Implementation of Vision Based Intelligent Home Automation Security System

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Abstract — Automated security systems are a useful addition to today's home where safety is an important issue. Vision-based security systems have the advantage of being easy to set up and non-obtrusive. An intelligent security system that provides a high level of home security using visual surveillance is developed and explored in this paper. Surveillance system is achieved using the face recognition system, which can be achieved through image processing and the communication system, which is achieved through the use of internet. The image of the user will be preloaded in the system. If the user left the premises and the system detects the presence of another human being in there, then an SMS will be sent to the cell phone of the user and the alarm is turned on. Also an image of the intruder will be sent to the mail of the user.

Keywords: Raspberry Pi B+, GSM Modem, Open CV, CMOS Camera, Python, LAN/Ethernet.

I. INTRODUCTION

We are living in a world where crime has been increasing dominantly. Crime prevention is one of goals of current research. This is because it saves valuable lives, money and time. Home and work place become the victims of crime. Many people have started using various types of security system to prevent unauthorized trespasses in their property. Such system helps to feel people a bit safe while they are traveling or staying outside for work. Many of these systems work only within a certain boundary. For example CCTV camera footage can only be seen while the user or the guard is in the control room. The current existing home security system for anti-theft and fire system includes infrared rays for input process. Even though these types of security system are comprehensive yet there are still some defects such as the range of infrared based home security system is 4 to 5 meters.

In this paper we have tried to develop an intelligent system that provides home security, automatic people counting and automatic energy saving. (i) Our module count people in a room and then control the loads on the room and when there is no people then the module goes to the surveillance mode for providing security service. (ii) The number of people count is done by one overhead camera at the entrance of a room. The count is done by background subtraction method in CSI. Then when there is no person in room another camera works for surveillance system. Motion detection algorithm and human detection is done in CSI. If any human is detected in the surveillance mode then using the way2sms, message is sent to the owner of the house, and also an E-MAIL will be sent to the user by using Ethernet / LAN .The user can reset the system sending a SMS from his cell phone. These different sub processes are run distinctly and maintained by a main process. For better detection the camera was mounted vertically with respect to the plane of the floor. (iii) Our system not only counts the number of people present in a room but also provides facilities home automation system by turning off all the loads in the residential or office room.

II. BLOCK DIAGRAM AND DESCRIPTION
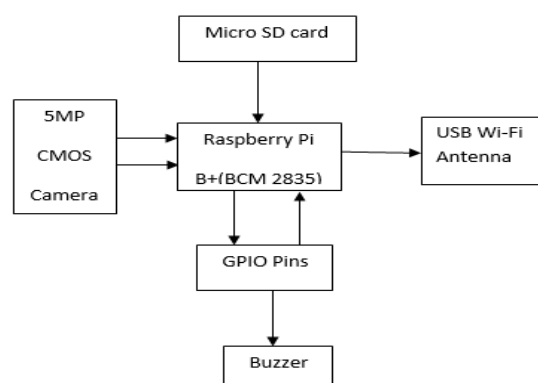
BROADCOM BCM2835:

Original Raspberry Pi is based on the Broadcom BCM2835 system on a chip (SoC), which includes an ARM1176JZF-S 700 MHz processor, Video Core IV GPU, and was originally shipped with 256 megabytes of RAM, later upgraded (models B and B+) to 512 MB. The system has Secure Digital (SD) (models A and B) or MicroSD (models A+ and B+) sockets for boot media and persistent storage.

RASPBERRY PI:

Raspberry pi comprises of two models Model A and Model B. The Raspberry Pi Model B+ is used here, this is the ideal model for anyone on a budget but still wants a piece of the Pi. The credit-card sized computer is capable of many of the things that your desktop PC does, like spread sheets, word-processing and games. It also plays high-definition video. The secret sauce that makes this computer so small and powerful is the Broadcom BCM2835, a System-on-Chip that contains an ARM1176JZFS with floating point, running at 700 MHz, and a Video core 4 GPU. The GPU provides Open GL ES 2.0, hardware-accelerated Open, and 1080p30 H.264 high-profile decode and is capable of 1Gpixel/s, 1.5Gtexel/s or 24 GFLOPs of general purpose compute. It means that if you plug the Raspberry Pi into your HDTV, you could watch Blu-ray quality video, using H.264 at 40MBits/s.

5MP CMOS CAMERA:

CMOS sensors have circuitry at the pixel level. This means that every pixel on the sensor is read and transmitted simultaneously, preparing voltage for the chip. The chip then uses additional technology, such as amplifiers, noise correction, and digitization, to convert the voltage to digital data. This means that CMOS sensors do not require a separate image processor. Because CMOS sensors are able to convert visual information to digital data more quickly than CCDs, they require less power, which preserves battery life. However, the extra technology on the sensor crowds the pixels, limiting their ability to capture light and resulting in generally poorer visual clarity in the final image. CMOS sensors are commonly designed with rolling shutters, especially on commercial applications. This means that the image frame is exposed from one side to the other, instead of all at once as on CCD sensors. For example, a video camera using a CMOS sensor may record data in a "rolling" sweep from left to right, or top to bottom. This results in the potential for a few types of distortion not found on CCD sensors.

LAN:

A local area network (LAN) is a computer network that spans a relatively small area. Most LANs are confined to a single building or group of buildings; however, one LAN can be connected to other LANs over any distance via telephone lines and radio waves. A system of LANs connected in this way is called a wide-area network (WAN).

Most LANs connect workstations and personal computers. Each node (individual computer) in a LAN has its own CPU with which it executes programs, but it also is able to access data and devices anywhere on the LAN. This means that many users can share expensive devices, such as laser printers, as well as data. Users can also use the LAN to communicate with each other, by sending e-mail or engaging in chat sessions.

GENERAL PURPOSE I/O (GPIO):

There are 54 general-purpose I/O (GPIO) lines split into two banks. All GPIO pins have at least two alternative functions within BCM. The alternate functions are usually peripheral IO and a single peripheral may appear in each bank to allow flexibility on the choice of IO voltage. The GPIO peripheral has three dedicated interrupt lines.

BUZZER:

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Active buzzer 5V Rated power can be directly connected to a continuous sound, this section dedicated sensor expansion module and the board in combination, can complete a simple circuit design, to "plug and play."

III. SOFTWARE REQUIRED

PYTHON:

Python is an interpreted object-oriented high-level programming language with dynamic semantics. Its high-level built in data structures, combined with dynamic typing and dynamic binding; make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together. Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse.

It can be extended to by this format using the C or C++ language. Once you have Python installed, you can choose your favorite editor to write your code

IV. WORKING

Vision based intelligent home automation System provides a high level of home security using visual surveillance. When we leave our premises and going out we should activate the security key and then it starts video processing by open CV. The main processing unit is a Raspberry pi processor with Raspberry pi operating system and the board. If any unauthorized person enters into our home GPIO activates and gives alert signal. Total number of people in a room is counted using the Open CV.

The 5MP CMOS Camera captures the image of person who enters and a SMS will be sent to mobile of the user by way2sms and the alarm will be turned on, after turning on the alarm the system will start recording video on the SD card and stores the data on SD card. So the user can inspect later and an E-MAIL will be sent to the user by using the internet through USB Wi-Fi antenna.

Surveillance system is achieved using open CV and the communication system is designed by using way2sms. We can set the threshold value to vary the pixels. The system continues automatic surveillance when the user left the house or office. This system is very flexible that we can monitor by sitting in our office. The entire code is developed using python language.

V. FLOW CHART

At the initial stage the first step to be performed is to initialize GPIO. After Initialization of GPIO then in further step Serial Port is to be initialized. Then Serial Port checks for Secure Mode Key. If the Key is activated it starts Video Processing using Open CV. If the Key is not activated it goes back and waits for the key to become active.

While Video is processing if motion gets detected it compares changed pixels number of image with Threshold value limit. If motion is not detected it goes back and starts processing the video again. After comparing the pixels number with certain value limit, if limit gets exceeded the image gets captured. If not goes back and starts video processing using Open CV. After the image is captured it gets stored in the SD Card for user access to have a glance at it. Later an E-MAIL is opened and image is attached and sent to the registered user by an alert message.
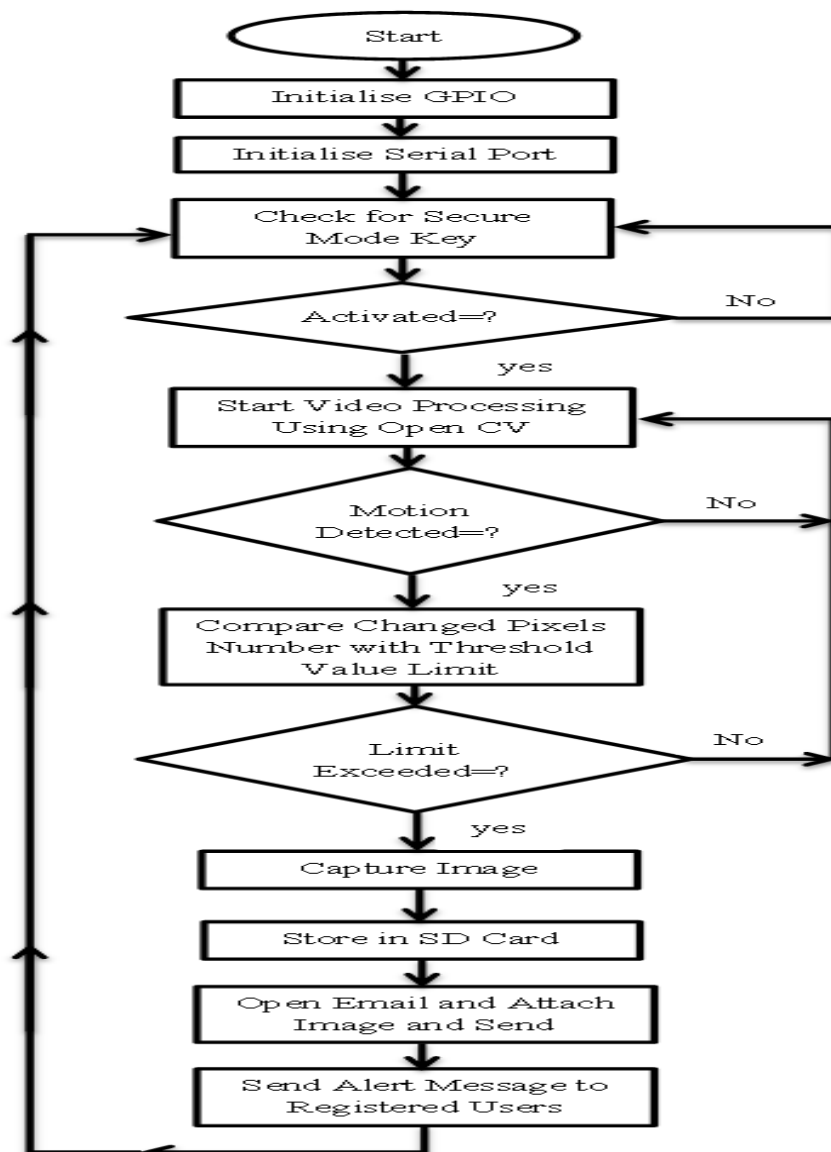
VI. CONCLUSION

In this Paper, we have introduced design and implementation of a low cost, flexible solution to the home automation. The system is secured for access from any user. The users are expected to acquire pairing password for the Raspberry PI the cell phone to access the home appliances. This adds a protection from unauthorized users. This system can be used as a test bed for any appliances that requires on-off switching applications without any internet connection. The full functionality of the home automation system was tested.

VII. RESULT
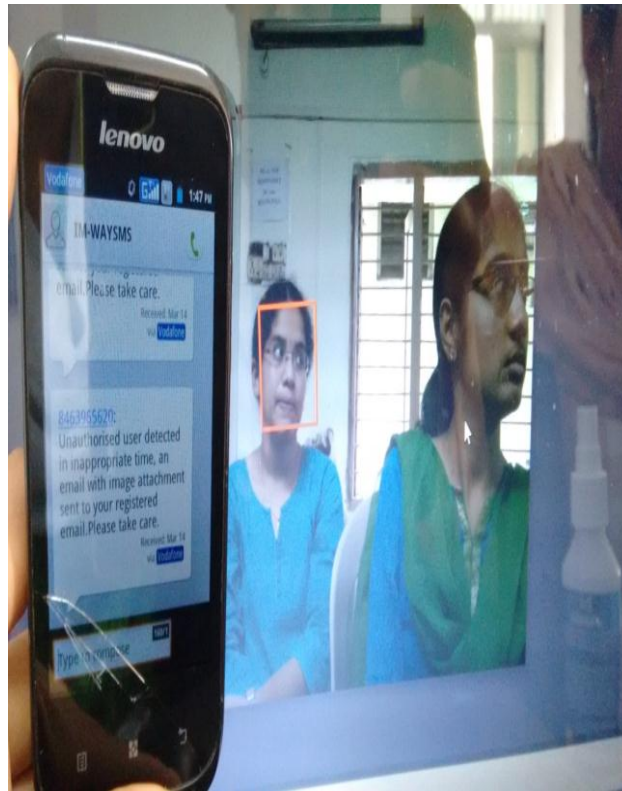
VIII. FUTURE SCOPE & WORK

Currently, the Raspberry device is too large to fit easily into a pre-existing wall switch electrical box. There are several ways this could be improved in future work. The use of surface mount components would dramatically decrease the overall size of the components. Surface mount components are also often less expensive as they require less material to produce.

This would help reduce the overall cost of the devices as well as the size. Another area to help improve the size is the circuit board that is used. Currently for the prototype, a generic breadboard style board was used. If this device were to be commercially produced, a more compact circuit board could be designed.

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