Mobile Surveillance Robot Based On IOT

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Abstract- *Robots are extensively used in various fields due their multi-tasking capabilities.IoT technologies have gained a lot of popularity in the recent years and are used for monitoring purpose.Use ofIoT technologies not only helps in controlling the robot but also in continuously getting feedback from the sensors of the robot.An economical robot is designed using the principles of IoT.In this control system we give voice commands to control the robot for short range using internet and Bluetooth technology whereas for long distance controlling action of robot takes place through internet. The entire system is built around Raspberry Pi 3 and Arduino UNO. A GPS is incorporated to track the robot and an ultrasonic sensor is used to help it to avoid obstacles. A camera module is included by which we continuously get live video stream from the robot thereby providing surveillance capabilities.*

Keywords- Arduino UNO, Bluetooth, Camera, IoT, Raspberry Pi 3, Robot

I. INTRODUCTION

Robots have turned out to be exceptionally well known in the course of recent years and on account of their unwavering quality are broadly used in various walks of life. Here we have designed a surveillance robot which can live stream the video of its surroundings. For monitoring usually we install Closed Circuit Cameras (CCTVs) but the disadvantage with this system is that it is immobile. Whereas, our robotic system which is mounted with a camera module can be moved in any direction.

Use of IoT technologies like Wi-Fi in robotics is very helpful in sending commands to the robot wirelessly located at a remote location. It also helps to monitor and keep a track of our robot. By designing a robot which is compatible with IoT makes monitoring and controlling the robot very easy. Robots will become efficient and robust using IoT technologies and will automate many processes which were done manually, thereby reducing human effort.

The main thought of using IoT mainly comes from the fact that we can access internet from anywhere across the globe. So in this project, we have designed a robotic unit which can be controlled by pressing appropriate buttons on the web page and the feedback from the robot is also obtained. The main advantage of using IoT technology is that we can control our robot from anywhere using local mobile hotspot by giving the IP address of Raspberry Pi which makes monitoring very simple.

The concept of IoT when used with other technologies enables us to implement unique systems. In our project we combine IoT and Bluetooth technology by which we can control our robot through our voice. The Bluetooth app we designed comes with a speech recognizer which when connected to the internet will process our voice commands and send it wirelessly to the robot.

II. LITERATURE SURVEY

Raspberry Pi forms a primary component of numerous web based systems. In the paper Multiple Motion Control System of Robotic Car Based on IoT to Produce Cloud Service[1], the authors proposed a novel system where Raspberry Pi and Arduino are arranged in master-slave configuration and the commands are stored in cloud. But the robot cannot be used for surveillance as the system does not possess a camera.

The paper namedDevelopment of Fire Alarm System using Raspberry Pi and Arduino UNO[2], describes a fire alarm system comprising of a GSM module and a webcam for monitoring the situation. But the system is stationary and hence cannot be moved from place to place.

Another robotic system designed in the paper titled Design and Implementation of a Robotic Arm Based on Haptic Technology [3], describes a pick and place robot using Raspberry Pi. The robot has no feedback so the user has no information about its whereabouts, also the user does not know if the command is executed or not.

In the paper titled,IOT Based Surveillance Robot [4], the authors designed a Robot using Raspberry Pi which can be controlled through internet. Here the robot is controlled only

through internet and it cannot be controlled if the Wi-Fi connection is unavailable.

The solution to all these drawbacks is to design a mobile robot with a camera which can be operated through internet and also by using Bluetooth technology which acts as a back-up for a short range.

III. SYSTEM DESCRIPTION

This section describes the block diagram and flow chart of our system.

A. Block Diagram

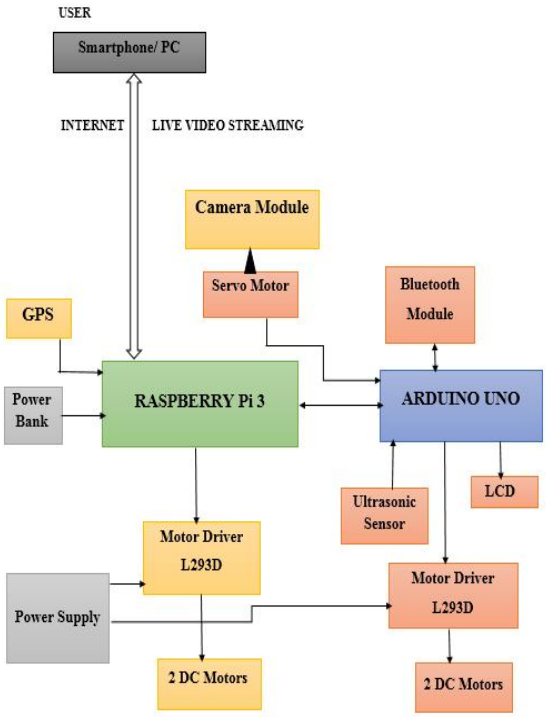

Figure 1: Block Diagram

Components of the Block Diagram

1. Raspberry Pi 3: This model come with a built in Wi-Fi module, this can be extensively used in IoT applications also.
2. Arduino UNO: An interface between our primary controller and Arduino is established by connecting a USB cable to one of the four ports of Raspberry Pi.
3. Ultrasonic Sensor: Higher order frequencies are delivered by this sensor which are indiscernible to the human ear. These waves are rectilinear yet when they hit an object close-by the waves get resounded back, giving the separation of the hindrance. By utilizing this sensor a robot can detect the nearness of an impediment in its way and subsequently it is equipped for dodging impacts.
4. Global Positioning System (GPS): It is an important module, because if we lose contact with the robot we can trace its location using GPS module.
5. Liquid Crystal Display (LCD): This is used to display the title of the project and also the direction in which the robot is currently present.
6. Motor Drivers: For the D.C motors to run we require motor drivers. Here we use two L293D series of motor drivers.
7. D.C Motors: Our system has four wheels. We have interfaced the a pair of D.C motors to Raspberry Pi which are operated by internet, whereas the back pair of D.C motors are interfaced to Arduino which are controlled by the Bluetooth app. The D.C motors can be programmed according to our requirement.
8. Power Supply: Power Supply is a crucial component of a robotic system. Here we use a battery to drive the motors and a power bank is used for Raspberry Pi.
9. Smartphone/Personal Computer/Laptop: A Personal Computer or android smartphone can be used to control the robot through internet by opening the required web page. But in order to control the robot with app we require a smartphone.
10. Bluetooth Module: In this system we interface a Bluetooth Module (HC-05) to Arduino. Here we use a Bluetooth module as a back-up that is to control the movement of robot in the absence of internet. A Bluetooth app is designed to control our robot.
11. Camera Module: A camera is interfaced to Raspberry Pi to equip our robot to get live information of the surroundings.
12. Servo Motor: A servo motor which pivots at a most extreme point of 180 degrees is utilized to alter the course of movement of the camera module. The camera is mounted upon a servo motor to control its direction.

B. System Flow Chart

The flow chart describes the sequence of events while the robot is operating.

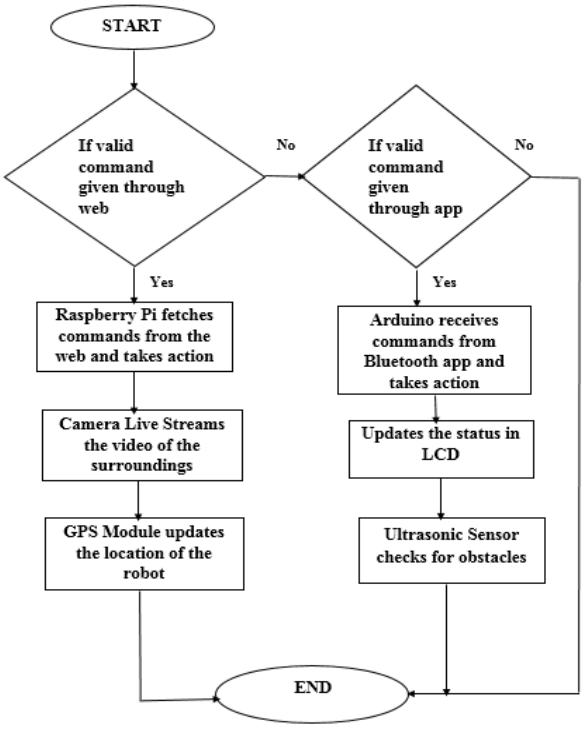

Figure 2: System Flow Chart

Controlling Robot through internet

1. Checks for validity of command: Whenever a valid command is given by the user through web, the same is received by Raspberry Pi.
2. Raspberry Pi takes action: The commands through web are received by Raspberry Pi. We establish a Wi-Fi connection using a mobile hotspot and enter the IP address of our Raspberry Pi. Once we enter a valid IP address, a HTML template is displayed in which all the robot controls are present. The backend coding is done using Python (Flask).
3. Camera Live Streaming: On the HTML template we also have a provision where we get live video of the surroundings through the camera. The angle of viewing can be adjusted using a servo motor. By interfacing a camera we can get the live feed of the surroundings as the robot travels.
4. GPS Module updates the location: A GPS module is interfaced to Raspberry Pi which updates the location of the robot. It displays output in terms of latitude and longitude enabling the user to track the robot.

Controlling Robot through App

1. Checks for validity of command: Whenever a valid command is given by the user through the app, the same is received by Arduino.
2. Arduino UNO takes required action: Arduino steers the robot based on the instructions received from the Bluetooth module, whereas the Bluetooth module receives command from the android app. If the app is connected to the net, voice commands can be given to control the robot using the speech recognizer present in the app.
3. LCD displays the status: The commands given by the user to the robot are displayed on the LCD, thereby giving the current status of the robot.
4. Ultrasonic Sensor checks for obstacles: An ultrasonic sensor's job is to constantly sense obstacles in its vicinity and stop the robot when it approaches any of it.

IV. RESULTS

The robot is designed and controlled in real time through web and also using the Bluetooth app. The exact location of the robot can be obtained using Google Maps by entering the co-ordinates obtained from GPS module.

Figure 3: Front View of the Robot

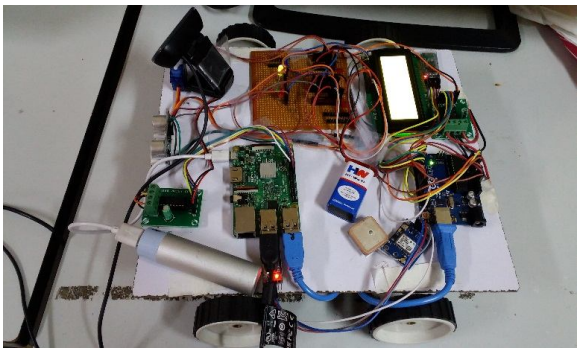

Figure 4: Top View of the Robot

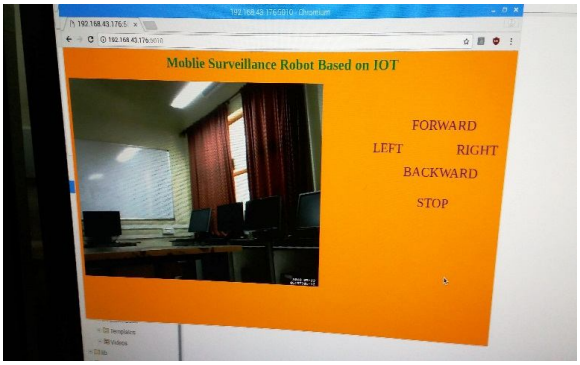

Figure 5: HTML Interface for Robot controls with a live streaming window

Figure 6: Bluetooth App

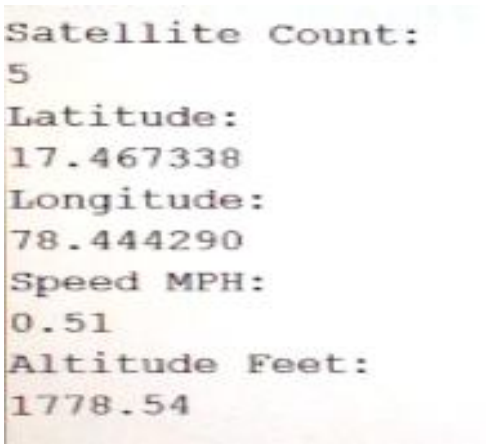

Figure 7: Output of GPS Module

V. CONCLUSION

A highly customized low cost robot is designed which can be used in monitoring applications which include watch and ward, defence, industries. It can be used in places which are inaccessible or hazardous to mankind like in coal mines. The robot is simple to design and cost effective.

VI. FUTURE SCOPE

More number of sensors can be interfaced to the existing system depending on requirement. Robots with Artificial Intelligence (A.I) can be designed.

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