Raspberry Pi Based Surveillance & Live Monitoring Robot

V. UMESH CHANDRA¹, D. RAMESH REDDY²

¹PG Scholar, Dept of ECE VNR Vignana Jyothi Institute of Engineering & Technology, Bachupally Hyderabad, TS, India, E-mail: Umeshchandra528@gmail.com.

²Research Associate Professor, Dept of ECE, VNR Vignana Jyothi Institute of Engineering & Technology, Bachupally Hyderabad, TS, India, E-mail: rameshreddy_d@vnrvjiet.in.

Abstract: In the present world, everyone is worried about their safety due to increase in crime rate. This has led to an increase in the importance of surveillance systems. In this paper raspberry pi 2 model B is used to make a robot which is used for real-time surveillance system within a local network. The live streaming is accomplished by using the MJPEG (Motion Joint Photographic Experts Group) streamer, the server-client model using Java programming language.

Keywords: Surveillance, Pibot, Raspberry Pi, MJPEG Streamer, Server-Client, Local Network.

I. INTRODUCTION

As the growth rate of crime has been increased in past years, as a result, everyone is concerned about their safety and security. Due to this reason people started to consider the significance of surveillance systems. Majority of the people is doing Internet Protocol (IP) based installations rather than analog because of IP-based installations are from anywhere. In order to make the IP-based systems affordable for the people having low budget, we need to develop a system which is cost effective and portable. This paper describes the system which acts as a robot. This robot uses raspberry pi model ‘B’ for making this real time surveillance possible by providing the installing and processing high resource software’s which makes it possible to live streaming & controlling the robot.

II. CURRENT SCENARIO OF SURVEILLANCE SYSTEMS

In the present world, everyone is worried about their safety due to increase in crime rate. This has led to an increase in the importance of surveillance systems. Surveillance systems are basically two types : Analog and IP-based video Surveillance systems. The analog systems are comparatively less expensive and easier to operate rather than the IP-based systems. But analog systems have some limitations such as, we need to deploy a number of cameras to cover a larger area. As the analog systems are wired if once the cameras are deployed in a particular place they are hard and complicated to shift them to a different location.

Fig1. Total cost per camera layout alternative.

III. WHY TO CHOOSE RASPBERRY PI2

The Raspberry Pi is a mini-computer also known as SBC (Single Boarded Computer) and L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

Fig2. L293D IC.

On the other hand, even if we use high resource software, Raspberry Pi 2 is intended to function smoothly. Raspberry Pi is also called as mini-computer because it includes Ethernet, video and audio processing, large quantities of RAM and a large amount of storage space. It runs a complete operating system (OS) like Linux and various other flavors.
of Linux as well as Android. It can also develop programs that can control system functions and Input-Output within the operating systems [8].

Raspberry pi 2 model B includes a complete operating system loaded on an SD card, audio out, HDMI and RCA video output and an Ethernet port [10][11]. For Electronics project HD camera is suitable. It contains various input and output that can be directly connected to components, sensors and is extremely easy to use [12].

HD CAMERA allows raspberry pi to communicate with a computer via USB and gives access [12]. Once a program has been dumped on it, it can be used anywhere. No additional work is required i.e., we don't need to reboot, plug in a keyboard, or choose an application to run [4]. It works as it is programmed. The Raspberry Pi is an extremely powerful device which is very small in size, and it is perfectly suitable for embedded systems, or projects demanding more memory and processing power.

Metal sensor:

Inductive Proximity Sensors detect the presence of metal objects which come within range of their oscillating field and provide target detection to "zero speed". Internally, an oscillator creates a high frequency electromagnetic field (RF) which is radiated from the coil and out from the sensor face.

Smoke sensor:

- High sensitivity to LPG, natural gas, town gas
- Small sensitivity to alcohol, smoke.
- Fast response.
- Stable and long life
- Simple drive circuit

IV. BLOCK DIAGRAM & WORKING

The pi is placed on the robot chassis which is connected by motors. The motors are connected to the raspberry pi via a switching circuit. This is a normal switching circuit which is used to make a robot. This switching circuit consists of the L293D driver IC which is activated via our Web GUI whenever the user directs the robot to move it forward, reverse or for that matter any direction which will activate the L293D driver to run the motors accordingly. Valeriu, Florin and Adrian-Viorel[10] research paper entitled “Control System for Video Advertising Based on Raspberry Pi 2” describes the implementation of the server client model for controlling the robot made in the Java platform. In this Pibot i.e. the raspberry pi controlled robot is a server-client model.
Raspberry Pi Based Surveillance & Live Monitoring Robot

The key feature of this system is it is platform independent using Java programming. The server–client model can run on any operating systems i.e, either windows, LINUX .The Web Graphical User Interface (GUI) is used to control the raspberry pi 2 and is also created using Java or then it is linked to the server. Widodo Budiharto [19] research paper entitled “Design of Tracked Robot with Remote Control” , he introduced a surveillance system using a controller and can be remotely controlled .It does not restrict its motion and it can acquire the live feeds of the surrounding environment, for example in rescuing disaster victims. This complete model of Pibot is connected to the local network and can be controlled by anyone, anytime, & anywhere. This Local network can be any place i.e., the place where a continuous monitoring is required like home, office, prisons. The individual has to just plug it in the network and the robot is good to do its work. This connection made in the network is wireless and it is made available to the Pi using a Nano Wi-Fi adapter. The MJPEG Steamer provides live streaming and it is installed in the pi 2 and then the camera module is initialized. This camera module used 5 megapixel 1080p 30fps and is designed by the raspberry pi organization for raspberry pi. The MJPEG Steamer uses the concept of time lapse photography to stream the video. It takes photos at a periodic interval and them overwrites one over another to make it look like a continuous stream of video.

Due to the computational power of pi we have to choose this method for streaming video. To keep the robot safe it has been interfaced with an infrared sensor to it so that to avoid collision with any object if the person controlling it tends to or by mistake attempts to collide it somewhere. It has two servo motors of 30 RPM each. The servo motors are interfaced to the raspberry pi via a switching circuit.GPIO Pin 6,11,12 are used for interfacing the motors, where pin 6 is ground while pin 11,12 are general input/output pins. The switching circuit basically comprises of a microcontroller IC AT89c51 and three relays switch each for individual motor and third one for the infrared sensor to stop it if an obstacle comes in its way. It has three 9V batteries being used for the motors and the infrared sensor each. The raspberry pi is being Powered by a 10400mAh power bank having a constant output of 5V 1A. Brian et al., 2014 research paper entitled “Sudo Pi Cooler / Heater” describes a typical temperature sensing device in which temperature of an area is recorded and is adjusted based upon the preset values [21]. The temperature sensor using raspberry pi aims to provide an adaptable temperature sensing approach using a Raspberry Pi. So the user can interface with various other sensors to get more data about the environment in which it is used like the temperature sensor,CO2 sensor for monitoring the carbon dioxide content in that particular place.

V. PROS AND CONS

It is important for the users that want to get the Pibot to consider whether it fits with their utilities and are willing to get this robot and tailoring the product to their own needs. Generally every project does have some advantages or disadvantages. Surely this project also has some pros and cons:

**PROS:**
- The biggest advantage of this robot is that it is fully dependant on the Raspberry Pi which is a micro-computer. This robot is useful for the organization where they can’t afford the costly surveillance systems
- This robot can occupy the whole auditorium or big hall for surveillance
- If the user think that it is based on Raspberry Pi technology and user should have the extensive command on programming then NO. The robot comes with all the utilities and software’s required for live streaming and surveillance so that the user can use it without any hesitation or fear that they might not be able to control it

**CONS:**
- As raspberry Pi does not have an integrated Wi-Fi. User has to buy the Wi-Fi adapter or something like that to connect to the network wirelessly
- This robot can occupy only one location for surveillance at a time
- This should be the biggest disadvantage that this robot can do work in only the local network, user can’t connect the robot via internet
- For configuring the robot user has to go to the system every time. This should be less hectic for user. Also considering that fact that this robot is not compatible with Windows operating system and cannot install it which most of the users are familiar to use.

VI. CONCLUSION & FUTURE SCOPE

In this paper we have illustrated the capabilities of raspberry pi over arduino and advantages of the pibot over the conventional surveillance systems. This paper can be extended further by making the robot accessible via the internet.

![Live streaming & Web-GUI for controlling the robot.](image)

This can be implemented by making a android/ iOS/windows phone app and then controlling it via the same. The robot can also made to implement the SLAM (simultaneous localization and mapping algos) to make it map the complete...
environment and then move autonomously after a certain periodic intervals to check everything. Also by giving it the ability to detect and recognize faces it can be made to alert us about any unknown person and take a snap of it and email us the same. It can be made to follow a specific face continuously rather than manually operate it to follow someone like the small children in the age group of 1-4 years so that kids are continuously in front of our eyes. Can also take help of sensors to maintain a safe distance from the kids for the safety of the robot.

V. REFERENCES
[7]. www.arduino.cc
[14]. http://www.tuicool.com/articles/6NfMfi
[15]. http://www.google.co.in/search?q=surveillance++system++costs&btnG=search
[18]. http://circuits.blog.rs/blog/circuits/arduino/2012/10/06/a
[20]. Valeriu, Florin and Adrian-Viorel, “Control System for Video Advertising Based on Raspberry

Author’s Profile:
V.Umesh Chandra presently pursuing M.Tech on Electronics & Communication Engineering in VNR Vignana Jyothi Institute of Engineering & Technology, Bachupally, Hyderabad, TS, India.

Mr.D.Ramesh Reddy is presently working as Research Associate professor Of ECE department in VNR Vignana Jyothi Institute of Engineering & Technology, Bachupally, Hyderabad, TS, India.