



Home Security System Using Raspberry Pi

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Abstract: Home Security is most important in today's world, Peoples are making their home secure by using security CCTV cameras. But there comes one downside along with CCTV Camera i.e. CCTV cameras have cost attached to it. Security Cameras are though effective we need more cost-effective System. This project aims to replace the security cameras from our Home security space and replace it with system that uses Raspberry pi. This project is designed for low to medium income segment of our society which usually lives in buildings. This system uses a combination of sensors that detects motion, Faces and heat that could be accidental fire etc. Existing Security Cameras stores the data on cloud that could be a breach to our privacy. Our System uses a Small debit card sized chip along with a PI Camera. Images are captured using camera and each frame is processed using Raspberry pi. The databases of all known humans are stored in OpenCV. When image is captured using PI Camera it is compared to the database stored, if the visitor human is known or unknown(stranger) an audio output is generated and user is notified on Email. By the use of this security surveillance we can keep track on our houses from anywhere in the world by using our mobile devices.

Keywords: Raspberry Pi, Pi Camera; OpenCV, PIR sensors, etc.

I. INTRODUCTION

Its dream of every individual to have a robust security system for the surveillance of their home. This dream can only be fulfilled when there will be a low-cost security system with same level of accuracy to make their home space safe. This project aims to deliver low-cost security solution to low- and middle-income segment of society. Traditional security Cameras are though effective but their cost makes it unavailable for large segment of people. Moreover, security cameras store the data on cloud that could lead to potential breach of privacy. So, we have reached to a solution to these problems which can be solved by developing a security system that uses combination of various sensors and Raspberry Pi for our home surveillance. Our System replaces the use of cloud servers. Raspberry Pi is a small sized single-board CPU that can process lots of data in very less time. Along with Raspberry pi, Pi camera, PIR sensor, temperature and humidity sensor will be used and all the data from these sensors will be sent to Raspberry Pi which acts as a controller and process all the data collected by sensors. Databases of all the known humans is stored and image captured is sent to be processed by raspberry pi. Every frame is matched with database in OpenCV. If the human is known or stranger user is notified by email. This system also detects some abnormal situations, when temperature is too low and the movement of strangers is detected, it will send notification to mobile devices of user directly. User can monitor any activities in house from anywhere using his/her mobile devices. It is low cost security surveillance which will be easy to use.

II. PROPOSED SYSTEM

Below shown is the block diagram representation of the "Home Security System using Raspberry Pi".

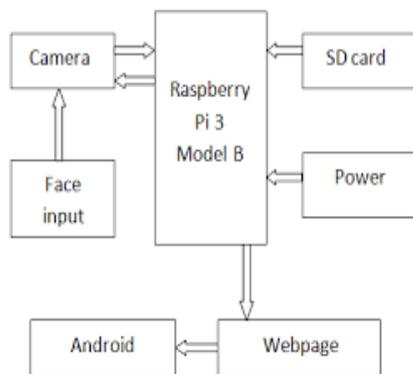


Fig. 1 Block Diagram



Fig. 2 Pin Diagram Raspberry Pi



The system consists of total five blocks, the function of the five blocks are as follows:

Raspberry Pi : Raspberry pi is a small CPU it has all the required specifications of a CPU. Thus, it is used as a controller in our proposed system. It is built on, cortex- A53 (ARMv8), Broadcom BCM2837B0 64-bit SoC chip which has speed up to 1.4Ghz. It has 1 GB of Ram for fast operations. It has Wi-Fi and Bluetooth facility inbuilt 2.4GHz and 5GHz IEEE 802.11 WLAN, Bluetooth version 4.2. It has HDMI port as well. It has a dedicated camera port for connecting pi camera. It takes 5V/2.5A as power input. It also has USB 2.0 support that can transmit at up to 300mbps. It also has 3.5mm audio jack as well as microSD card slot. Keyboards and mouse can be connected through USB ports provided in Raspberry pi. In this project we are using OpenCV library for facial recognition. Raspberry pi meets all the requirements of our project thus, is suitable for our home security project. Raspberry Pi is open source. Linux-based Raspbian (a group of courses) and its main supported working structure is open source and runs an open-source suite of programs. The Raspberry Pi Foundation adds Linux to its parts and expands other open source types accordingly, exclusively releasing its own rare pieces of programming as open source. The circuit diagram of the Raspberry Pi is low. In any case, the board itself is not an open device. The Raspberry Pi Foundation does its useful work by relying on rewards from the respite of the Raspberry Pi. Some people buy a Raspberry Pi to understand how to code, while others who are starting now can understand how to use Pi to encode equipment for physical work. Raspberry Pi can open a portal and create its own home robotics experience. This is because it is the standard among open-source inspirers, not the use of a closed, closed structure. In the figure below, we can see there are 40 output pins for PI. There are total 26 GPIO pins that range from GPIO2 to GPIO27.

Pi camera module: It is a mobile camera and basically a mobile phone camera module. This camera uses a rolling shutter for capturing images. It is not a still camera it captures live images and sends it to pi for processing. It uses MIPI serial interface protocol for data transfer mechanism. It can be used in projects that are somewhat related to image processing, machine learning and surveillance.

A **passive infrared sensor (PIR sensor)** can sense lights radiating from any type of objects in its field of view. By sensing the lights, it comes to conclusion whether the object has any movement. Thus, it senses any type of movements of objects. It finds its application in security alarms etc. It has sensitivity up to 20ft. They consume very less power and have very low cost. It can be interfaced easily thus can be used easily.

III.NEED OF THE SYSTEM

Home Security is most important in today's world, Peoples are making their home secure by using security CCTV cameras. But there comes one downside along with CCTV Camera i.e., CCTV cameras has cost attached to it. Security Cameras are though effective we need more cost-effective System. This project aims to replace the security cameras from our Home security space and replace it with system that uses Raspberry pi. This project is designed for low to medium income segment of our society which usually lives in buildings. This system uses a combination of sensors that detects motion, Faces and heat that could be accidental fire etc. Existing Security Cameras stores the data on cloud that could be a breach to our privacy. Our System uses a Small debit card sized chip along with a PI Camera. In today's world security is of utmost importance, we can make places secure by monitoring any type of criminal activities. Our homes need to be secured at least so that we can sleep peacefully at night. In today's world everything is become smart so IoT based home surveillance system is need of hour and cannot be ignored. This project has filled the gap of storage issue and provided a low-cost security solution that can be implemented for a better secure home. Earlier systems were also good at their respective time but at present scenario IoT based system is necessary as it does not require any extra manpower required to watch the video recordings.

IV. WORKING

The System consists of Raspberry pi, Pi camera, PIR sensor. The data from these sensors is sent to Raspberry Pi which acts as a controller and process all the data collected by sensors. Databases of all the known humans is stored and image captured is sent to be processed by raspberry pi. Every frame is matched with database in OpenCV. If the human is known or stranger user is notified by email. This system also detects some abnormal situations, when temperature is too low and the movement of strangers is detected, it will send notification to mobile devices of user directly.

- I. We are using a Raspberry Pi which acts as a microcontroller. It takes input from all the sensors and process these inputs using software libraries and then sends the notification to user using Internet.
- II. Second component is Pi Camera it is like a mobile camera module. It captures still images and send images to Raspberry pi for processing.
- III. We are also using PIR sensor, it senses any type of motions and sends data to Raspberry Pi for further processing of these data.



IV. We are also using SD card to store images, when our system is unable to connect to the internet.

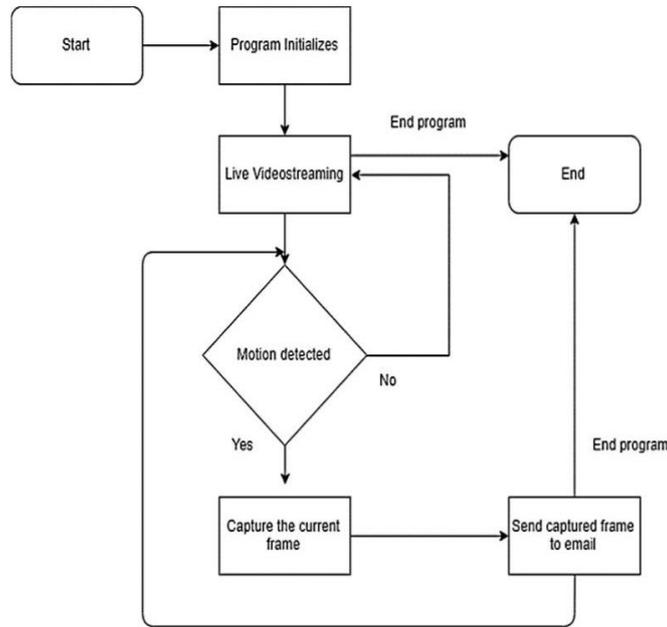


Fig.3 Flow Diagram

V.PSEUDOCODE

- i. The program imports all the files from library useful for our project to run.
- ii. Camera starts and starts capturing image during suspicious activity.
- iii. Image is changed into grayscale and gaussian blurring is done.
- iv. Image Captured is matched in the databases.
- v. The image matching is done using haar algorithm.
- vi. Program comes to conclusion after comparison whether person is authorized or unauthorized.
- vii. End of flow

VI.CIRCUIT DIAGRAM

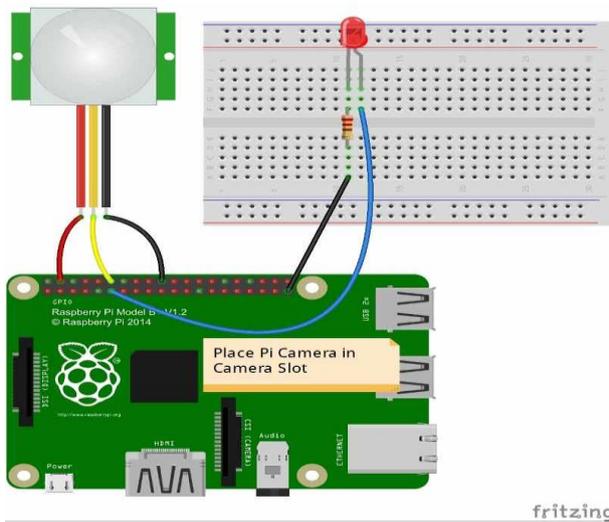


Fig. 4. Circuit Diagram of Security System



Fig.5. Device Setup



VII.CONCLUSION

The project implemented a security system that is built using the Raspberry Pi. The aim of this project is motion detection, video capturing using a Pi Camera and alerting through e-mail. This project system can be successfully used to monitor the places to prevent any intruders access by some an alert mechanism, image processing, emailing or SMS to company's owner and to keep an eye on people enter and leave the premises using the pi camera. The significance of this project can be applied in the various and wide places such as; UMEME ltd, power transmission companies, homes, schools, institutions, government warehouses, hospitals, and some other places where critical security concern is highly demanded. In this project a new type of home surveillance system is deployed using Raspberry Pi 3 Model and open-source python library Open CV. Both the hardware and software together combined produces extra ordinary results in image processing, motion detection, facial recognition and thus makes it a complete surveillance system based on IoT. The experiments conducted has shown that this system is highly accurate. The false alarms have been eliminated in this vision-based system. Various experiments conducted in set of 10 trials per experiment to know about performance of the system as whole. These experiments will surely help in various enhancements and help in achieving greater accuracy levels. The OpenCV motion detection system is found out to be more accurate and effective than the PIR sensor with passing rate average of 100% against passing rate average of 76% of PIR sensor.

VIII.RECOMMENDATION & FUTURE SCOPE

- This project can be an advancement in the field of security. It can be developed as independent security system solution.
- GSM can be used in this project so that this project can alert user when the device is offline. In this way this project will work anywhere without internet.
- Remote control of various devices can be incorporated in this proposed system and in future it can certainly be improved.
- The processor used can be developed more in the future so that it can process large chunk of data in short span of time. e.g., video for effective motion detection and tracking
- Soon everyone will be talking of smart homes and our project is one of the laid milestones in making our homes smarter. As we are growing technically our security system should also improve from time to time. Everything is being controlled by using mobile devices using IOT. Our project can be integrated with all other home automation controls to make it more robust.

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