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PIBOT: Surveillance & Live Streaming System using Raspberry Pi

R.KARAN KUMAR[1], RAJU.N[2]
M. Tech (ES), Department ECE from MREC (A), Hyderabad, Telangana, India[1]
Assistant Professor, Department ECE from MREC (A), Hyderabad, Telangana, India[2]

***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 a surveillance system. A system is designed for continuous monitoring and also the system provides live streaming. The system can be deployed at the anyplace i.e. office, house and some remote place where people cannot monitor the particular place. The system acts like a Robot within a local area network through Wi-Fi technology using Raspberry pi 2 model B. The live streaming is accomplished by using a webcam interfaced with raspberry Pi, it data provided is processed by MJPEG (Motion Joint Photographic Experts Group) streamer and the robot is controlled through webpage's created. The system is programmed using python programming language.**

***Keywords*— Surveillance, Pibot, Raspberry-pi, mjpeg streamer**

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. The majority of the people are 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 a 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. EXISTING SYSTEMS

Smart Security Camera using Raspberry pi and OpenCV is a system constructed for surveillance and it is designed to be used inside a warehouse facility. This system is devised using a low-cost security camera with night vision capability using a raspberry pi. This system is having the ability of human detection and smoke detection that can be used to avoid potential crimes and potential fire. The researchers evolved a light-footed surveillance camera that has the potential of identifying the condition of the scene that is being monitored and also gives notification or alarm as the event occurs This system also provides security during night time as it is having the potential to provide night vision. Night vision capability is attained by simply taking off infra-red (IR) filter from an ordinary webcam and thus can be used for night vision sensing with the help of IR Light Emitting Diode illuminator.

The system can also detect motion of an object using background subtraction algorithm. Once moving entity is diagnosed, the system can classify it as human or smoke. If smoke is detected, the system notify in the form of alarm and email to indicate fire or unauthorized person [2].
Multi-environment robot for surveillance and live streaming is developed to assemble real-time surveillance system possible within a local network. The live streaming is accomplished using mjpeg streamer and the server-client model is build using java. As IP-based installation provide access from anywhere and hence are preferred over the analogue system. IP-based systems offer superior picture quality and they are also favorable when it comes to scalability and flexibility. But IP -based system needs some knowledge about networking and these systems are too expensive than the analog ones. This raspberry pi controlled robot is incorporated by a server-client model. This client-server model is constructed on java and thus can work on any systems such as windows, Mac or Linux. This entire model is connected to a local network and anyone available in that particular local network can control it from anywhere. The live streaming is done by MJPG streamer [3].

III. PROPOSED SYSTEM

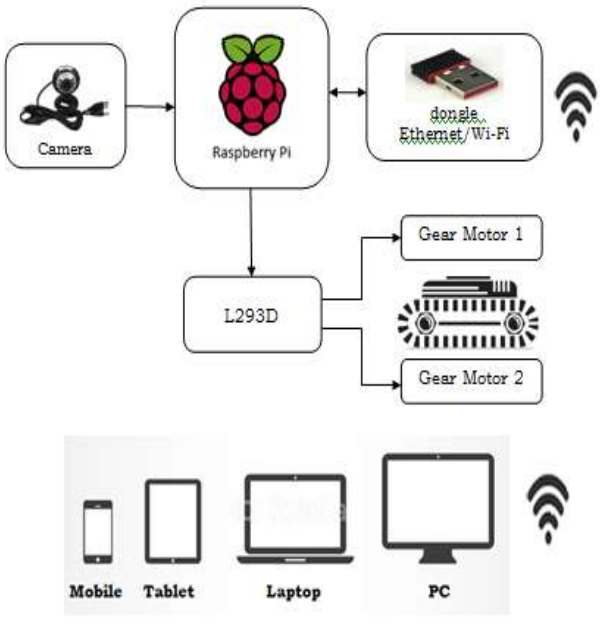

Fig 3.1 Block Diagram of Proposed System

We proposed a system to build a real-time live streaming and monitoring system using Raspberry pi with installed wifi connectivity. In monitoring phase, the pi will record the video of the location in real-time. Capturing video is done through commands given through the computer to the raspberry pi. This command will be communicated to the pi using Wi-Fi. The pi camera is being used which will give a very good quality of the picture in the video.

The connection of Raspberry pi with the motor driver is done using the General Purpose Input Output (GPIO) pins of Raspberry Pi. The GPIO pins are connected to the input pins of the motor shield. The output pins of the motor shield are connected to the motors. A portable charger of 2 amp current is connected to the motor shield and raspberry pi. Once the connections are done properly the raspberry pi is ready to boot up. A Python program is written for controlling the motors wherein the GPIO pins will give out the output from the raspberry pi to the motor shield. The robot movement is controlled through the directions mentioned on the web page created using HyperText Markup Language (HTML) code and webpage Universal Resource Locator (URL) address. This process is communicated through Wi-Fi to the Raspberry Pi model B. The camera module is installed into its port and it is enabled in raspberry pi settings. For the Live Streaming of videos, MJPEG streamer is installed and configured. After the configuration steps are done just view the live streaming in the app as well as the website. The website has been developed to allow a large number of people to experience the live streaming irrespective of their location. Here admin rights are given to authenticate the visibility of critical information by only authentic users.

Raspberry Pi: Raspberry Pi 2 model B is the main control board, which will do the majority of the operations. The camera module sends the images to it. A Wi-Fi router is used for communication between data transmission and receiving. The DC motors are attached to the wheels and are controlled through the General Purpose Input Output (GPIOs) Pins of Raspberry Pi via the Wi-Fi network. The Pi will send out signals to the microcontroller for control of the motors required for the robot. The Raspberry Pi 2 packs a 900MHz Broadcom BCM2836 ARMv7 quad-core processor, 1GB of RAM, support for up to four USB devices, HDMI support and micro SD port. The board also features an increase in memory capacity to 1Gbyte. The 40-pin GPIO enables multiple sensors, connectors, and expansion boards to be added, with the first 26 pins identical to the Model A and B boards, for full backward compatibility.

Fig 3.2 Raspberry Pi 2 Model 2 Board

DC Motor Driver

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers as they take a low-current control signal and provide a high current signal. This high current signal is used to drive the motors. L293D contains two inbuilt H-bridge driver circuits used to drive the motors. The DC motors can be driven simultaneously i.e. Both Forward or backward direction in its common mode of operation. The motors are controlled by input logics 2 & 7 and 10 & 15 pins. Enable pins must be high for motors to start operating. When enable input is high, the associated driver gets enabled.

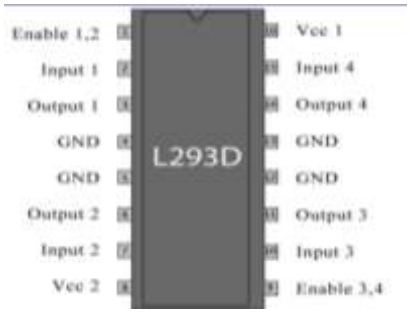

Fig 3.3 L293D H-Bridge motor Driver IC

Motors

Motors are required for its motion and mobility of the robot. The motors are interfaced to raspberry pi through drivers because the output ports of the microcontroller cannot source the required amount of current. The Motors are complete motive force systems consisting of an electric motor and a reduction gear train integrated into one easy-to-mount and easy to configure. This greatly reduces the complexity and cost of designing and constructing power tools, machines and appliances calling for high torque at relatively low shaft speed or Rotations Per Minute (RPM).

Fig 3.4 Motor to drive the robot

USB CAMERA

The camera board is a small PCB that connects to the CSI-2 camera port on the Raspberry Pi using a short ribbon cable. It provides connectivity for a camera capable of capturing still images or video recordings. The camera connects to the Image System Pipeline (ISP) in the Raspberry Pi's System On Chip (SoC), where the incoming camera data is processed and eventually converted to an image or video on the SD CARD.

Fig 3.5 Camera for Capturing Pictures/Live streaming

SD Card

The Raspberry Pi 2 Model B (second generation) require the smallest one, the MicroSD.SD cards come in a range of storage sizes. Generally, micro SD card we require is more than 2GB.

Wi-Fi Router

A Wi-Fi adapter will probably need more power than the Raspberry Pi USB port can provide, especially if there is a large distance from the Wi-Fi adapter to the Wi-Fi Access Point, or it is transferring large amounts of data. Therefore, you may need to plug the Wi-Fi adapter into a powered USB hub.

Key Features

- 802.11b/g/Draft-N compatible
- High-efficiency antenna that expands the scope of your wireless network
- Supports major encryption methods like WEP, WPA, and WPA2 encryption
- USB 2.0 interface for easy installation.
- Wireless access control - prevent unauthorized network access to your network and computer

The system designed has advantages and disadvantages and these are as follows:

PROS:

- The System is useful for the organization where they can't afford the costly surveillance systems
- Can occupy the wide area for surveillance i.e.; whole auditorium or big hall
- It has all 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:

- Separate Wi-Fi adapter has to be connected
- Only one location would be under surveillance at a time
- For configuring the robot user has to go to the system every time
- Not compatible with Windows operating system

IV. RESULTS

The system has been implemented and the following results have been observed.

Fig 5.1 Overview of PIBOT

The pibot is controlled and monitored using the webpage's designed. The HTML page created provides the user for controlling the robot and also the live streaming.

Fig 5.2. HTML page for Robot Controlling

If the user selects for the robot controlling, the page is directed to another page which provides controlling of the robot.

Fig 5.3. Controlling of Robot through HTML Page

For live streaming the user should select the live streaming option, the live streaming is monitored through the HTML page designed.

Fig 5.4. Live Streaming

V. CONCLUSION AND FUTURE SCOPE

The system designed mainly aims at monitoring and surveillance at sensitive areas or unreachable areas .It will be helpful for the user who need surveillance of any place and this system provides the best results with low cost of deployment . This paper can be extended further by making the robot accessible via the internet. If user wants to use the location, they can use mapping algorithms 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.

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Authors Details

R.Karan Kumar, Pursuing final Semester M.Tech in Embedded Systems at Malla Reddy Engineering College (Autonomous), Dhulapally, Secunderabad -500100, India

N.Raju, Presently Working as Assistant Professor, Department of Electronics and Communication Engineering at Malla Reddy Engineering College (Autonomous).