

Implementation of Web-Surveillance using Raspberry Pi

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Abstract—For years since its inception, video surveillance was something mainly used by the government and prodigious, affluent companies. Now you can see video cameras everywhere you look, across the street, whether you're grabbing a quick bite at a fast-food restaurant, at the intersection, or walking up to your neighbors' front porch. Video surveillance has become a necessity for local business owners, and is becoming more prevalent for cross-country business owners as well. The reason for writing this paper, however, is not to discuss the possibilities for the rise of video surveillance system, but to provide the overview of the configuration of the live streaming and camera monitoring through Raspberry Pi in such a way that it can be used in a robust and user mobile environment from any part of the world, not just local. It will help in rescue operations and user can access the images captured and the video transmitted from the remote area such as the sensitive areas or areas which are beyond our reach, with the aid of Internet. Through this system, incorporating instructions in the ethical conduct of surveillance, it might help in reducing the discriminatory potential of CCTV surveillance in public areas.

Keywords—Raspberry Pi; surveillance; global; Internet

I. INTRODUCTION

Robots are being used in variety of industrial applications for various activities like welding, painting, drilling, sanding, cutting, and moving tasks in manufacturing plants assembling of subsystems etc. Robots are becoming smarter and smarter as technology makes progress in the areas of CPU speed, sensors, memories etc. And there is ever demanding applications even in defense. With the rapid growth of the world wide web, more and more intelligent devices or systems have been embedded into it for service, security and entertainment, including, surveillance cameras, telescopes, manipulators, mobile robots and general purpose. Although the conception of Internet robotics or web-based robotics is new and in its nascent stage, it has captured huge interest of many researchers around the globe.

With the explosive exponential growth of internet robotics-in the commercial sense, it is now possible to conceive many new networked robotic applications for diverse domains. It is a rapidly advancing field, as technological advances continue; research, design, and building new robots serve various practical purposes, whether domestically, commercially, or militarily. Video surveillance is an important research area

in the commercial sector as well. Technology has reached a stage where mounting cameras to capture video imagery is economical, but finding available human resources to sit and watch that imagery is relatively expensive. Surveillance cameras are already prevalent in commercial establishments, with camera output being recorded to discs and tapes that are either rewritten on a continuous basis or stored in video archives.

But there's a slight problem. Local video surveillance is awful, and it's everywhere. But it would be much beneficial to see about surveillance in the hands of private people – it's a matter of –metaphorically speaking– Who watches the watchmen?, and to help, there comes Raspberry Pi, bringing the price of networked motion-sensitive HD surveillance cameras down to be affordable by consumers. Off the shelf, you're looking at prices in the hundreds of pounds. But a Pi to make your own HD system, and your setup should come in at under £50, with a bit of shopping around.

In this implementation of robotic system, web camera connected to the microcontroller keeps on capturing what is going on there at the host place and saves it into the computer. When the concerned people in control room, wants to get an indication to the host section, they log into the host section computer via internet on their own HTML page, and view all information of the field section videos on PC, mobile or any device that supports an internet connection. Credit to technology, there is also an android app to view such videos on mobile devices.

II. BLOCK DIAGRAM

Architecture of the surveillance system is shown in the Figure 1. Raspberry Pi, RaspiCam, Wi-Fi adaptor/Dongle and Power Supply forms the entire surveillance system to be installed at the required place. The images captured and the video recorded will be directly streamed on your pre-decided HTML page. You can access the video directly using the IP address or you can also stream on your local domain with the help of websites such as patato.

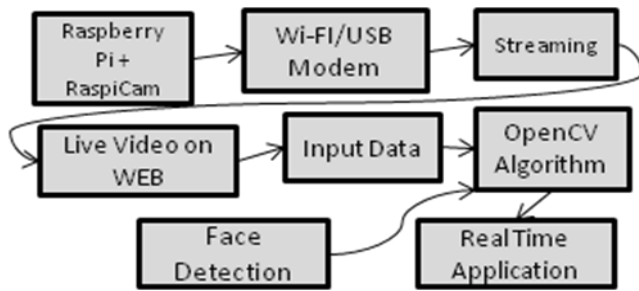


Figure 1: Block Diagram

The images/videos received can be moderated in a number of ways. The images can be additionally compressed, zoomed, sliced and much more, if required, by making use of number of algorithms provided by OpenCv. Face Detection, Color Detection, Object Detection etc. too can be carried out.

III. IMPLEMENTATION

In this project, control of robotic unit is from remote end with the use of Internet and also we are able to get the videos from the robot end for the purpose of surveillance. At the user PC, we will have videos on the web browser on our HTML page. Raspberry Pi is used for video processing and sending the processed video to user PC with the help of Internet. The use of Internet does not bring the limitation of range into consideration as if we have the internet access, we can control the robot from anywhere, no matter how remote the location is. Imagine moderating your local store located in New Zealand from a place located miles away, like from India, things have never been simpler.

The images captured by the camera should be processed very fast to provide real-time visualization of environment to the user. These images captured then can be processed according to our likes by using algorithms such as face detection, object detection and many more.

A. The Central Unit :

The Raspberry Pi is a credit card sized single-board computer developed by The Raspberry Pi Foundation, a UK charity, with the aim of providing low-cost computers and free software to students. Their ultimate goal is to foster computer science education and they hope that this small, affordable chip-size computer will be a medium that enables that.

RASPBERRY PI MODEL B

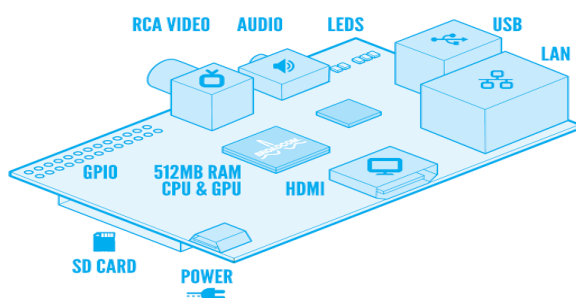


Figure 2: Raspberry Pi Board

The first product is the size of a credit card, and is designed to plug into a TV or HDMI monitor. It comes in two variants, model A and B, with B having more features. The expected price is \$25 for model A and \$35 for model B. The GPIO pins on each board allow the use of optional expansion boards.

Model A has one USB port and no Ethernet controller, and will cost less than the Model B with two USB ports and a 10/100 Ethernet controller.

Though the Model A doesn't have an 8P8C (RJ45) Ethernet port, it can connect to a network by using an external user-supplied USB Ethernet or Wi-Fi adapter. On the model B the Ethernet port is provided by a built-in USB Ethernet adapter. Just like modern computers, generic USB keyboard and mouse are compatible with the Raspberry Pi. Multiple USB ports can also be connected by using a USB Hub. The Raspberry Pi does not come with a real-time clock, so an OS must use a network time server, or ask the user for time information at boot time to get access to time and date for file time and date stamping. However, a real-time clock (such as the DS1307) with battery backup can be added via the I²C interface.

The small size makes for an easy-to-hide computer that sips power and can be mounted behind the display with an appropriate case. The major requirements of Raspberry Pi are a bootable SD card with Linux, USB power adapter with support for 700 mA and USB Wi-Fi adapter for internet connectivity.

B. Up and Running:

Once the SD card is loaded with Raspberry OS, to update the software we use the commands as follows

- `sudo apt-get update && sudo apt-get upgrade`
- `sudo apt-get install motion`

To enable motion

- `sudo nano /etc/default/motion`

C. Camera Setup:

Now you also need to enable camera support, using the `raspi-config` program you will have used when you first set up your Raspberry Pi.

- `sudo raspi-config`

Use the cursor keys to move to the camera option and select enable. On exiting `raspi-config` it will ask to reboot. The enable option will ensure that on reboot the correct GPU firmware will be running (with the camera driver and tuning), and the GPU memory split is sufficient to allow the camera to acquire enough memory to run correctly.

To test that the system is installed correctly and is in working condition, try the following command:

- `raspistill -v -o test.jpg`

D. InternetConnection:

Internet connection required can be either provided by Wi-Fi adapters or USB device called Dongle.

Wi-Fi adapters provide wireless connectivity to the local area network (LAN) in the home or office. Typically used to add Wi-Fi to desktop computers, they can also retrofit older laptops that never came with Wi-Fi. The adapter will retrieve the real time video from raspberry pi within the coverage range and provides safety means of video surveillance without any kind of complex wired network.

Instead of Wi-Fi, USB Dongle can also be used. The setup of Dongle with Raspberry Pi is a little bit cumbersome but once it is ready, it provides every advantage that a Wi-Fi does. Setting up a USB 3G/4G modem on a Raspberry Pi is not a simple task.

The main problem is that most USB modems act as two devices - a USB storage device and a USB modem. When plugged in to the Raspberry PI the device is usually in USB storage mode. There is a program called `usb_mode` switch that we can use to do the switching

The other missing part is a way to connect to the cellular network with the USB modem from the Raspberry. For this we use the classic `ppp` and `wvdial` programs.

E. Motion Detection:

To configure motion detection, edit `/etc/motion/motion.conf`. Motion detection is not active while the old video is converted to mp4. To prevent this, stop boxing the h264-video after recording by replacing "MP4Box true" with "MP4Box false" in `/etc/raspimjpeg` and restart your RPi.

Temporarily start/stop and de-installation:

If you want to stop the interface temporarily, run `./RPi_Cam_Browser_Control_Installer.sh stop`. To restart it, run

- `./RPi_Cam_Browser_Control_Installer.sh start`

If you want to remove the interface completely, run

- `./RPi_Cam_Browser_Control_Installer.sh remove`

Attention: It removes all files in `/var/www`.

Update: If you want to update your existing interface to the newest version, just navigate into the git- and run `git pull origin master`. `./RPi_Cam_Web_Interface_Installer.sh install` and `./RPi_Cam_Web_Interface_Installer.sh start`. If it doesn't work, restart the RPi or clear the cache of your browser.

Using this you can interface raspberry pi with local web server. But for universal broadcasting, port forwarding is required. Now for port forwarding, you can either use the same Wi-Fi connection or can make use of wireless dongle. In case of Wi-Fi, you need to get the permission of your service provider. If you get the permission, well and good but if you don't, you can make use of wireless dongle.

Here the dongle used is Mblaze and the installation steps for it are provided. Now, after the installation of USB modem on your Pi which is easy to create a static IP of raspberry pi globally so that any user can access it on IP of USB modem. Now for each session it has a different dynamic allocation of IP address so every time we need to type a different allocated IP of each session. So, to reduce the complexity we will create a domain server and pool that dynamic allocated IP to the DNS assigned website. Our is `arjuntrvd.zapto.org` with each different session of USB modem the varying dynamic IP will be forwarded to this website and so we have a simple lookout for each new session as the NOIP client will automatically synchronize the dynamic IP to the website and IP gets pooled over there and we get the video on our permanent website though IPs are temporary allocated to the USB modem. Thus, we here create a user free environment and a simple approach of global broadcast.

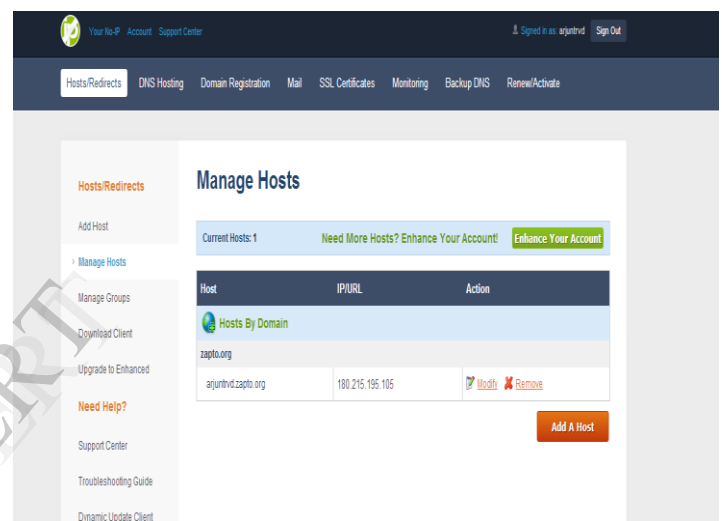


Figure: 3 Manage hosts on noip

So after the successful for installation of dongle and noip enter the following two commands after rebooting

- `sudo /etc/init.d/mts start`
- `sudo /etc/init.d/noip start`

IV. CONCLUSION

Thus, the cheap and compact R-Pi has the RaspiCam, USB Modem / Ethernet connections with it we have loaded it with IP forwarding to a fixed website for all IPs thus we create a global environment of live streaming on which Real Time Applications can be carried out using face, object recognition techniques and thus we have a plug and play aspect of broadcast for humanity with security measures in a very simple, innovative and cost effective way for the betterment of society. Human Machine Interaction on this system will improve the user portable experience and will be of great help for the entire segment of society.

ACKNOWLEDGMENT

We would like to express sincere gratitude to our project guide "A.B. Upadhyay" for giving us the opportunity to work on this project.

It would never be possible for us to take this project to this level without his innovative ideas and his encouragement. We would like to thank him for his exemplary guidance & monitoring as well as for providing necessary information regarding the project & also for their relentless support throughout.

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