

# Monitoring and Controlling of Mobile Robot Via Internet Through Raspberry PI Board

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**Abstract-***This paper presents the control of terrorist attack throughout the world by monitoring and controlling of mobile robot via internet through Raspberry pi board. The monitoring and controlling of robotic movements through wireless network by using a web browser and accessing a webpage. A camera is mounted on the robot to get better visibility of the objects. The programming language of the robot is based on the LINUX platform which will be interfaced with Raspberry Pi board. The PIR sensor detects a person or an object enters into a surveillance area and the smoke sensor detects the fire accidents by sensing the smoke level increase in the atmosphere. The output of the sensors can be indicated via alarm to the user. This mobile robot can be operated from everywhere in the world by using internet of things (IOT).*

**Keywords-** Mobile robot, Raspberry pi board, PIR sensor, smoke sensor, Wi-Fi dongle.

## I. INTRODUCTION

Robotics is an art of designing, applying by using robot in human endeavours. A robot is a machine which is designed to perform a particular task based on the programming done by the user. It can perform multi task at a time. Nowadays most of the industries are automated. The development of automation introduces the robots into the industries to perform the risky jobs which cannot be done by the human. The mobile robot was fully controlled by the webpage and the commands from the LINUX platform via RASPBERRY PI were received by the microcontroller. Here the system is proposed with the help of low cost PIR sensor and smoke sensor to trace out the intruders and to detect the fire accidents by using Raspberry pi.

The Internet based robotic system is implemented to control a robot lawnmower. The control can be done by using a pc based technology. This robot is developed to connect with internet through VBscript, HTML and JAVA [1]. The simulation is made through the MATLAB platform. The MATLAB uses the MRC algorithm which has been translated into VHDL model and then it is

converted as logic gate level through VLSI design, implementation [2]. This type of mobile robot is implemented with speed control and position on various CCD camera and the sensors with fuzzy detection method and line detection algorithms are designed. The positioning controller is used to observe not only on image capturing process algorithm, due to this controller has been operated independently from speed and fast running using microprocessor based optical sensors which is mounted on the robotic vehicle [3]. This Robotic vehicle can be controlled by a simple Skype text messages sent by the user. A webcam is externally connected to the robot, and a video is captured and send back to the operator through the use of Skype video. This robot is connected to the pc by wireless communication method through two Xbee modules [4]. This paper contains the information for controlling a robotic vehicle movement through the use of internet. The images sent by the robotic vehicle to the user. This determines whether the size of the image is small or large depending upon the speed of the Raspberry pi [6]. The controlling of the spy robot by sending vocal commands to it depends upon the user. The voice communication is a most efficient in human robot through interaction among the media system. This command is used to control the robotic arm movements and visualize the area to provide the control of the robot [7]. This paper presented a design of robot to control using the DTMF tone generated on pressing the keypad buttons of a mobile phone by the user. This can be done by interfacing the mobile with internet connection. It can able to control the robot continuously [8]. The development method of using UI is an AJAX platform, this UI is better when compared to the HTML forms. The user is the whole responsible for the activation of the code to produce the UI, which can be done by receiving a live video [9]. This paper presents the interfacing of internet to the robots in public places. The interface results in low bandwidth of network connections and shared control through

interaction with the people in the robot's environment [10]. Due to low cost and reduced size of the robot makes it has main part in many fields like home applications. Home security is one of the important applications of home robots developed. In this system, camera is mounted on fixed location such as doors, windows, walls and ceilings also [11]. Control of robot is done by using a pc, Android mobile or a laptop which is controlled via website and there will be the presence of buttons to control the movements of the robots. It can also be controlled by the hand gestures methodology. A robot can perform the particular risky tasks which cannot be done by the user. The robots are used in its specific fields of applications such as office, military, hospital, school and agricultural places.

The webcam will capture live data in the surroundings and then send it to a desired device through internet. The user will be observing this data on the monitor at the user end. According to the movement, the user will control the wheel through the webpage by using Raspberry pi and Arduino controller. The input given to the webpage is sent through the internet and desired movement occurs at the robot end. In case of any camera fault occurs, the whole process may become failure. This is the main drawback of that type of robot. And also it requires more hardware components to be interconnected.

## II. PROPOSED METHOD

The construction of Mobile robot with the help of programs an internet connection is established between the robotic vehicle and the user. This robot motion can be controlled by the webpage through Raspberry pi board. The robot captures the images using a webcam and stored them into the memory. It captures and sent the live images using internet at a rate sufficient to make them as like a live video to the human eye. By overcoming the existing technique, the sensors are included to increase the efficiency of the project. In case of any fault occurs in the camera the PIR sensor detects the object motions and also introducing an advanced future of Smoke sensor that detects the smoke produced during fire accidents and bomb blast. The LINUX operating system is used to reduce the hardware components. The PC connection and the block diagram of proposed method are given in Fig.1, Fig.2 respectively.

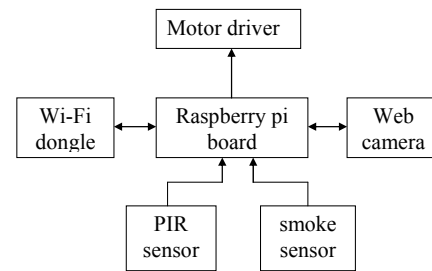
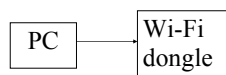


Fig.2 PC connection of Mobile Robot

Fig.2 Block Diagram of proposed method

## III. DESIGN AND IMPLEMENTATION

### A. Raspberry pi

The Raspberry Pi is a small debit card sized single-board computer with an open-source platform that has a thriving community. It is similar to the Adriano. It can be used in various types of projects from beginners learning and designing home automation systems. This higher-spec variant increases the GPIO pin count from 26 to 40 pins. There are four USB 2.0 ports in which 2 ports are available in Model B. The more modern push-push type micro SD slot is used. It consumes slightly less power, provides better audio quality and a cleaner form factor.



Fig. 3 Raspberry pi board diagram

To started we need a Raspberry Pi Model B+, a 5V USB power supply of 2 amps with a micro USB cable, any standard USB keyboard and mouse, an HDMI cable, monitor/TV for display, and a micro SD card with the operating system pre-installed. The NOOBS (New out Of the Box Software) OS is instructed for beginners. The Model B+ features are

more GPIO, more USB, micro SD, lower power consumption, better arduino, neat form factor.

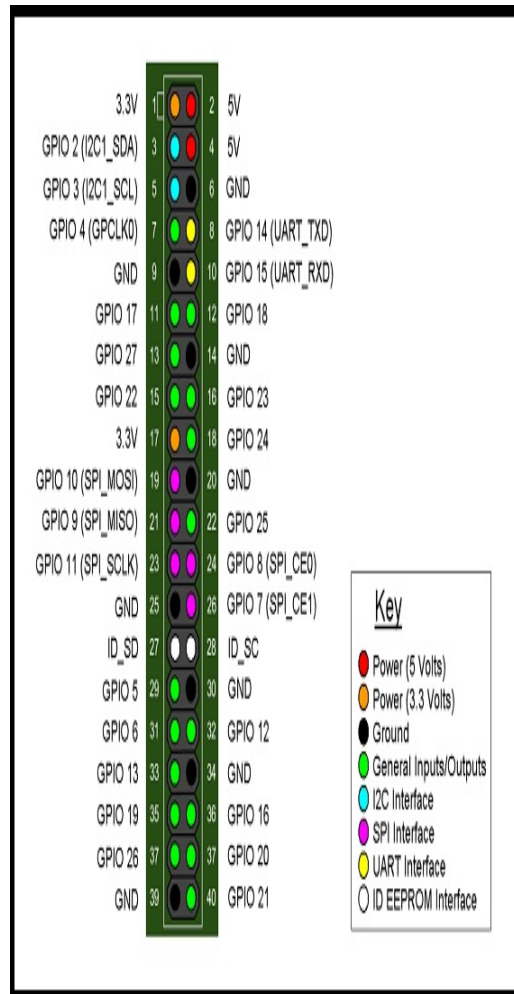


Fig.4 Pin diagram of Raspberry Pi board

This higher-spec variant increases the GPIO pin count from 26 to 40 pins. There are now four USB2.0 ports compared to two on the Model B. The SD card slot has been replaced with a more modern push-push type micro SD slot. It consumes slightly less power, provides better audio quality and has a cleaner form factor.

The Raspberry pi board requires 5V of input voltage supply where the Analog to Digital converter requires only 3.3V as input supply. The GPIO pins 8 and 9 are used to transmit and receive the input signal given to it. The data and clock are concerned with pins 3 and 5(I2C). The UART is known as Universal Asynchronous Receiver and Transmitter which is used to receive the input, process it and to transmit the input signal.

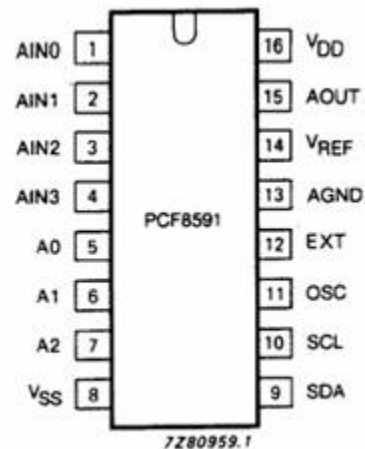


Fig.5 Pin diagram of ADC

The ADC is used to read the analog input from the sensors and then convert it into digital output signal. It has 16 pins on its configuration. The first 4 pins are for input signal. The data and clock are 9 and 10 pins respectively.

#### B. Web camera

The image can be captured by using IntexIT-306WC webcam. The camera resolution is up to 30 MP. It is connected to the USB port of Raspberry pi



Fig.6 Web camera diagram

#### C. Motor driver circuit

The motor driver circuit is a low current amplifier that drives the DC motor. The GPIO pins are made high or low according to the user input. This input is used to control the robotic vehicle movements.

#### D.DC motor

The motor driver circuit has capable of power the DC motors, which in turn control the movements of the robotic vehicle. It has the voltage of about 5volt and current is about 600milliampere.

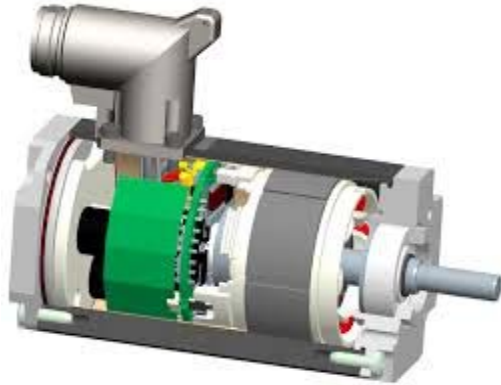


Fig.7 DC motor diagram

#### E. Wi-Fi dongle

The term “dongle” means which is to provide additional forms of wireless connectivity to devices (Wi-Fi or Bluetooth support) as well as small form factor digital media players and personal Computer meant to plug directly into an HDM input



Fig.8 Wi-Fi dongle diagram

#### F. Sensors

In case if any default occurs in the camera in future means the sensors can detect the object motions and provide the information to the user. Passive Infrared sensor is used in order to detect the human or an object at the certain distance by sensing the radiation emitted from the objects. They are commonly used in burglar alarms. When an object in front of the background such as wall, it rise the room temperature to body temperature. Smoke sensor detects the fire accident and bomb blast by sensing the smoke level in the atmosphere due to presence of CO<sub>2</sub>, N<sub>2</sub>, H<sub>2</sub>, etc. It is like a disk shaped structure of about 100millimeter(6inch) in diameter and 25millimeter(1inch) thin.

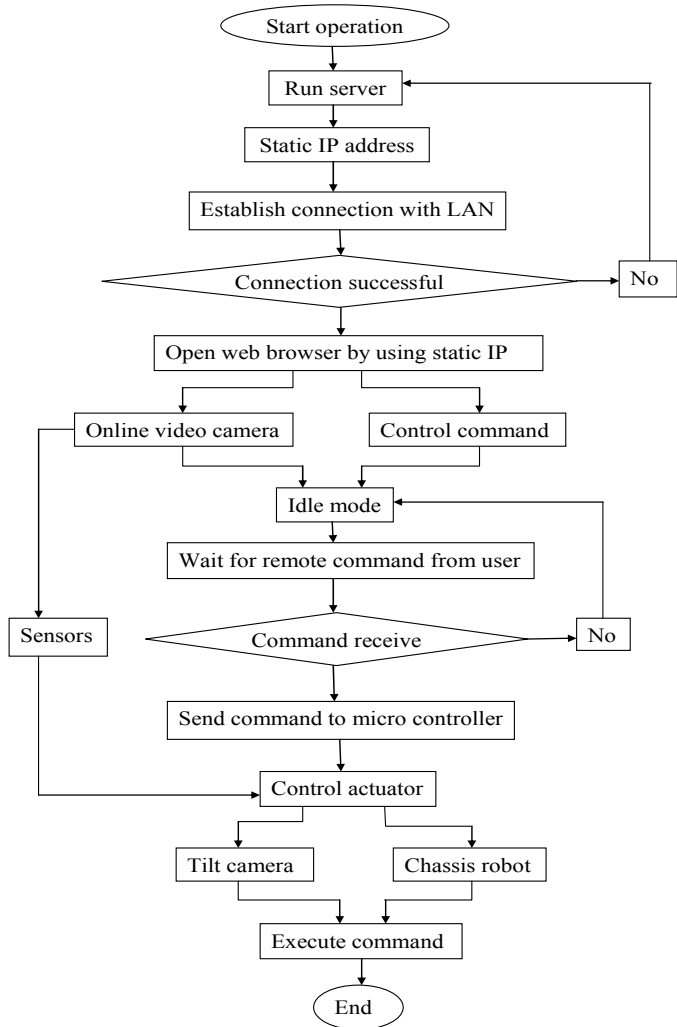


Fig. 9 Flow chart of monitoring and controlling of mobile robot using Raspberry pi board

## IV. RESULTS AND DISCUSSION

The wheeled robot structure is completed and interface of wireless robot through webpage. The camera is mounted on the mobile robot and can rotate in two axes(X&Y) to get better visibility. The sensors are attached with the robot for sensing even the camera gets fault in future.

$$\text{Time delay(AV)} = \sum_0^K k \frac{(\text{Round trip time})}{K}$$

Where,

Time delay (AV) = Average time delay



The time delay occurs by the type and speed of network connection. It will be very less value. This leads to some delay in the robotic vehicle movement control and monitoring.

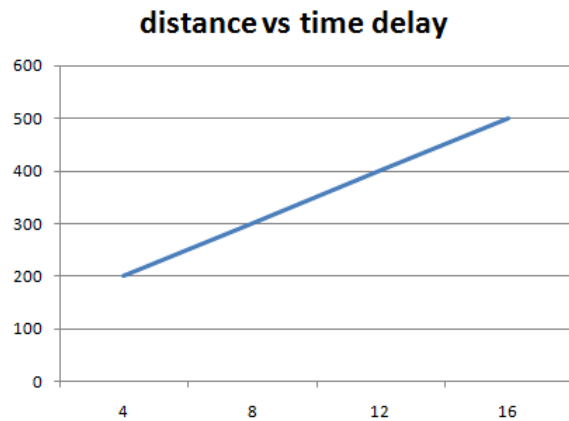


Fig. 10 Graph Drawn Between the Distance and Time Delay

Table. 1. Result of the Distance and Average values

Distance in Km	Min(ms)	Max(ms)	Avg(ms)
271	9	13	9
356	8	16	12
375	7	19	9
549	9	22	12

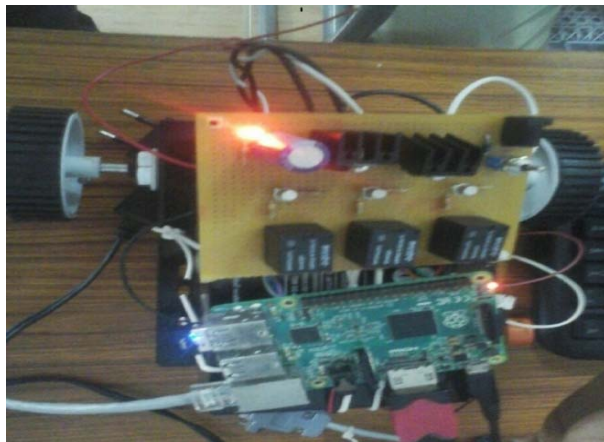


Fig.11 Diagram of Mobile Robot

## V. CONCLUSION

The monitoring and controlling of the mobile robot via internet using Raspberry pi board through the use of creating the webpage is done successfully. It needs only the Internet connection which can be obtained by wireless communication network. There is no interrupt can be occurred during

the commands to the robot from the user and the response from the robot to user. The robot can be easily controlled through using the personal computer or a smart phone. By use of the internet there will be a small time delay occurs which depends on the type, speed and distance of the network. This mobile robot can be controlled by the user from everywhere in the world through Internet of Things (IOT). The webpage created to control the robotic movements is secured by the unique user name and password which cannot be hacked by anyone.

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