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Wireless Controlled Surveillance Robot

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Abstract: In this paper we present a wireless controlled robot system for surveillance purpose. A robot is a machine capable of carrying out a complex series of actions automatically, especially one programmable by a computer. A robot can be controlled by a human operator, sometimes from a great distance. In such type of applications wireless communication is more important. This paper also shows general idea and design of the robot.

Keywords: mobile robot, android, surveillance, wireless communication, GUI (Graphical User Interface), navigation.

I. INTRODUCTION

A mobile robot is a machine that is basically placed or mounted on a movable platform and can be with the help of certain instructions. In today's world a lot of fields use mobile robots. Many of the complex robots that we now see have originated from the simpler mobile robots. This technology has increased many new applications in the industry. The combination of mobile devices and robots are leading to new ideas in lots of fields.

The mobile devices are now being used in many of the industrial applications this is mainly because of the reason that they are portable and have a longer battery life as compared to a laptop. Also they have a data plan through a cell phone carrier which is convenient as we can interact with the mobile robot once the connection is established.

Mobile Robots: The mobile robots can be classified into different types. The track robot is the robot that uses tracks to move around. However such robots are costly to build. Also they are not as flexible as the wheeled robots. The wheeled robots are the robots which use wheels for moving. Such robots can move only on smooth flat surfaces. The third type is the legged robots which are based on human form. They have legs which helps them to move around. These robots are very difficult to design.

II. LITERATURE REVIEW

Conventional Wireless Robotics: In conventional robotics, the controlling and operation of robots is usually done by using RF [Radio Frequency] circuits. These circuits are widely used for control and working applications and are also reliable over a small range. The RF circuits consist of transmitter and receiver which are independent of each other. All the control signals and commands are sent via wireless medium in between transmitter and receiver.

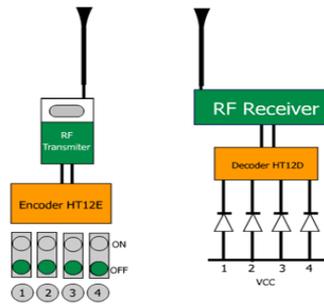


Fig 1: Transmitter & Receiver kit

There are a number of advantages of RF circuits such as Low cost, Ease of Construction & design, easy decoding, less maintenance cost etc. Besides these advantages, there are still many serious drawbacks of using a RF circuit in circuit. They are

Limited Frequency Range: The frequency range used for typical RF communication is near about 3KHz-3GHz. The use of channel separator increases the reliability but decreases the actual usable working frequency range.

Limited Functions: The limited number of channels causes less number of combinations and thus there are less numbers of available functions.

Limited Working Range: The working range of RF circuits with transmitters and receiver is very small. It starts from a few meters to a few kilometres. The working varies from circuits to circuits, but mainly depends on the values of physical components used in the circuit.

Mainly Wi-Fi and Wi-Max wireless services are used in RF transmitter and receiver circuits. The following table shows the actual working range of different wireless standards that can be used in wireless communication.

Reliability of Operation: The RF circuits are very prone to errors due to external conditions such as EMI (Electro-Magnetic Interference), medium saturation, absorption due to repetitive reflections from surface. Hence the output recovered is not always what is expected. This might be a serious problem when working with scientific experimental components.

Security reasons: This is the main disadvantage of using a RF circuit and the main reason why RF circuits are not preferred today. The RF frequency band is available for almost all the users for data communication. So there might be a scenario where more than one user is trying to accommodate channel for its own communication. In such case the frequency band may get interference from another user. Or worst case would be, some user intentionally trying to jam our communication network. The RF jammer circuits are very easy to design; hence the question of security arises when RF circuit is used in the circuit. This security loop hole can be very dangerous when the robot is being used for very confidential purposes. In areas of military these security threats can produce disastrous outcomes.

III. PROPOSED SYSTEM

The new age of technology such as Android, GSM has redefined communication. Most people nowadays have access to mobile phones and thus the world indeed has become a global village. At any given moment, any particular individual can be contacted with the mobile phone. New innovations and ideas can be generated from it that can further enhance its capabilities. Technologies such as Infra-red, Bluetooth, Wi-Fi which has developed in recent years goes to show the very fact that improvements are in fact possible and these improvements have eased our life and the way we live. Remote management of several home and office appliances is a subject of growing interest and in recent years we have seen many systems providing such controls.

Mobile robots are robots which have the ability to move around and interact with their environment and not just hinged to a particular place. There are many labs and research groups from various universities and industries which are completely dedicated on researching mobile robots, because of their immense potential and varied application in industry, military, security, and entertainment.

The robot is specially designed for surveillance purpose. The control mechanism is provided along with video transmission facility. The video transmission is practically achieved through high speed image transmission. Initially, the robot will be equipped with an Android smartphone which will capture the scenario in front of it & will transfer the images to the server on which the user will be controlling and watching the live feed.

The Block Diagram given below explains the actual working of the robot. We can split it into three stages as follows-

1. Robot
2. Remote Computer
3. Communication link between the above two, which is a Web server.

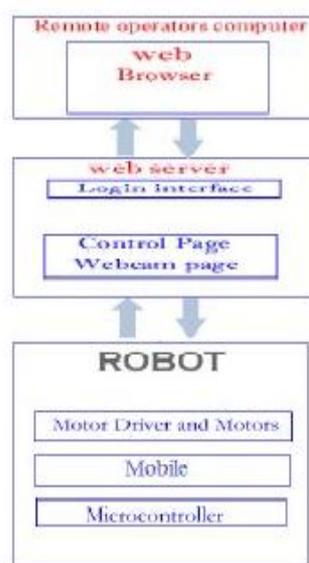


Fig 2(a): Block Diagram

1. **Robot:** - The main components of the robotic body as shown in the above Block diagram are an Android device, a microcontroller and motor drivers and motors. The Motion of the Robot is programmed using Atmega-8 microcontroller.
2. **Remote Computer:** - Now, the robot can be controlled by the user operating the Remote computer. The essential component here is the web browser on which we will be opening the control page to control the robotic action. Also we will be able to watch the live streaming on the video screen on the control page.
3. **Web Server:** - The web is consisting of a log-in interface and control page with video screen or a webcam page.

Anatomy of Robot:-

The body of a robot holds all its vital parts. The main structure of the robot is generally a metal frame, which is constructed a little like the frame of a house with a bottom, top, and sides. Onto the frame of the robot are attached motors, batteries, electronic circuit boards, and other necessary components.

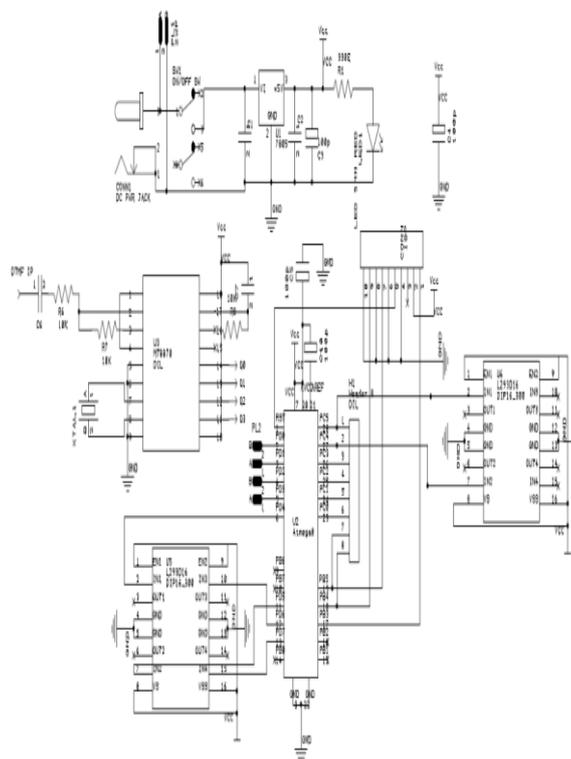


Fig 2 (b): Schematic for Robot Control

Web Programming: There are several server side scripting languages which process the data on the server and send the data to the browser. PHP was primarily chosen because it is open source and for the easiness of embedding the scripts in the HTML page itself. HTML or Hypertext Mark-up Language is used to create web pages and it gives a clear understanding of the primary objectives. The HTML language is designed to achieve an efficient way of achieving transfer of data, and to evolve as new media formats were created, whilst remaining predictable to use. HTML is a set of codes that a website author inserts into a plain text file to format the content. Here we will be using HTML to design our web page to get a look of the video data transmitted from the camera on the bot. We will be having a login system to provide access to details transferred from bot to only required person. HTML is the basis for our video data transmission process.

Video Transmission: The Android device will be the creator of the video via the camera and responsible for transmitting the video over the internet to the server. It also maintains communication with the server through a custom protocol to ensure proper identification and video streaming. Since many image processing algorithms require high complexity cost, running these algorithms on a mobile client with responsive interactions is often infeasible. One remedy to this problem is to offload the work to a high-performance server over the network.

Video streaming from the Android device entails a combination of many elements. The custom RTSP server built to interact with the Android devices, their video streams and applications (ex. VLC) capable of playing live video is the largest contribution of the project (over 2000 lines of code).

The user will first capture an input image using an Android client and send the image to a server via HTTP. A PHP script on the server then invokes the server-side application to compute SIFT on the image. This project develops an open source solution capable of transferring the live video with little overhead on the phone and/or server. Users will have the ability to broadcast news and events live using only an Android-enabled mobile devices and an internet connection via the cellular network or Wi-Fi.

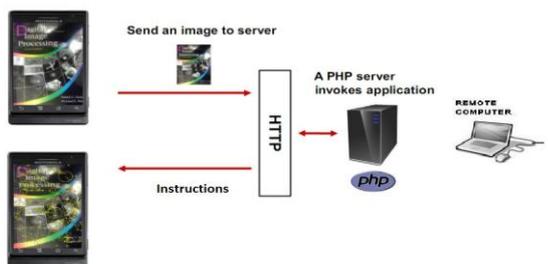


Fig2 (c): Video Transmission Algorithm

IV. FUTURE WORK

There are lots of improvements that can be made on the current design and technology and lots of additional features can be added. The current autonomous navigation is a blind method where the robot doesn't keep track of the direction and position of where it is heading. So in the future we would like to add an electronic compass for the robot to keep track of the direction. And a better method of cell based navigation can be done with the help of encoders for which a provision is provided. The architecture can also be modified by providing a more powerful embedded computer which could handle HTTP requests within the robot itself. The modified architecture is shown in the figure below.

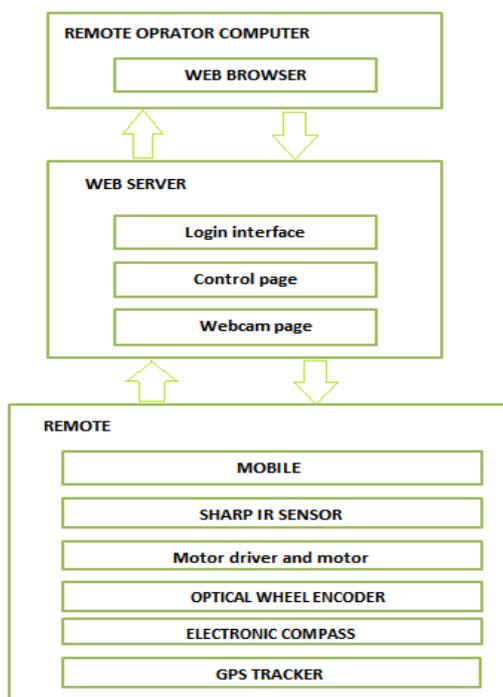


Fig 3: Block Diagram

V. CONCLUSION

In the designing of our projects, we have kept in mind the user. The controlling of robot is easy as the various buttons are available on the web page specifying the various actions. The Android device used here makes possible the fast and good quality of image transmission. The programming used gives very good control on the movements of the robot. The Controlled Wireless communication can be achieved using Wi-Fi network or internet. The future implications of the project are very great. The robot is very robust.

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