is replacing a lot of conventional types of locks. This report tries to propose a door access and monitoring control system which consist of different stages:

Detecting by keypad and camera pi user

Fetching user-id

Verification

Information

Process according to request

A low-cost authentication system based on Raspberry pi3 system and face recognition makes home automation system more secure and cost efficient. This technology can surely make change in the society to go down the percentage of crimes. Both NFC, RFID can be used in securing home but implementation

cost and availability of supply to hardware requirements is not up to the mark. But the system based on Raspberry Pi system is a low cost and efficient device for such purposes.

In future, the android application should display support in controlling more doors, windows and basic home electronic appliances. An auto trigger report of the attempt to theft can be sent to nearest police station along with domestic address. This idea can be considered to make the proposed system better.

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