Embedded Video Processing on Raspberry Pi

T Anuradha, S Monika, S V S Prasad

Abstract: ***The paper focuses on the study of the methods existing in the present scenario for detection of motion and faces using various algorithms and discuss about their area of application by implementing with the help of on the on-board miniature Raspberry Pi. Open CV functions are optimized to the specific platform and can be further used as a surveillance system which is embedded on the computer. The paper also focuses on hand detection using a trained custom classifier.***

Keywords: Raspberry Pi, USB Camera, Open CV

I. INTRODUCTION

In the past decade, the need for security has been increased for various reasons. The next evolution of security cameras is to annotate video and local coordinates of the objects that are tracked by multiplexing many video streams together in real-time. Video surveillance is playing a vital role in maintaining security in privately or socially like banking, in house monitoring, finance etc. This can be easily monitored by using our regular personal computer. Over the years back all of us have used analog cameras that are connected to coaxial cables. As the years passed to improve the performance and increase the compatibility of the user we have switched to digital systems, now to IP- based systems.

In practice it is not easy to detect and track any moving object. The omni directional cameras are generally used for this purpose. Mobile cameras can also be used for this purpose. In this implementation, we use the Raspberry pi. The recorded video data captured is collected and compressed into MPEG format then transferred to the network. This signal is processed by the client monitoring the system; it will reframe, restructure and recompose the video images. Using a coaxial cable cost more than this wireless video monitoring system.

II. EXISTING SYSTEM

In existing system, there are no methods for detecting the human face. In case of any confidential matters the authorities must know the person. For example any person who is trying to harm the nation, then compulsory authorities need to know that person's face and his movement. But there are no specific technologies to know all these.

DRAWBACKS

- We cannot know the person.
- We are not able to get the movement of the person.

Proposed System

This paper deals with the Raspberry pi 3B minicomputer which is used to design an embedded surveillance system. This paper mainly focuses on face detection using various motion detection methods and face detection algorithms. After selecting the specific method for testing and implementation, it is programmed using C/C++ to calculate and reduce the processing power of the embedded minicomputer. Using image processing algorithms, the image captures from the externally places web cam are captured and the all the passive scenes are processed. These algorithms analyze the images in real time and extract the information about the objects which are moving and if any motion has occurred it saves that video sequence.

The captured images are processed using various computer based vision approaches. All these can be initially tested using open source software which contains over optimized algorithms for image and video analysis and manipulation. The open CV libraries contain all the functions that can be operated and optimized on the Raspberry Pi platform.

III. LITERATURE SURVEY

A few literatures checked various probabilities of acquiring the required data from concept of localization. This is made a bit easier with the IOT platform to get the details. This system is also provided with IOT to get a localized environment values. The previous literature review also has some disadvantages that this type of system cannot be used where there is no GSM facility. It also has some more problems like the signals cannot be properly transferred nor received properly in case of cloudy atmospheric conditions. There may be a delay in communication networks which is presently being used as a portable black box that detects the blast items. Similar few more applications like accident detection in case of blast of mines, station alarm system, mine tracking system using GPS. This helped in developing the paper to design a module that can easily identify the particular object and analyze its local parameters.

IV. HARDWARE MODULE

Raspberry pi 3 is the major modules used in the project whose detailed information is discussed in this chapter. Along with all the individual modules and their explanation is provided in this chapter. Block diagram gives the brief idea about the overall modules used which is the explained prior to all other information.

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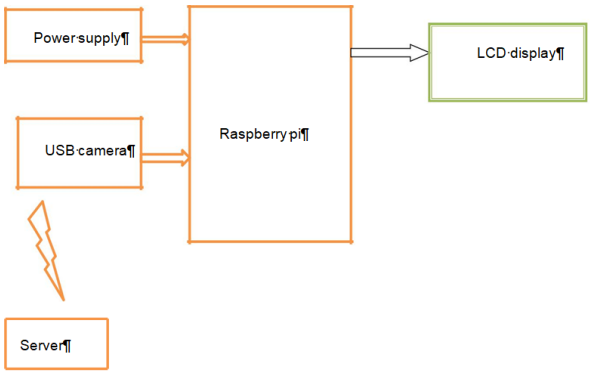


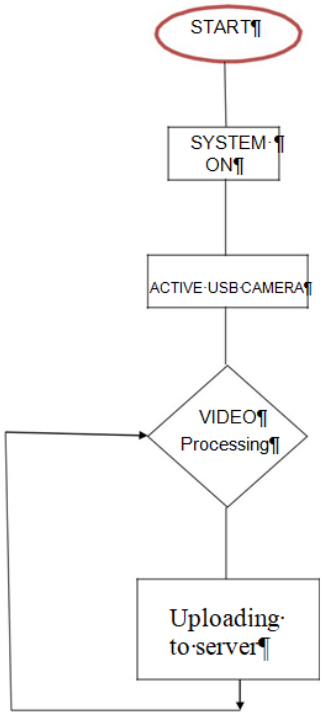
Fig 4.1 Block diagram of video processing system

The project Raspberry Pi3 based wireless controlled operated robot in disaster zones for the detection of mine presence contains the blocks as shown in figure 3.1above. It contains embedded video processing system.

Overview of Block Diagram

A web camera is installed to record the live video. The proposed model uses Raspberry Pi Model B with a Logitech C300 which includes serial port (USB) webcam. An external hard drive is used to accumulate data. Here 16GB secure digital high limit card is used. Web association is given by means of CAT6Ethernet link. The camera is attached to the stepper engine so that it captures all pictures. Raspberry Pi is arranged with USB designed camera module and an outside screen to see the captured video.

Flow Chart



Step 1: Turn the system by providing power supply which can be done using a power bank to Pi and from 5V battery to USB camera.

Step 2: Open the screen by login into the Pi and in the terminal open the program to execute here it is USB camera program as well as turns the USB camera.

Step 3: It will up load capturing images to the server

Step 4: Log in your server and observe video processing.

Step 5: On successful operation turn off the system.

V. RESULT

This chapter provides the information about how the robot is been operated using the commands and what are the outputs displayed on the screen on instruction execution, followed by overall operation of the project.

Hardware Modules in the video processing

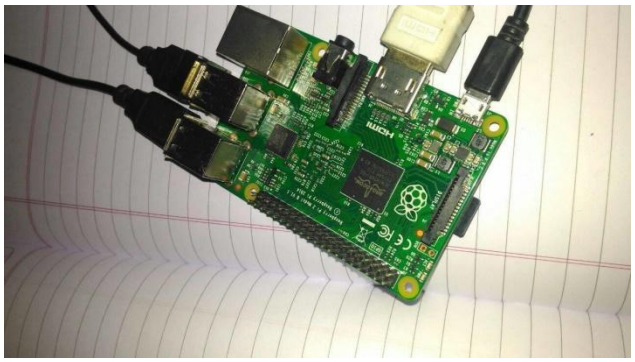


Fig 5.1 USB camera and Pi board

Fig 5.2 SD Card

Hardware modules involved in the project are LCD display and USB cam which are shown in fig 5.1. To run the Raspberry Pi3 we need an external SD card where the OS is been written is shown in fig 5.2 and to place all these components placed on the raspberry pi

Observation on server side

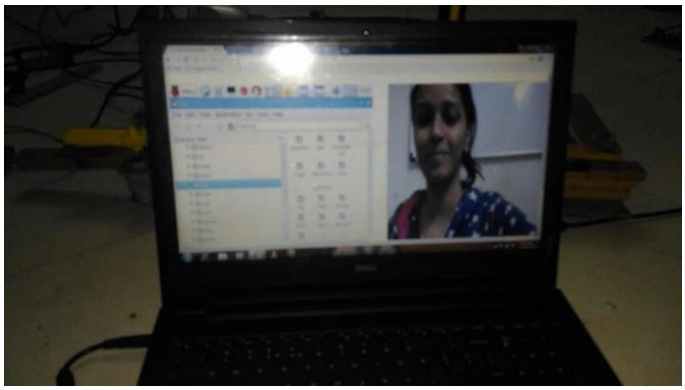


Fig 5.3 Observation on server

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Observation section includes a PC or any display and a Wi-Fi router which are shown in the fig 5.3. the use of PC/display is to execute the code in the terminal, to observe video live. The use of Wi-Fi router is to provide hotspot for the PC and the Raspberry Pi board.

Raspberry Pi3 screen

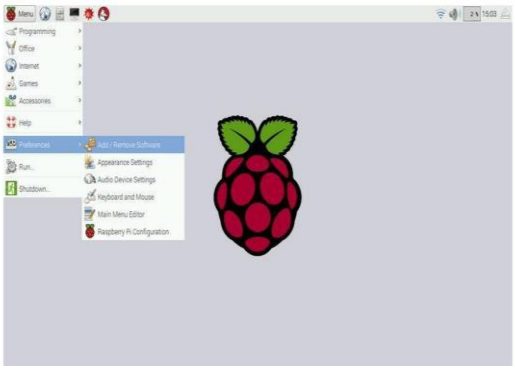

Fig 5.4 Raspberry Pi screen on first boot

On providing the power supply to the Raspberry Pi3 board the screen should look like above shown in figure 5.4. In some versions of OS to get the above screen we need to type **startx** command in the terminal shown on the screen then the above screen appears.

Terminal window of Raspberry Pi3

The fig 5.5 shows the terminal window used in Raspberry pi where the program can be written and executed by using appropriate commands into it. It is also used to configure any library files and can also be used to add/remove files from the directory.

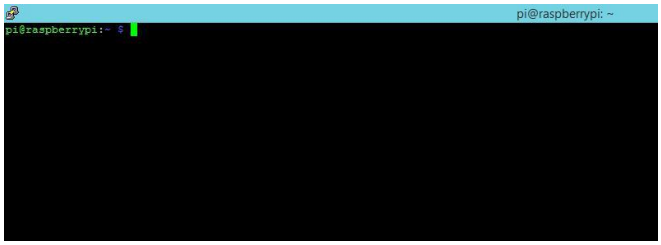

Fig 5.5 Terminal window of Raspberry pi3

Install usb camera drivers

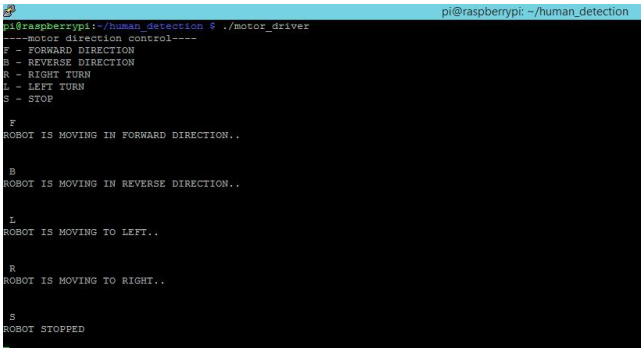

Fig 5.6 Output on the screen after USB cam drivers installation

To execute the USB cam program the command should be **"./filename"**. In my case it is ./apt-get install_driver, then the screen looks as shown in fig 5.6 above. This program is used to run the USB cam in any direction.

CAM output window

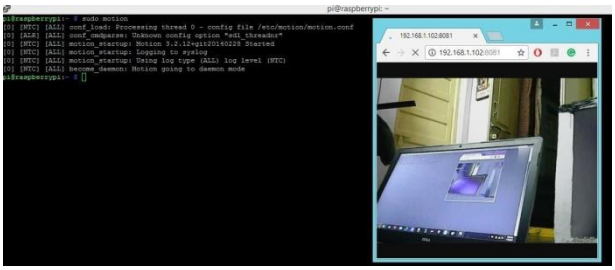

Fig 5.7 USB cam output screen

To get the live streaming of the location through USB cam the instruction should be **"sudo motion"**. On successful execution we can see live video by entering the IP address in the browser as shown above fig 5.7.

Output screen of overall project operation

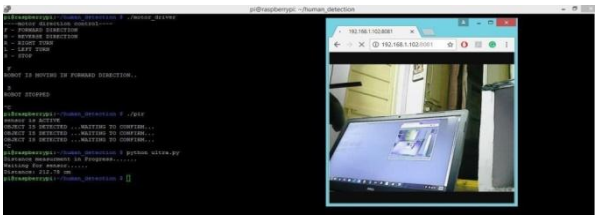

Fig 5.8 Output Screen with commands

Fig 5.9 Output Screen along with video streaming

After successful operation the final output screen is shown in the fig 5.12. Left side window in fig 5.8 is used to enter the commands to execute the code and also to operate the robot by giving the right directions. The window on the right side is used to monitoring the location using the USB cam by entering the IP address in any of the browser. The overall kit along with screen can be seen in fig 5.9.

VI. CONCLUSION

The project has been successfully done with a designed embedded real-time video monitoring system. Linux operating system is used for streaming purpose. It is available at portable, low cost, easy to use and maintain. It can easily be upgraded to any high end application. Here the web browser is based on MJPG streamer for streaming captured video from camera placed in remote location. The

MJPG streamer is cross-compiled and loaded in to the Raspberry pi board to act as a web streaming server. The regularly captured videos are transmitted to the server and these are being processed to obtain the actual data whenever it is needed.

Future Scope

This project can be enhanced further in following ways.

As this project has a limitation of distance, which can be overcome by creating the wireless access points as raspberry pi 3 has inbuilt Wi-Fi which makes the work easier. Another ways this project can be enhanced by making the Pi online that is once Pi is made online we can easily operate it from anywhere in the world which can be done by PORT forwarding technique.

As security threats increase once Pi becomes online due to poor security of Wi-Fi. To overcome this problem we can use techniques like

1. **Wired Equivalent Privacy (WEP):** An RC4-based 40-or 104-bit encryption with a static key.
2. **Wi-Fi Protected Access (WPA):** This is a new standard from the Wi-Fi Alliance that uses the 40 or 104-bit WEP key, but it changes the key on each packet. That changing key functionality is called the Temporal Key Integrity Protocol (TKIP).

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