HOME SECURITY SYSTEM BASED ON FINGER PRINT AND FACE RECOGNITION

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ABSTRACT *:* Smart security system has become indispensable in modern daily life. The proposed security system has been developed to prevent robbery in highly secure areas like home environment with lesser power consumption and more reliable standalone security device for both Intruder detection and for door security. The door access control is implemented by using face recognition and finger print technology, which grants access to only authorized people to enter that area. The face recognition and detection process is implemented by principal component analysis (PCA) approach and instead of using sensor devices intruder detection is achieved by performing image processing on captured video frames of data, and calculating the difference between the previously captured frame with the running frames in terms of pixels in the captured frames. This is the stand alone security device has been developed by using Raspberry Pi electronic development board and finger print , operated on Battery power supply, wireless internet connectivity by using USB modem. Auto Police e-Complaint registration has been achieved by sending security breach alert mails to the nearby police station e-mail id. This proposed is more effective, reliable, and this system consumes very less data and power compared to the other existing systems.

1. INTRODUCTION

An efficient and accurate home security and access control to the doors system which is based on face recognition is very important for wide range of security application. Security is an important aspect or feature in the smart home applications [5]. Most of the countries are gradually adopting smart door security system. The most important major part of any door security systems are identifying accurately the persons who enter through the door. Face recognition is probably the most natural way to perform authentication between human beings. Additionally, it is the most popular biometric authentication trait, after fingerprint technology. Most of the security system was implementing a principle component analysis (PCA) algorithm for face recognition on hardware platform for its dimensionality reduction and simplicity. Wireless technologies for example and ZigBee, radio frequency identification (RFID) and etc are used in access control systems. This proposed system also act as home security system for both Intruder detection and provide security for door access control by using facial recognition for home environment.

Human body is identified as an intruder within a home environment achieved by capturing live video from web camera and processing will be done on captured video frames to identify the motion detection of the intruder. The web camera to capture the series of images as soon as the intruder motion is detected in certain area of the home premises and also it is having sending automatic e-Mail alerts along with captured images and other contact details to the nearby police station control room e-Mail id about the intruder detection to take further immediate necessary actions.

The advantage of this system is for accessing the door is that face detection and recognition is performed by using face detection technique and the entire face recognition is completed by pressing single and tiny push button switch. Face recognition includes feature extraction from the facial image, recognition or classification and feature reduction. PCA is an effective feature extraction method used based on face as a global feature. It effectively reduces the dimension of captured images and at the same time holds the primary information. In this project, face recognition system is implemented based on standard PCA (Principle component analysis) algorithm. Classification or Recognition is done by the measure method such as Euclidean distance technique, which is used to classify the feature of images stored in the database and captured test images

2. IMPLEMENTATION

There are two parts in this section. The first is the implementation of Door lock access by using Face Recognition and the second is the implementation of Intruder detection along with auto alert sending.

1. Implementation of Door Lock Access by using Face Recognition

This project work proposes an idea of for face reorganization concept for accessing the door lock system and it implemented with the help of OpenCV [7] which is a popular computer vision library. Face recognition is an important application of image processing owing to its use in many fields. An effective face recognition system based on OpenCV is developed in the project. Face recognition has been a best choice after problem of biometrics and it has a various type of applications in our present life. An efficient face recognition system can be of great help in forensic sciences, identification for law enforcement, authentication for banking and security system, and giving preferential access to authorized users i.e. access control for secured areas etc.
A real time door lock access system by face recognition system based on PCA is presented in the project. The technique used here involves generating the 'Eigen faces' then projecting training data into face space and evaluation of a projected test element by projecting it into face space and comparing to training data. The face recognition systems presented here can extract the features of face and compare this
with the existing facial images of database. The faces considered here for comparison are still faces.

2. Implementation of Intruder Detection along with Auto Alert Sending.

The proposed home security system (i.e. Intruder detection Module) builds up on the frame subtraction approach. The main purpose of this approach is to build a model of the static scene (i.e. without moving objects) called background, and then compare every subsequent frame of the sequence to this background frame in order to identify the regions of motion, called foreground (the moving
authentication for banking and security system, and giving preferential access to authorized users i.e. access control for secured areas etc.
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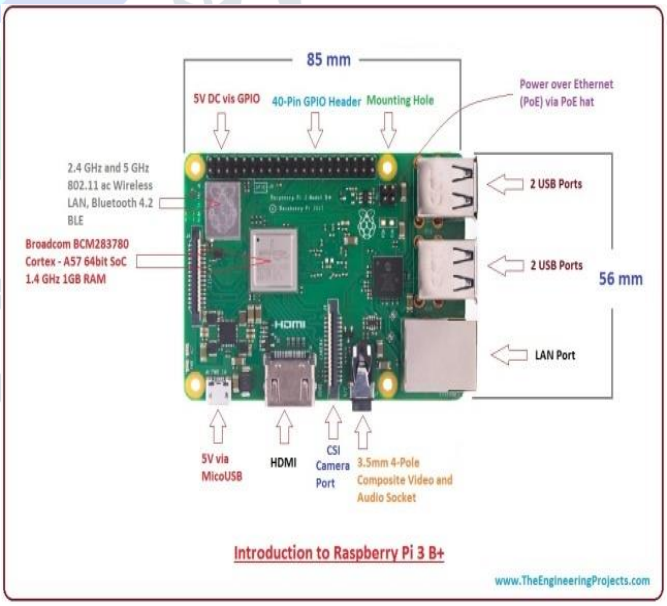
3. Hardware & Software Required

- Atmega lm 328,
- Ir sensor,
- Raspberry pi
- pi Camera
- Gate
- Open cv
- c embedded system
- and arduino ide

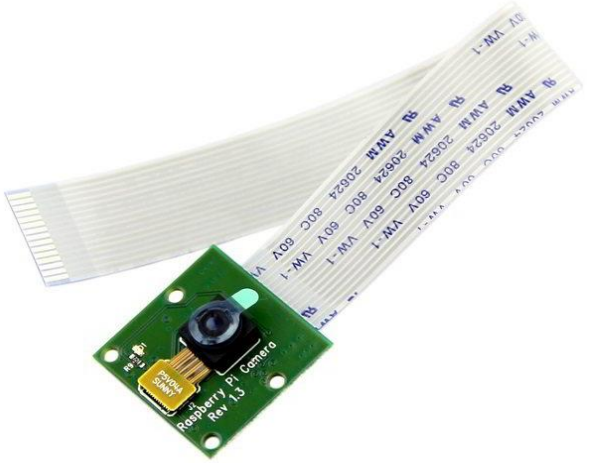
4. RASPBERRY PI.3

Raspberry Pi 3 B+ was introduced by Raspberry Pi foundation on 14th March 2018. It is an advanced version of Raspberry Pi 3 B model that was introduced in 2016.
It is a tiny computer board that comes with CPU, GPU, USB ports, I/O pins, WiFi, Bluetooth, USB and network boot and is capable of doing some functions like a regular computer.
Features of the B+ version are almost same as B model; however, USB and Network Boot and Power over Ethernet facility only come with B+ model. Also, two extra USB ports are added to this device.
The SoC (system on chip) combines both CPU and GPU on a single package and turns out to be faster than Pi 2 and Pi 3 models



5. PI CAMERA

Pi Camera module is a camera which can be used to take pictures and high definition video. Raspberry Pi Board has CSI (Camera Serial Interface) interface to which we can attach Pi Camera module directly. This Pi Camera module can attach to the Raspberry Pi's CSI port using 15-pin ribbon cable.



6. SERVO MOTOR

The simplicity of a servo is among the features that make them so reliable. The heart of a servo is a small direct current (DC) motor,
These motors run on electricity from a battery and spin at high **RPM** but put out very low **torque** (a twisting force used to do work— you apply torque when you open a gate). An arrangement of gears takes the high speed of the motor and slows it down while at the same time increasing the torque. (Basic law of physics: work = force x distance.)

7. INFRARED IR SENSOR CIRCUIT DIAGRAM AND WORKING PRINCIPLE

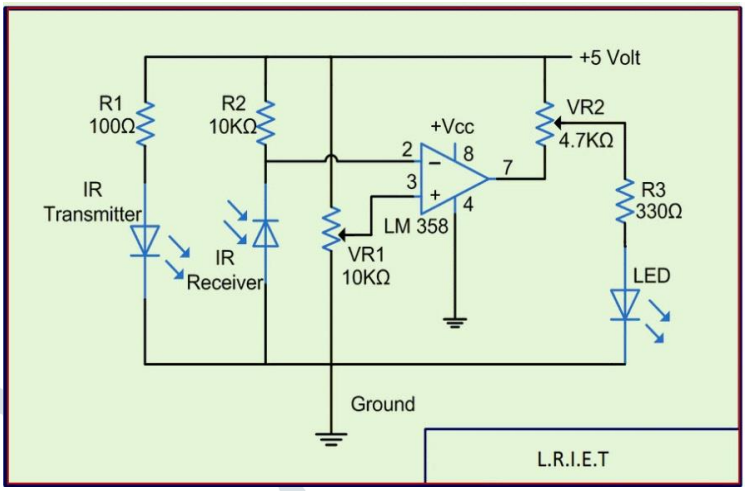
An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, The resistances and these output voltages, change in proportion to the magnitude of the IR light received.

8. IR SENSOR

IR Sensor Circuit Diagram and Working Principle

An infrared sensor circuit is one of the basic and popular sensor module in an electronic device. This sensor is analogous to human's visionary senses, which can be used to detect obstacles and it is one of the common applications in real time. This circuit comprises of the following components

LM358 IC 2 IR transmitter and receiver pair
Resistors of the range of kilo ohms.
Variable resistors.
LED (Light Emitting Diode).



In this project, the transmitter section includes an IR sensor, which transmits continuous IR rays to be received by an IR receiver module. An IR output terminal of the receiver varies depending upon its receiving of IR rays. Since this variation cannot be analyzed as such, therefore this output can be fed to a comparator circuit. Here an operational amplifier (op-amp) of LM 339 is used as comparator circuit.
When the IR receiver does not receive a signal, the potential at the inverting input goes higher than that non-inverting input of the comparator IC (LM339). Thus the output of the comparator goes low, but the LED does not glow. When the IR receiver module receives signal to the potential at the inverting input goes low. Thus the output of the comparator (LM 339) goes high and the LED starts glowing. Resistor R1 (100), R2 (10k) and R3 (330) are used to ensure that minimum 10 mA current passes through the IR LED Devices like Photodiode and normal LEDs respectively. Resistor VR2 (preset=5k) is used to adjust the output terminals. Resistor VR1 (preset=10k) is used to set the sensitivity of the circuit Diagram. Read more about IR sensors.

9. SERVO MOTOR

A Servo motor (or servo) is a rotary actuator that allows for precise control of angular position, velocity and acceleration. Servos are found in many places: from toys to home electronics to cars and airplanes. If you have a radio-controlled model car, airplane, or helicopter, you are using at least a few servos. Servos also appear behind the scenes in devices we use every day. Electronic devices such as DVD and Blu-ray Disc TM players use servos to extend or retract the disc trays.
Servo vs PWM
PWM stands for Pulse Width Modulation. PWM is the process of turning ON and OFF digital voltage quickly

to simulate a range of voltage. For example... If the digital output pin of a micro is 3.3v, and the PWM is set for a 50% duty cycle, the output voltage would be approx 1.65v. This is because the microcontroller is turning ON and OFF the digital 3.3v pin real quick, which is producing a simulated lower voltage. You can use PWM to vary the brightness of an LED, for example. A servo uses PWM as well. The "frame" of a servo PWM signal is 20ms. Many controllers, such as Arduino libraries do not maintain the 20ms specification defined for servos. Because of this, challenges have been introduced to servo manufacturers when decoding incoming PWM signals. This has caused the need for servos to be "Smarter" by adapting to the unusual PWM transmitted by poorly written libraries which do not adhere to the servo PWM Standard. The EZ-B does adhere to servo PWM standards

10. HHOW DOES A SERVO MOTOR WORK

The simplicity of a servo is among the features that make them so reliable. The heart of a servo is a small direct current (DC) motor, similar to what you might find in an inexpensive toy. These motors run on electricity from a battery and spin at high RPM (rotations per minute) but put out very low torque (a twisting force used to do work— you apply torque when you open a jar). An arrangement of gears takes the high speed of the motor and slows it down while at the same time increasing the torque. (Basic law of physics: work = force x distance.) A tiny electric motor does not have much torque, but it can spin really fast (small force, big distance). The gear design inside the servo case converts the output to a much slower rotation speed but with more torque (big force, little distance). The amount of actual work is the same, just more useful. Gears in an inexpensive servo motor are generally made of plastic to keep it lighter and less costly. On a servo designed to provide more torque for heavier work, the gears are made of metal (such as with EZ-Robot Servos) and are harder to damage.

With a small DC motor, you apply power from a battery, and the motor spins. Unlike a simple DC motor, however, a servo's spinning motor shaft is slowed way down with gears. A positional sensor on the final gear is connected to a small circuit board. The sensor tells this circuit board how far the servo output shaft has rotated. The electronic input signal from the computer or the radio in a remote-controlled vehicle also feeds into that circuit board. The electronics on the circuit board decode the signals to determine how far the user wants the servo to rotate. It then compares the desired position to the actual position and decides which direction to rotate the shaft so it gets to the desired position.

11. CONCLUSION AND FUTURE WORK

In this proposed system door access system by using face recognition and along with the Intruder detection system has been presented. This system has been tested successfully with home door lock access control based on face recognition method by verifying enrolled facial images. The police department control room of a nearby place and concern persons will be informed successfully about the intruder detection via e-Mail and SMS alert generations along with details attached. The proposed system is completely standalone and wireless to form a reliable, robust, easily operable, and low price security system. The internet communication has been achieved by connecting through USB cellular data card. The battery power source has been provided to make this whole system as standalone security device successfully. I conclude that various operations are successfully tested and results are documented.

This proposed system can be enhanced by using the infrared image scanner camera to find concealed weapon detection under the clothes of the human body. We can also use this security system by making required modification to the system in an area like banking sector to provide more security to the lockers, based on their facial authentication and keep track of account holders record of information when and who is accessed the lockers. In this way we can enhance the proposed system effectively by making some modifications according to requirements.

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