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SECURED SPY FOR HIGHLY SECURED AREAS

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Abstract - *In today's world all are concerned about their security. This has caused surveillance systems to play most crucial role in day to day life. Majority of the people are using the Closed-Circuit Television (CCTV) surveillance system. This type of surveillance has several defects which end up in lots of memory & energy wastage. Lots of storage space is required to store surveillance information, 24/7 monitoring is required & price remains relatively high. This paper describes new design and implementation of low-cost smart surveillance system using raspberry pi (Model B), infrared sensor (PIR). In addition motion detection algorithm is used to overcome the memory restrictions and save investment cost. The algorithm detects the motion which is implemented on credit card size computer raspberry pi (Model B), which enables live streaming camera. When motion is detected then raspberry pi alerts the user by sending short link through SMS (Short Message Services) on smart mobile phone. The live video camera can be viewed from any web browser, even from mobile browser in real time. The proposed system is smart enough, cost & energy efficient, storage effective and secured solution for surveillance of highly secured areas like military areas, research areas, laboratories etc.*

Key Words: **Motion detection, Raspberry Pi, PIR Sensor, Surveillance system, USB Camera, Motion Detection Algorithm etc.**

1. INTRODUCTION

In today's world people are concerned about the security and various technologies are required in order to satisfy the increasing demand for an easier & comfortable lifestyle. Surveillance systems have become more important for security monitoring purpose in any organizations, laboratories, research areas, firms and military areas. Various surveillance systems are used like CCTV, cameras etc, in which user is stationary and has to monitor what is happening in that place. Whereas in proposed system user is moving from one place to another & can keep track of what is happening in that place. When motion is detected user get alert by receiving a short link through SMS on mobile phone. By clicking on the link user can view what is happening in that place by live video camera streaming and allows the person to go in the room by opening gate remotely.

There are many problems in the video surveillance systems such as picture is indistinct; a lot of storage is required to store the data. To overcome this problem we are applying Motion Detection Algorithm based on Approximate Median Filtering (AMF). A USB Camera is connected to Raspberry Pi which will take the images of motion detected and live streaming can be viewed from any web browser. So the collected images are stored in a folder for further administrators review. Due to this automated approach there is no requirement of individual to monitor 24/7. We can significantly decrease the storage spaces & save investment costs. This type of systems can be used in highly secured areas.

The following paper is organized as: In Section II describe the whole system architecture. Section III presents the motion detection algorithm. Section IV presents the results and experiments. Finally conclusions and future scope is given the Section V.

2. SYSTEM ARCHITECTURE

The Fig- 1 shows System Block Diagram. The Block Diagram has Raspberry Pi the single board computer, USB Camera module, PIR Sensor, DC motor for door assembly, driver ICs are used for relays and DC motor relays are used to on/off the room LEDs.

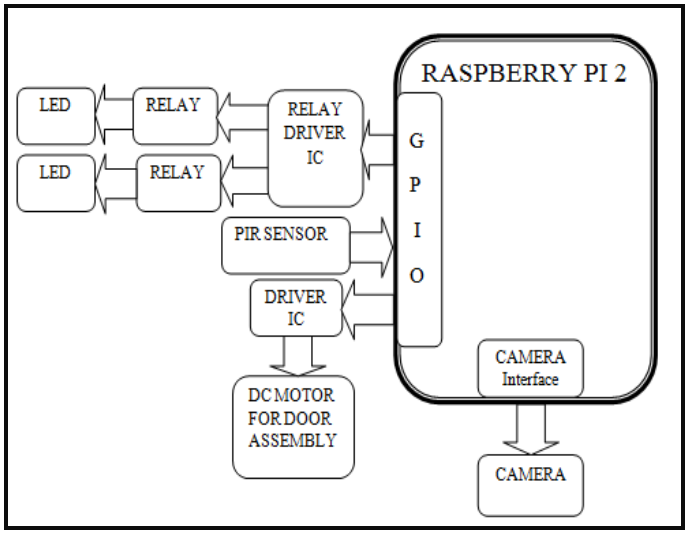


Fig -1: System Block Diagram (Architecture)

1.1 Raspberry Pi Model B

The proposed system uses Raspberry Pi model B credit card size, single board computer developed in the United Kingdom by the Raspberry Pi foundation. The Raspberry Pi works on

power consumption of 5v, 2A. The operating system boots from micro SD card with a current version of Linux OS such as Raspbian, Debian, NOOBS, and Fedora. Fig-2 shows image of Raspberry Pi model B which is many features.

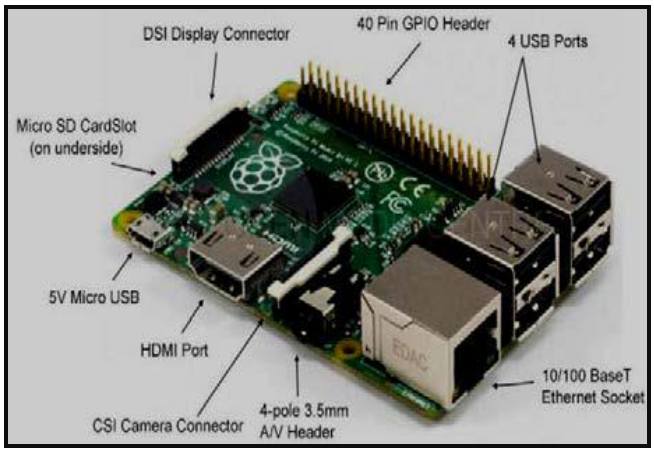


Fig -2: Features Offered In Raspberry Pi Model B

Raspberry Pi has various functionalities which are given below as:-

- Broadcom BCM2835 processor with 700MHz, ARM1176JZF-S core.
- Micro SD Card slot, 4x USB 2.0 Ports, HDMI (high definition multimedia interface)
- 5MPix Camera Module.
- 512MB RAM.
- GPIO allows us to control and interact with outside world.

1.2 USB Camera

5MP camera module is used, which captures the image & send it to the USB port of the Raspberry Pi board. The camera model used here is USB Camera model 2.0. It is connect to the CSI (camera Serial Interface) Raspberry Pi Port through ribbon cable.

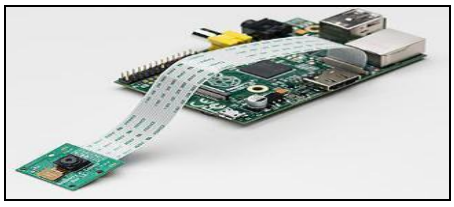


Fig -3: Camera Board Connected To Raspberry Pi

1.3 PIR Sensor

The Pyroelectric Infrared (PIR) Sensor device is nowadays in widely use. A PIR detector combined with a Fresnel lens are mounted on a compact size PCB together with an analog IC. The PIR sensor IC consists of 3 pins- Vcc, Ground and Output. It has limited components to form the module. High level output of variable width is provided. Fresnel lenses are good collectors.

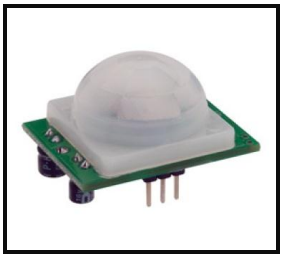


Fig -4: PIR Sensor

Other required hardware's are DC Motor driver IC L293D, 5V power supply, Relays, Red/Yellow LEDs, Relay driver IC ULN2003. The basic software tool used for Raspberry Pi is JAVA. In this paper JAVA is used as a programming language. It is a high level programming language which allows expressing the concept with the help of inbuilt libraries.

3. MOTION DETECTION ALGORITHM

Motion Detection Algorithm mainly works on the basis of Background as the Approximate Median Filtering (AMF).

Algorithm Name: Background as the Approximate Median Filtering (AMF)
Input: Video
Output: Motion Detection

Step 1: Start Camera in video mode, Start GPIO listener.
Step 2: Capture a frame from video.
Step 3: Convert the video frame data into RGB form.
Step 4: Extract RGB of input frame.
Step 5: Calculate mean of R, G, and B side of image separately.
Step 6: Check whether this frame is 1st frame.
Step 7: If yes repeat from step 2, else compare pixel by pixel value of current frame with previous one.
Step 8: Update pixel difference count in step 7.
Step 9: Check if pixel difference count is greater than threshold value.
Step 10: If yes, mark *motionByImage=true*.
Step 11: Check PIR sensor value, if it is HIGH, mark *motionByPIR=true*.
Step 12: If *motionByImage* & *motionByPIR* are true, report motion detection else repeat from step 2.

End

Fig -5: Motion Detection Algorithm

Fig -5 shows complete motion detection algorithm where input is video. Frames are captured from this video and converted into the RGB form. Then calculate mean of R, G & B of each frame separately and compare the pixel to pixel value of frames. Comparison is done between current and previous frame. If this pixel difference is greater than threshold value, then motion is detected by camera. Sensor value is checked if it is HIGH the motion is detected by Sensor. If motion detected by camera and sensor is true then it is reported as motion detected and user gets the notification through SMS.

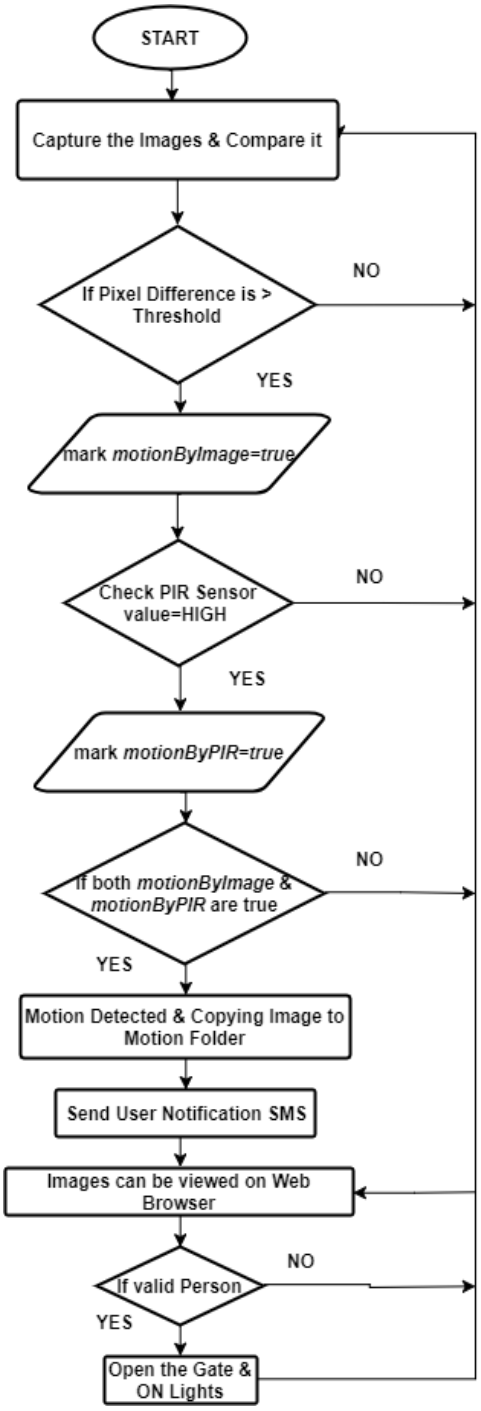
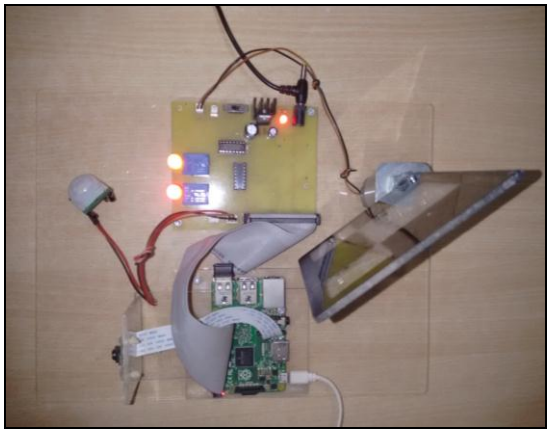


Fig -6: Motion Detection Flowchart

Motion Detection Flowchart is shown in Fig -6. If there is no motion detected, the program will not the save the images which are saved in folder on Raspberry Pi.

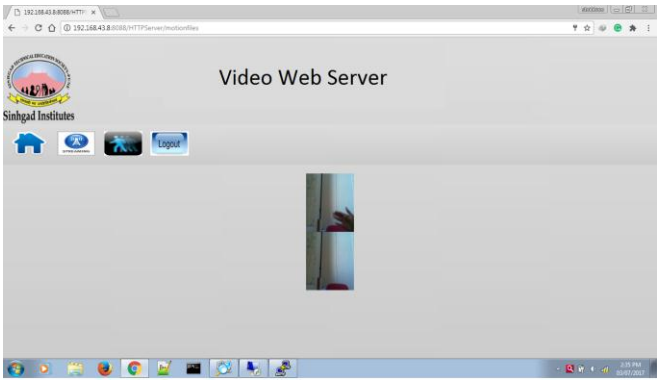
4. EXPRIMENTS & RESULTS

Fig -7 presents the screenshots of the proposed system. When movement occurs go to the link (fig-7b) on any web browser, authenticated user will login to the page. User will see the set of motion images (fig-7c) for which he got the SMS. Live streaming can be viewed (fig-7d) and user can allows the person to enter by opening the gate button on web page.

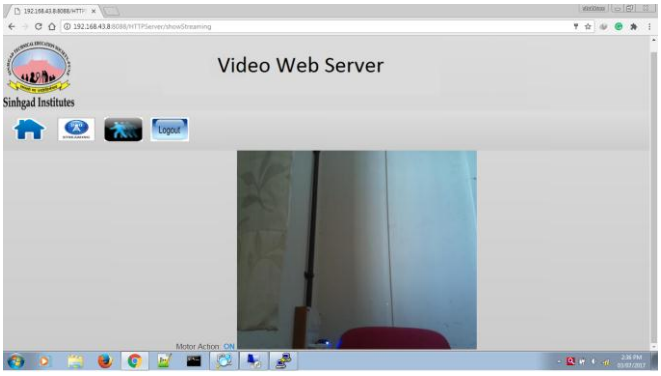


(a)

(b)



(c)



(D)

Fig -7: System Screen Shots: (a) Hardware setup for proposed system (b) Notification link SMS (C) Motion Detected Images on web browser (d) Live streaming on web page & Gate open action control

5. CONCLUSIONS AND FUTURE WORK

Thus we have designed a smart surveillance system capable of recording images and transmitting to web server. It is advantageous because the system offers privacy, reliability and we don't have to surveillance it for 24/7. This system can be used in highly restricted areas, research laboratories, military areas, smart homes, industries. This system design is cost effective and storage efficient. If you are travelling the output can be checked with the help of the mobile by using Google chrome and Mozilla Firefox or any other mobile applications.

Future work is to locate the number of persons located in surveillance area. We can also record the video footage to enhance the security. More sensors can be used for accurate output. The Digital image algorithms can be implemented to recognize the difference between human and animals.

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