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Research Article

Secure Home Entry with Face Recognition and Notification via Telegram

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ABSTRACT
Secure home entry using Internet of things is an attempt to construct a smart innovative and secure entry by using raspberry Pi controller and camera and various types of sensors associated with that like IR sensor Notification via telegram is used due to flexibility of using current social network for all types of generations. Face-recognition is a computer technology which can make use of visual characteristic information of human for identification. Since it has many characteristics, such as direct, friendly and convenient, face recognition technology has become a hot research topic in the field of pattern recognition and artificial intelligence currently. The advantage of using telegram app for this user as it to send notification to the user as it provides an instance secure communication between the user and home automation system. Nowadays, there is a growing interest in the smart home system using Internet of Things. In this project, we proposed a face recognition security system using Raspberry Pi and notification via telegram which can be connected to the smart home system. Face is captured and compares with the images present in the data base. The output of face recognition algorithm is then connected to the relay circuit, in which it will compare the images of the person with the database images and if there is a match with the database image and the person image captured by the camera. The door opens and if not, it will send a notification to the owner that some unknown person is entering into the home through the telegram app. Notifications are sent to the person who has the access to the telegram account. Moreover, we can create various expressions of the person and store them in separate data base and likewise we can create any number of databases in our app we are using particularly face terminals app for face recognition.

Keywords: Telegram, Face, Notification, Recognition.

Introduction

Motivation

The world is at the brink of a new digital revolution and Internet of Things (IoT)-based Cyber Physical security architecture" and "Internet of Things" both of which are listed on Gartner's 2016 top 10 strategic technology trends. In addition to the services offered by other instantiations of IoT, smart vehicular networks transform vehicles into formidable sense-and-move platforms and assist in safe navigation, pollution control, reducing land used for parking, energy efficiency, lower delay, passenger comfort, and congestion management through smooth traffic flow . The idea of autonomous vehicles dates back to 20^{th} century. but it wasn't until last decade when advances in deep learning, computing systems for route planning, communication standards, and image processing made it a reality. The main benefits of autonomous vehicles include reducing mobility costs by sharing cars, simplifying the introduction of alternative fuels, reducing traffic accidents and fatalities, better road utilization (fewer roads will be needed), reducing climate change (higher passengers per mile per gallon), allowing elderly and physically challenged people to live more independently and improve disaster response among other things.18% of crashes with injuries are attributable to distractions caused by smartphones, an issue that is more prevalent with younger generations. This project focuses on communication and security concerns associated with IOT. We also demonstrate the feasibility of cyber threats to such archetypes. Now days there is a growing interest in internet of things for security systems.

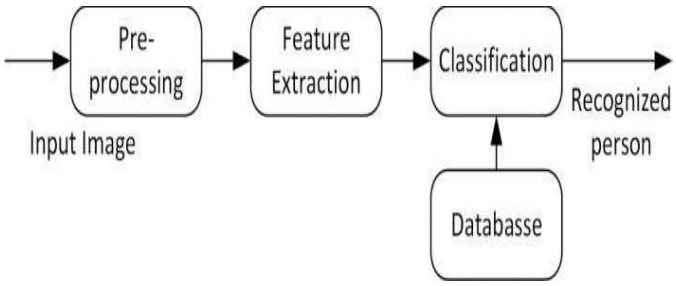


Fig. 1: Typical Face Recognition System

There are many algorithms have been developed for face recognition algorithm, including appearance based active appearance support vector machines. Bayesian model deep learning neural network and texture based In this research, we will focus on appearance based face recognition which includes direct correlation.

In this project, the face recognition security system implemented on Raspberry Pi will be connected to the smart home control system proposed in next sections will present the design, implementation, and experimental results

Literature Survey

Currently, we depend mostly on the networks to do majority of our jobs. Ranging from connection and security, internet handles our tasks that seem either too tedious, or smarter for us to do it on our own. Smart living mainly implies using methods and options that are better than the normal manual or other ways that we have been using to date. There are many gadgets in the market that provide smart security with cameras and digitized locks incorporating one or the other technology to open the door. Remote home security, focuses on providing access to the person standing outside the door even when the owner is not physically present, by using the concept of internet and wireless networks. Internet of things is an emerging technology, which has the scope of changing the industrial operations. IoT was previously used to refer to a term called radio frequency identification technology (RFID). After its implementation, the more common way of defining IoT was explaining that it is based on communication protocols whose infrastructure is spread globally. It can connect and virtually control Things that follow the internet protocol [1]. With smart cities, there has also been a rising need for the basic home security.

It's not enough for tech savvy customers to be satisfied with just metallic locks. Consumers keep searching for various upgraded locking mechanisms, each being a better version of the previous techniques. This paper explains the method of integrating various small modules into one single system security product. A simple connection of a database to the raspberry in the system will provide for an effective face recognition algorithm, recognizing and relaying the message to the owner of the house. A back and forth communication will be involved where the authentication of the owner of the house as well as the authentication of the visitor would be performed.

Face Detection and Recognition using Raspberry Pi

Face recognition technology emulates the capabilities of human eyes to detect faces. This is done by smart computing that creates "face bunch" that consists of 70 nodal points. Features are extracted from the face and saved as templates. These templates are compared to the face detected. For this research, we interfaced an LCD, Camera and a Motor to the Raspberry Pi board. We have made a real time application, which compares the scans to records stored in the Raspberry Pi which in turn is used as a gate pass, wherein the name of the detected person is displayed on LCD and the motor will rotate indicating opening and closing of the gate. Fig 2. Face Bunch Graph

Face Detection Using Haar Cascades

Object Detection using Haar feature-based cascade classifiers is an effective method which was proposed by Paul Viola and Michael Jones [2, 3]. It is an adaptive machine learning based approach in which a cascade function is trained from several positive and negative images. This is then used to detect objects in other images. Initially, this algorithm requires plenty of positive images (images of faces) and negative images (images without faces) to train the classifier. Then Features are extracted from it. Every feature is a single value obtained by subtracting sum of pixels under white rectangle from sum of pixels under black rectangle. Then all possible sizes and locations of every kernel are used to calculate plenty of features

Aim Of the Project

The aim of the project is to detect the images of person who is entering the home and compare with them with the images in the databases and then if the unauthorized person enters the door then

notification is sent to the telegram.

Proposed System

The proposed system is cost effective solution for security home entry and notification via telegram. A facial recognition system is a technology that is capable of matching a human face from a digital image. Telegram is one most secure social media apps used by all kinds of citizens (senior citizens).Telegram app is used because it reserves a special kind of machines called Bot accounts since we are using raspberryPi which will be explained in further process

Circuit Diagram and Working

Circuit diagram and Components Description

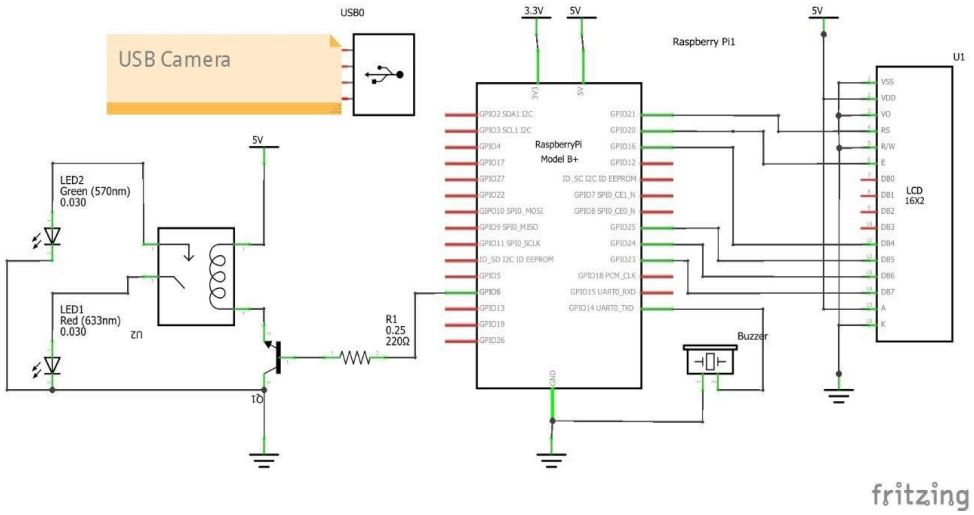
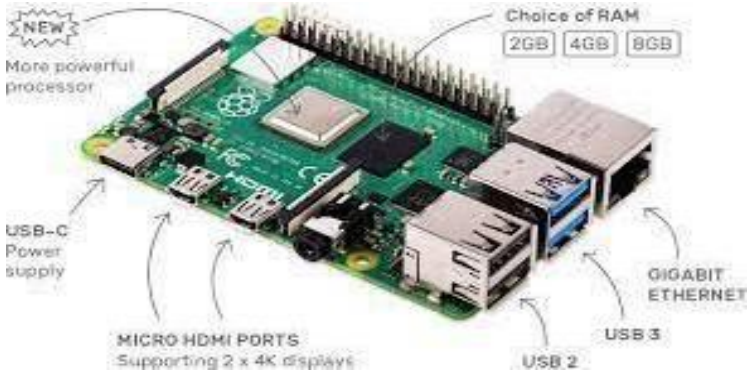


Fig. 2: Circuit Diagram

Raspberry Pi

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It's capable of doing everything you'd expect a desktop computer to do, from browsing the internet and playing high definition video, to making spreadsheets, word-processing, and playing games.

What's more, the Raspberry Pi has the ability to interact with the outside world, and has been used in a wide array of digital maker projects, from music machines and parent detectors to weather stations and tweeting birdhouses with infra-red cameras. We want to see the Raspberry Pi being used by kids all over the world to learn to program and understand how computers work.



How does the Raspberry Pi work?

An SD card inserted into the slot on the board acts as the hard drive for the Raspberry Pi. It is powered by USB and the video output can be hooked up to a traditional RCA TV set, a more modern monitor, or even a TV using the HDMI port.

Pi camera module

The Pi camera module is a portable light weight camera that supports Raspberry Pi. It communicates

with Pi using the MIPI camera serial interface protocol. It is normally used in image processing, machine learning or in surveillance projects. It is commonly used in surveillance drones since the payload of camera is very less. Apart from these modules Pi can also use normal USB webcams that are used along with computer.

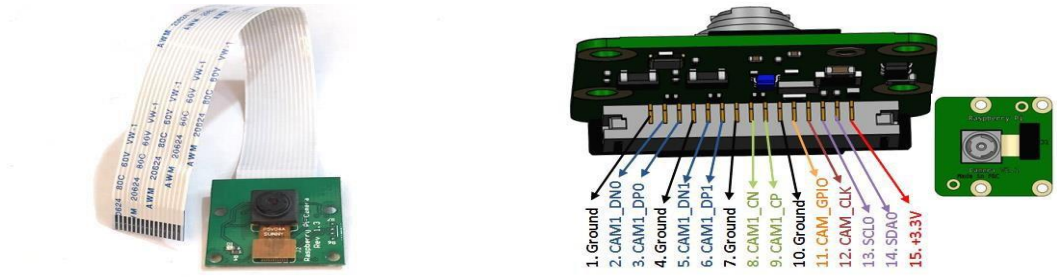


Fig. 3: Pi camera module and Pi camera pin point

PiCam Features

5MP colour camera module without microphone for Raspberry Pi Supports both Raspberry Pi Model A and Model BMIPI Camera serial interface Omnivision 5647 Camera Module Resolution: 2592 * 1944 Supports: 1080p, 720p and 480p
Light weight and portable (3g only)

How to use Camera module with Pi

The Pi camera module when purchased comes along with a ribbon cable, this cable has to be connected to the CSI (Camera Serial Interface) port of the Pi. This port can be found near the HDMI port just connect the cable to it as shown below.

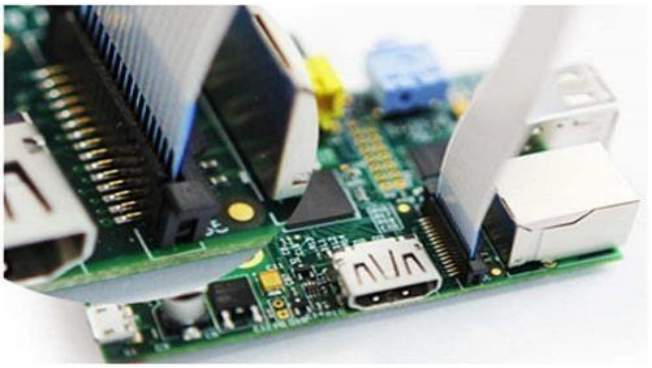
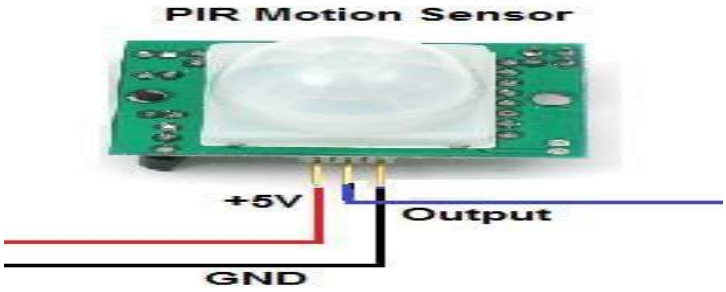


Fig. 4: Camera serial interface of Pi

After interfacing the hardware, we have to configure the Pi to enable Camera. Use the command "sudo raspi-config" to open the configuration window. Then under interfacing options enable camera. Finally reboot the Pi and your camera module is ready to use. Then, you can make the Pi to take photos or record videos using simple python scripts.

Pir Sensor

An Passive infrared radiation sensor is an electronic device that measures an detects infrared radiation in its surrounding environment. When an object comes close to the sensor, the infrared light from the LED reflects off of the object and is detected by the receiver. The Passive infrared sensor is use to detect the presence of human. But this detects the humans only if they are in motion. The PIR sensor itself has two slots in it, each slot is made of a special material that is sensitive to IR. When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a positive differential change between the two halves. They are most often used in PIR-based motion detectors. The term passive refers to the fact that PIR devices do not radiate energy for detection purposes. The sensor mainly employed to detect motion.
Wave length: 780nm to 50 um. Frequency range: 300GHz to 400 THz.



Working

Our project is face recognition using 2D and notification via telegram. For these we are using relays and Led's namely Red and green. Initially we are storing the five different facial expressions of a person as a single folder of databases (folder 1, folder2.).

Later we have a face recognition app on our desktop whenever we start to run the python programming it will initially read all the databases of the images stored in folders and then when an authorized person stand at the door raspberryPi camera clicks the image of the that particular person and compares them with the databases and if they are matched then green led is on and door is opened. The lcd displays you are authorized

Lcd displays on the screen as authorized person. On the other hand if unauthorized person enters the house then buzzer is on and red light is on and it automatically locks the door and notification via telegram along with photo of that unauthorized person is sent to the owner who has that access. The lcd displays you are not authorized.

Face Detection

Face detection is a computer vision technology that helps to locate/visualize human faces in digital images. This technique is a specific use case of object detection technology that deals with detecting instances of semantic objects of a certain class (such as humans, buildings or cars) in digital images and videos. With the advent of technology, face detection has gained a lot of importance especially in fields like photography, security, and marketing.

For face detection, OpenCV cascade classifiers will be used. These trained classifiers include detectors of face, eyes, nose and whole body, etc.

OpenCV-Python

OpenCV was started at Intel in the year 1999 by Gary Bradsky. The first release came a little later in the year 2000. OpenCV essentially stands for Open Source Computer Vision Library. Although it is written in optimized C/C++, it has interfaces for Python and Java along with C++. OpenCV boasts of an active user base all over the world with its use increasing day by day due to the surge in computer vision applications.

OpenCV-Python is the python API for OpenCV. You can think of it as a python wrapper around the C++ implementation of OpenCV. OpenCV-Python is not only fast (since the background consists of code written in C/C++) but is also easy to code and deploy(due to the Python wrapper in foreground). This makes it a great choice to perform computationally intensive programs.

Installation

OpenCV-Python supports all the leading platforms like Mac OS, Linux, and Windows. It can be installed in either of the following ways:

From pre-built binaries and source :

Please refer to the detailed documentation here for Windows and here for Mac. Unofficial pre-built OpenCV packages for Python.

Packages for standard desktop environments (Windows, macOS, almost any GNU/Linux distribution) run pip install opencv-python if you need only main modules

run pip install opencv-contrib-python if you need both main and contrib. modules (check extra modules listing from OpenCV documentation)

You can either use Jupyter notebooks or any Python IDE of your choice for writing the scripts.

Face detection using Haar Casecades is a machine learning based approach where a cascade function is trained with a set of input data. OpenCV already contains many pre-trained classifiers for face, eyes, smiles, etc.. Here we will be using face classifier. We can also experiment with other classifiers as well

We need to download the trained classifier XML file (haarcascade_frontalface_default.xml), which is available in OpenCV's. Save it to your working location.

Code for face detection

```
# import the necessary packages from imutils.video
import VideoStream from imutils.video import FPS
import face_recognition import argparse
import imutils import pickle import time import cv2
# construct the argument parser and parse the
arguments ap = argparse.ArgumentParser()
ap.add_argument("-c", "--cascade", required=True,
```

```
help = "path to where the face cascade resides")
ap.add_argument("-e", "--encodings", required=True, help="path to serialized db of facial encodings")
args = vars(ap.parse_args())
# load the known faces and embeddings along with OpenCV's Haar
# cascade for face detection
print("[INFO] loading encodings + face detector...")
data = pickle.loads(open(args["encodings"], "rb").read()) detector = cv2.CascadeClassifier(args["cascade"])
# initialize the video stream and allow the camera sensor to warm up print("[INFO] starting video stream...")
vs = VideoStream(src=0).start()
# vs = VideoStream(usePiCamera=True).start()
time.sleep(2.0)
# start the FPS counter fps = FPS().start()
# loop over the facial embeddings for encoding in encodings:
# attempt to match each face in the input image to our known
# encodings
matches = face_recognition.compare_faces(data["encodings"], encoding)
name = "Unknown"
# check to see if we have found a match if True in matches:
# find the indexes of all matched faces then initialize a
# dictionary to count the total number of times each face
# was matched
matchedIdxs = [i for (i, b) in enumerate(matches) if b] counts = {}
# loop over the matched indexes and maintain a count for
# each recognized face face for i in matchedIdxs:
name = data["names"][i]
counts[name] = counts.get(name, 0) + 1
# determine the recognized face with the largest number
# of votes (note: in the event of an unlikely tie Python
# will select first entry in the dictionary) name = max(counts, key=counts.get)
# update the list of names names. append(name)
# loop over the recognized faces
for ((top, right, bottom, left), name) in zip(boxes, names):
# draw the predicted face name on the image cv2.rectangle(frame, (left, top), (right, bottom), (0, 255, 0), 2)
y = top - 15 if top - 15 > 15 else top + 15
cv2.putText(frame, name, (left, y), cv2.FONT_HERSHEY_SIMPLEX, 0.75, (0, 255, 0), 2)
# display the image to our screen cv2.imshow("Frame", frame) key = cv2.waitKey(1) & 0xFF
# if the `q` key was pressed, break from the loop
if key == ord("q"):
break
# update the FPS counter fps.update()
# stop the timer and display FPS information fps.stop()
print("[INFO] elasped time: {:.2f}".format(fps.elapsed()))
print("[INFO] approx. FPS: {:.2f}".format(fps.fps()))
# do a bit of cleanup cv2.destroyAllWindows()
vs.stop()# stop the timer and display FPS information fps.stop()
print("[INFO] elasped time: {:.2f}".format(fps.elapsed()))
print("[INFO] approx. FPS: {:.2f}".format(fps.fps()))
# do a bit of cleanup cv2.destroyAllWindows()
vs.stop()
```

Results

Fig. 5. Data from the sensor nodes is stored on the Easy IOT server. This data can be accessed by any authorized used from any lactation. The obtained data can be stored in various format and can be represented in graphical format, depending on day, week and month. Following figures shows obtained data and GUI.

Fig. 6: Circuit in working state

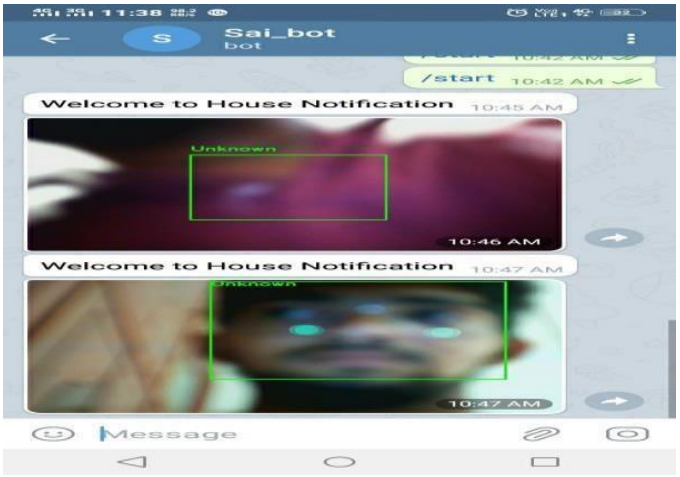


Fig. 7: Telegram message received on face detection

Advantages

- Increasing safety and security
- Prevention of crimes
- Reducing human interaction
- Smart integration
- High accuracy rates
- Automation

Disadvantages

- Threats to privacy
- Violation of rights and personal freedom
- Potential data theft
- And other crimes

Applications

- In industrial areas
- In homes
- Protect law enforcement
- Aid forensic Investigation
- Smarter advertising
- Unlocking

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