



Design and Implementation of E-Surveillance Robot Using Raspberry Pi

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Abstract— : Machine vision nothing this is the one type of vision of the machine to see the actual object & it behave like human being .If machine wants to see some object with specific feature detection then it need to interface some camera module with the machine . By using different type of object detection algorithm machine can identify the object. Based on the algorithm used it is possible to detect the object. Also if object detection is done based on this machine wants to perform the particular task like to start & stop the robot module. Whole system based on ARM 11 raspberry pi B+. The object detection & tracking it needs to use the Open CV software to process the live video streaming. E-Surveillance robot is nothing but it having the camera module on the top it is used to see the surveillance view & send this data to the user on the specific IP address. Also the robot movement control by using the algorithm. It is also possible to control the speed of the robot using PWM technique. The Wireless control of the Robot is possible using the Wi-Fi Adaptor module connected with the raspberry pi module The Robot does the surveillance by live video streaming through WiFi & detecting the live human body detection.

Keywords—: RASPBERRY PI B+; OPEN CV; PWM TECHNIQUE; IP ADDRESS

Introduction

This project based on ARM 11 Raspberry Pi & Android OS. This robot capable to show the remote video on the mobile phone or the remote desktop. The robot movement control by using the Android Apps & the monitoring takes place by connecting the Camera module with the Raspberry Pi Board. The movement of the Robot in the particular direction takes

place based on the Button pressed from the Android mobile phone.

Raspberry pi is a credit- card sized computer .It functions almost as a computer. There are various surveillance systems such as camera, CCTV etc., In these types of surveillance systems, the person who is stationary and is located in that particular area can only view what is happening in that place .Whereas, here, even if the user is moving from one place to another. The main advantage is used in security purpose and another advantage that it offers privacy on both sides since it is being viewed by only one person .The other major advantage is that it is a simple circuit .the operating system used here is Raspbian OS.

Surveillance robot nothing but automatic robot move in any direction it having robotic arm for movement in any direction. This robot can be control by using zig bee or Wi-Fi. System.

Robot movement is possible by moving its arm. When it wants to take next position then it moves in particular direction by moving its ARM. So robot arm control by using DC motors used in the robot.

In the ancient times the war was fought using bow and arrows etc., this involved a large army of men that would fight and lay down their lives for their country. Some centuries later there was development in science and guns came into pictures . Today due to immense development in the area of technology it is possible to built more automated, unmanned, accurate, and more destructive forces in the form of weapons that human kind have never seen. The objective of this project is to minimize human casualties in Natural Calamities such as Malingaon, badrinath incident. This is a project of robot with multipurpose applications in military areas.

Mobile video surveillance system has been envisioned in the literature as either classical video streaming with an extension over wire and wireless network system to control the human operator [2]. Remote monitor has become an important maintenance method that is based on the



network. There are two units Raspberry Pi Unit and Process unit with wireless link between them. Process unit will send sensor reading to Raspberry Pi Unit which will be uploaded to the server. The USB camera will be connected to ARM11 controller.

II. LITERATURE SURVEY

In [1] the existing method if we want to monitor the video on internet first of all records the video by using camera. Store the video into CD, DVD or any other device. Then the stored video can be uploaded on internet. But the main disadvantage present in existing system is that there is no live video streaming in internet. Therefore the users can't get live surveillance by using this technology.

Control of the 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 browsers & also we are able to control

The robotic movement & also the camera movement in vertical as well as horizontal direction. Dc motor is being used for the movement of robotic wheels & stepper motor is used for camera movement i.e. for vertical & horizontal movement. The PIR sensor on the robotic unit gives us the information about the living body. Motors & PIR sensors are being interfaced to PIC microcontroller. Raspberry Pi is used for video processing & sending the processed video to the user PC with the help of Internet, The use of Internet doesn't bring the limitation of range into consideration as if we have the internet access, we can control the robot from anywhere.

The image captured by the camera should be processed very fast to provide real time visualization of environment to the user. For this purpose along with low cost we think to use ARM based processors. Some of the reasons for the proliferation of ARM-based Processors includes: low cost, low-to-very-low power consumption, decent processing power, and open development environment. The raspberry Pi is credit card size computer that plugs into your T.V & a keyboard. It is capable little computer which can be used in electronics projects, and for many the things that your desktop PC does, like spreadsheets, word processing and games. It also plays high definition video.

Dr. M. Meenakshi[8] presents a paper which include validation of vision based autonomous robotic system for military application. Sum of Absolute Difference (SAD) algorithm is used. This paper verifies the implementation of proposed image processing algorithm on the basis of image subtraction. The developed algorithm is validated in real time by change based moving object detection method [8]. So this type of work is effectively take main role in the application of detection of mines in the war field. This autonomous robot present a novel vision based technique for obstacle identification and path planning on the principle of image

processing algorithm. Whatever images are clicked by wireless camera are undergoing the process using Sum of Absolute Difference (SAD) algorithm and then obstacle are identified.

A model of a robot based on "Human Interface Device" utilizing hand gesture. This hand gesture used to communicate

along with embeded system for tracking of enemies at war ground. The input of embeded system is 3-axis accelerometer is selected for the seck of capturing the human arm behaviors. The 3-axis accelerometers offer the possibility to control a robot via wireless camera. The 3-axis accelerometer offer to control system with the help of zigbee communication. This work system so much easy that a non-perfect robot programmer can also control robot fluently in easier way. This

paper include zigbee network technology is preferable for long

distance communication. This paper consists of LCD display which displays the voltage value at y-axis and x-axis. If the 3-

axis accelerometer move to any one of the direction and if obstacle are near about it then the LCD Displays the distance measuring from the obstacle and direction of the robot. The speed of robot also control by 3-axis accelerometer. In this work system two microcontroller are used .one is act as a master at transmitter end and another can act as an slave at receiving end. The master microcontroller is sending the signal to the slave microcontroller from one point to another. Whatever signal are transmitting from one end to another this are execute by using slave microcontroller and according that action or movement are carry out by robot. Ankita patel[7] invents a paper on the basis of touch screen which control multifunctional spy robot. For the seck of long distance communication zigbee network is used. This work system include microcontroller for collecting data from various places and accordingly movement of robot it can control the direction of robot. This paper consists of geared motors which include two wheels attached to it. The motor is started with the help of relay and going to control touch screen. The signal is send from touch screen to be executed bymicrocontroller at receiver section. It includes component like gripper, camera, video screen and sensors. The methodology of this paper is divided into two sections. Hardware and software implementation. At hardware development various component are uses such as touch screen sensor, zigbee, LCD, intelligent robot. In software implementation microcontroller is prefer. A microcontroller having ability to use large amount of memories such as RAM, ROM. also it having own ports i.e I/O port, timer. All this embeded on a single chip. At hardware section touch screen, tuner card, antenna, zigbee technology are used. At programming section USART communication,

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analog to digital convert programming and LCD character module programming are prefer. All of this programming are done in C language Programming are preferred. Perna Jain has design a paper on the base of RF technology used for spying in war field. The new innovation added here that is colour sensor. The colour sensor senses the colour according to surrounding environment and changes its colour. So the robot easily changes its colour and because of this feature the enemy can't easily predicted.

III. SYSTEM OVERVIEW

A. System Description

The fig 1 shows block diagram of E-sueveillance robot using raspberry pi b+ model. The detection part consists of web camera which is under live streaming video capturing with sensors PIR & Obstacle detector TSOP 1738. The human IR rays are detected by PIR sensors which allows the robot to drive in detected direction with continuous live video streaming. If any obstacle like rock, tree, messy area is occurred it is detected and the robot is self-programmed to take action on further obstacle to get another route. This live video is streamed through WiFi- dongle to the user end with the help of provided IP address of Raspberry pi. The wheels of robot are drive by the Ic drivers which gives efficient power. As using the Raspberry pi b+ model we can use the application by means of wired communication, android apps, Wifi connections and even Bluetooth or Zigbee. But, We are using Wifi dongle connection for wireless communication where there is no consideration of range. So, only one user is well sufficient to control the video streaming for detection of human body while operation at work.

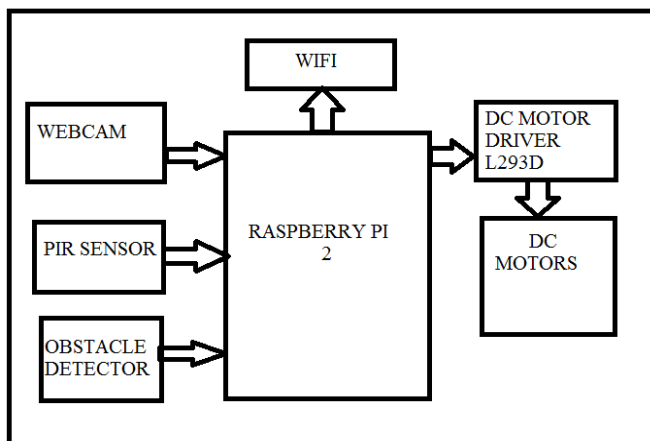


Fig 1:- Block diagram

These gives an all-round idea of the project work how the flow of robot work would be taken under consideration.

B. HARDWARE REQUIREMENTS

a. USB 2.0 Webcam Camera Module

It is used to take the continuous video in front as well as back side with 30 frames per second. It is used for just capturing the images from the outside the world.

b. DC motor driver L293D

It is used to drive the DC motor in all the direction control through the program ,it is also possible to change the power supply polarity from programming. It having the 600mA current rating.

c. DC motor 300rpm

In car module DC Motor is used to drive the wheels connected to the car module. Also it is possible to control the speed of the Dc motor by using L293D DC motor driver.

d. Raspberry pi B+ model

It is main heart of system used to control whole operation. Its having ARM 11 core with BCM 2836 Audio video codec used to provide GPIO's having frequency about 900Mhz.

e. PIR Sensor

It is used for live detection of human body. It's having two slots. Each slot is made of a special material that is sensitive to IR.



Fig 2:- PIR Sensor

f. Obstacle Detector

It is TSOP based obstacle sensor. It has most essential part 1.

Transmitter & 2. Receiver. If an obstacle comes in between transmitted beam, some part of waves is reflected back from obstacle detector & it is received by Rx. & generates some indicating signal according to that.

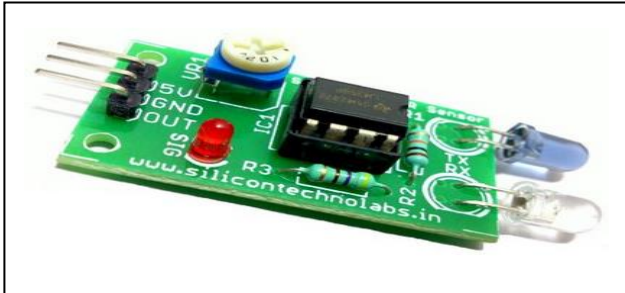


Figure 3: Obstacle sensor

g. WiFi Dongle

Leoxsys WiFi LEO-HG150N wireless 3 dBi High gain USB adapter is high-gain wireless USB which provides a simple and easy way to add or upgrade wireless connectivity to your desktop or notebook computer. This LEO-HG150N high gain USB adapter supports higher data rate upto 150mbps when connecting with wireless 802.11n device. You can just plug it into computer usb port & enjoy unbelievably high speed wireless network access.



Fig 4:- WiFi Dongle

i. Raspberry Pi Development Board

The bilateral filter is a non-linear technique that can blur an image while respecting the strong edges. The bilateral filter is also defined as a weighted average of nearby pixels, in a manner very similar to Gaussian convolution.

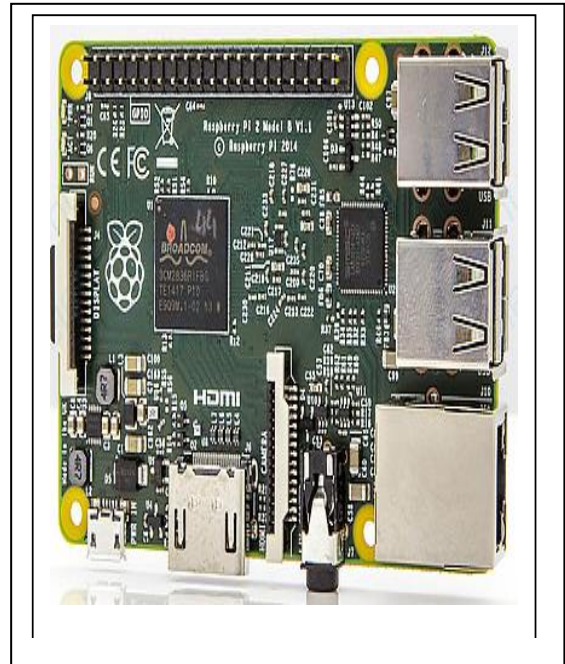


Fig. 5:- RASBERRY PI

The difference is that the bilateral filter takes into account the difference in values with neighbors to preserve edges while smoothing. The key idea of bilateral filter is that for pixel to influence another pixel, it should not only occupy nearby location but also have a similar value. Its formulation is simple: each pixel is replaced by a weighted average of its neighbors. It depends only on two parameters that indicate size and contrast of the features to preserve. It can be used in non-iterative manner. It can be used at interactive speed even on large images.

C. FLOWCHART

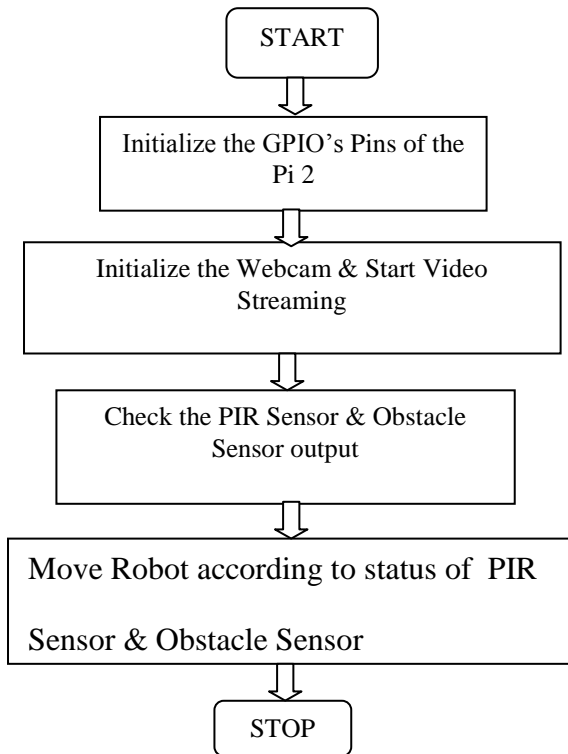


Figure 6: Flowchart

Porting of Raspbean OS on Raspberry Pi

To port Linux kernel on the Raspberry Pi board Nothing but take 4/8GB SD card place Raspbean OS kernel image file in card make it bootable.

Installation of Tool chain

For writing script in python it need to install python in raspberry, for Image capturing & video streaming it needs its own libraries by using following commands we get

```

$ sudo apt-get install python
$ sudo apt-get install ffmpeg
$ sudo apt-get install fswebcam
$ sudo apt-get install omxplayer
$ sudo apt-get install gstreamer-0.10
after installing this we can take image by writing
$ fswebcam -r 1280x720 cam1.jpg
$ gstreamer-0.10 used by using gst-launch-0.10
  
```

plugin

```

$ gst-launch-0.10 videotestsrc ! ffmpegcolorspace!
autovideosink
$ gst-launch=0.10 videotestsrc ! pattern=11 !
ffmpegcolorspace ! autovideosink
  
```

It having onboard peripherals like Ethernet port USB 2.0 port, 3 UART, GPIO pins, TFT screen interface connector, also it having onboard Raspbean operating system within it . having Boot mode & NVROM flash mode also. It supports all higher level languages like C,C++ also ,so it is possible to write device driver program to control the speed of the DC motors as well as to control the Ultrasonic sensor modules & also implemented the TFT screen driver it is used to show all the parameters on the screen. So writing python script we can interface GPIO pins by importing library files of the raspberry pi development board for example test.py we can write this script in IDLE python editor

```

import RPi.GPIO as gpio
import time
gpio.setmode(gpio.BCM)
gpio.setup(25, gpio.OUT)
while True:
  gpio.output(25, gpio.HIGH)
  time.sleep(1)
  gpio.output(25, gpio.LOW)
  
```

time.sleep(1)

IV. RESULT AND DISSCUSION

A. Result

Demo module consist of the actual the Raspberry Pi board with TFT screen connected to the all the peripherals with having the ultrasonic interface, Dc motor interface, camera interface , Battery interface with 4 wheel chasse system its on car module of the system.

It gives result as the live video streaming on the user end while the detection of live human body tracking operation is on duty. The following figure shows the actual robot which is going to be in operation.

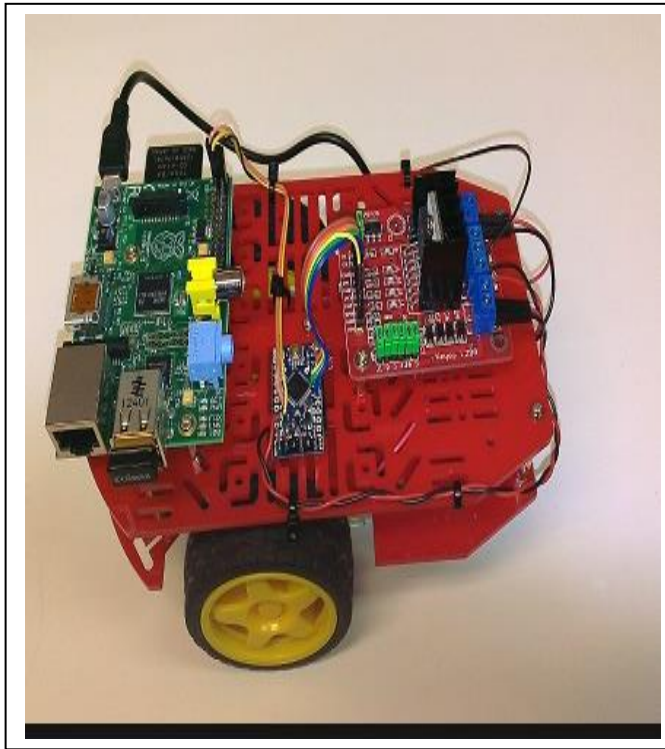


Fig no :-7 Actual Robot

b. Discussion

This model is prototype and if developed as per the standards it will be a good detection device . The main feature of this robot is to detect the victims in destroyed areas with the natural calamities like earthquake, land sliding, glacier movements, etc. It can be a very unique & helpful robot for the rescue team in military as well as research centres.

V.CONCLUSION

This system completely based on the ARM 11 core with Raspberry Pi platform. This Development Board capable to process the video streaming in as faster as other Microcontroller can't do. Because of the speed of the Raspberry pi it is in the 900 MHz.It fulfil the image processing part using python scripting using OpenCv Libraries based on the UBUNTU LINUX as well as on RASBEAN LINUX Kernel Raspberry Pi Development Board Operating System.

Raspberry Pi the best feature is it supports the Python scripting so it capable to do the programming of the GPIO. This feature added advantage in the system design to drive the Robot Module.It's Interface to Raspberry Pi Board is very simple because of the serial Interface.Raspberry Pi 2 having

the 4 USB ports so it is very easy to interface the USB Webcam to it

VI. FUTURE SCOPE

1. By implementing terrestrial featured robot we can have a powerful robot which can sustain in any climatic condition.
2. We can add GPS co-ordination in our robot.
3. We can also implement a 360 degree rotational camera which can cover all area simultaneously.
4. We can add various sensors to increase the capability of our robot like solar panels, hd camera.

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