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WIRELESS INSPECTION ROBOT

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***Abstract*−Main aim of the project is to develop a robot used for industrial, military and general purpose inspection. Visual feedback from the robot is taken with the help of a camera interfaced with raspberry pi which transmits data to the laptop wirelessly through Wi-Fi. The robot will be controlled with a wireless joystick for locomotion and the movement of the camera(mounted on a servo) along the vertical axes using RF module(range of at least 500m).It can be used for inspecting those areas where human reach is not feasible. In our project, we are inspecting the vicinity of the area where the user is controlling the robot. But if we want to inspect remote areas, then we will require something through which we can access the remote areas so that we can monitor the surrounding which will be far from where we are accessing it. The idea can be viewed as a potential IoT application viz. Multimedia surveillance sensor networks wherein Telnet can be effectively used to connect to the Internet dynamically.**

Keywords –RPi (Raspberry Pi), RF (Radio frequency), IoT (Internet of Things),Multimedia surveillance sensor networks, Telnet.

I. INTRODUCTION

Our paper is based on enabling technologies which deals with embedded systems and robotics. An embedded system is a system that has embedded software and computer hardware, which makes it a system dedicated for an application(s) or specific part of an application or product or a part of a larger system [1]. A robot is a mechanical or virtual artificial agent, usually an electro-mechanical machine that is guided by a computer program or electronic circuitry [2]. It is a device with autonomy. It does its thing "on its own" without a human directly guiding it movement-by-movement . Robotics can be defined as the science or study of the technology primarily associated with design, fabrication, theory, and application of robots. The idea is about inspecting the areas with a robot where human reach is difficult. This manuscript is done to present a version of inspection robot that can enable us to observe the place of our interest. Thus, to create the robot we should be able to change its path when necessary. To realize all that a microcontroller is required. In this control unit, RF signals are used. Using these signals encoding is done and signal is sent through the transmitter. At the receiver end, the received signals are decoded and given as input to drive the motor. A webcam mounted on top of the robot helps us to see the path of its motion and it is interfaced with RPi.

This paper is organized as follows: Section II presents the survey presents an overview on the use of robotics in the inspection of inaccessible areas. Section III describes the proposed robot design. Section IV lists the applications of wireless inspection. Utility of our robot in multimedia sensor networks is highlighted in section V. Section VI is the concluding section

II. LITERATURE SURVEY

A spy robot which can be controlled by using a keyboard is proposed by Lokesh Mehta et al. [3]. A CCD camera is used for the surveillance of the surrounding area. The data is transmitted to a remote area through RF signals. Surveillance is also possible in darkness using the flashlight. The spy robot also includes the measurement of the distance at the front part of the robot and automatically

stops it. I.F.Akyildiz et al.[4] describes a concept in which networks of devices interconnected wirelessly are able to retrieve data from the environment. The battery powered miniature video cameras are capable of processing, sending and receiving data .The available audio and video sensors help to enhance the surveillance system. Priya Shukla et al.[5] presented a paper in which the main idea is to reduce the risks to workers. It serves as a multipurpose robot for providing access to confined and humanly inaccessible areas. Various places need to be periodically monitored using sensors and cameras. The robot investigates and cleans the area using wireless communication. Wai Mo, Mo Khaing et al. [6] proposed design and implementation of remote operated spy robot control system which is equipped with a CCD camera that transmits the video signals and can be seen by the receiver. The robots used are small, compact and made up of wireless camera, antenna and PIC controllers which are used to remotely control along the wireless system and to control the spy robot. It can be used remotely to enter and exit dangerous places.

III. WIRELESS INSPECTION ROBOT

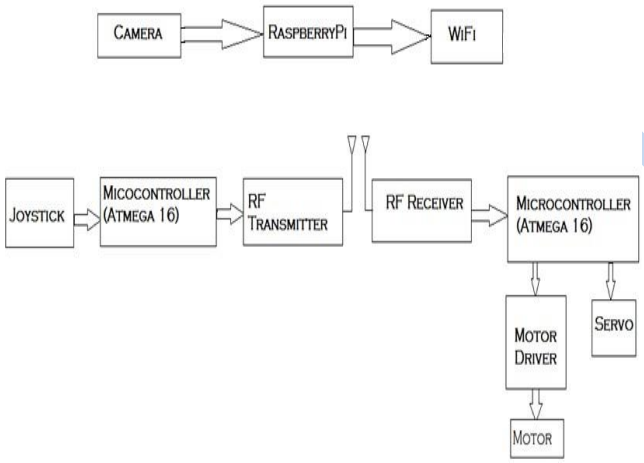

Fig. 1 Block diagram

System description:

a. **RaspberryPi**:-It is a single board computer developed in UK. We are using RaspberryPi 2 Model B[7] in our project. It contains 900MHz quad core ARM Cortex-A7 and Broadcom BCM2836 SoC[8]. RPi is used for interfacing wireless camera with Wi-Fi. As we are inspecting the area which is far from us, we will require a camera and for that live video streaming is required. So RPi interfaces camera with Wi-Fi i.e. we will connect RPi with laptop or any smart device through Wi-Fi which is connected through router and then the camera is connected to RPi through USB cable placed on a robot and thus, we can see live video of the surrounding area.

b. **Microcontroller:-**It is the main part of the embedded system used for controlling and executing specific task. The controller we are using for our project is ATmega-16 which is high performance low power Atmel AVR 8-bit microcontroller [9]. We are using it at the transmitter as well as receiver side.

c. **Joystick**:-Joystick is used for the movement of the robot in forward-backward and left-right direction. Other than that, the movement of the camera from left to right is also done by joystick.

d. **RF Tx-Rx**:-As the transfer of data is wireless, we are using RF module TX433, RX433.Its operating frequency is 433MHz.Transmitter receives serial data and transmits wirelessly through RF module. To transmit and receive data, RF requires encoder and decoder IC's namely HT12E and HT12D respectively.

e. **Motor Driver**: - L298 motor driver is used to drive the motors. It is operates at 12V with a peak output current of up to 3 Amps. A 12V lead acid battery supplies the required supply. The motor driver is connected to motor through motor connectors.

IV. APPLICATIONS

i) Spy robot for military purposes.

ii) Can be used for providing information of moisture, gas leakage, harmful radiations etc.

iii) Face recognition using image processing.

iv) Used in pipe inspection.

v) Aerial line inspection for power transmission lines.

vi) Multimedia surveillance sensor networks.

V. WIRELESS INSPECTION ROBOT IN MULTIMEDIA SURVEILLANCE SENSOR NETWORKS

A wireless video sensor network is composed of inter-connected, battery-powered miniature video cameras, each packaged with a low-power wireless transceiver that is capable of processing, sending, and receiving data. Use of video and audio sensors enhance and complement existing surveillance systems against crime and terrorist attacks. Large-scale networks of video sensors can extend the ability of law enforcement agencies to monitor areas, public events, private properties and borders [4]. Our wireless robot is used for inspecting the area in the vicinity of the user controlling the robot. Using Telnet one can access the remote areas through internet and thereby monitor the surrounding which will be far from where we are accessing it.

Telnet is a user command for accessing remote computers. Through Telnet, an administrator or another user can access someone else's computer remotely [12]. On the Web, HTTP protocols allow user to request specific files from remote computers, but not to actually be logged on as a user of that computer. With Telnet, one can log on as a regular user with whatever privileges one may have been granted to the specific application and data on that computer. Flexibility is be increased due to its easy accessibility to any person i.e. he can create his own login id and password through which he will be able to access the data of the robot from remote areas and can get the required results promptly. Intelligence level increases since the robot is accessible to any person from anywhere and accesses the necessary data. The collected data could be used to take some necessary action to prevent mishap.

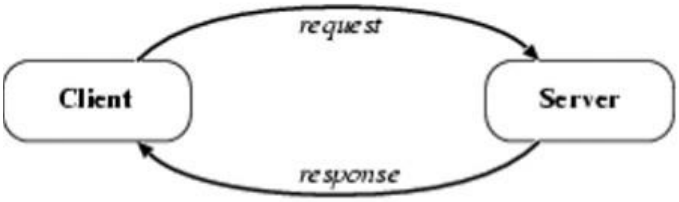

Fig. 2 General schematic diagram of working of telnet

Security Challenges:

Security: Telnet clients and servers exchange data by using unencrypted characters (plaintext). Anyone with a network protocol analyser with access to the network media can see the information in the Telnet session. There is no support for more advance authentication methods such as public/private key, digital certificates. There is no server authentication which means that users have no way to be sure that the host they are communicating with really is the Telnet server and not an attacker impersonating the server.

To overcome the problem, there is another protocol viz. SSH(secure shell) which provides encryption i.e. all the text or data is sent and received in a way that only two computers involved can understand.

RESULTS:

Fig. 3 Transmitter Board

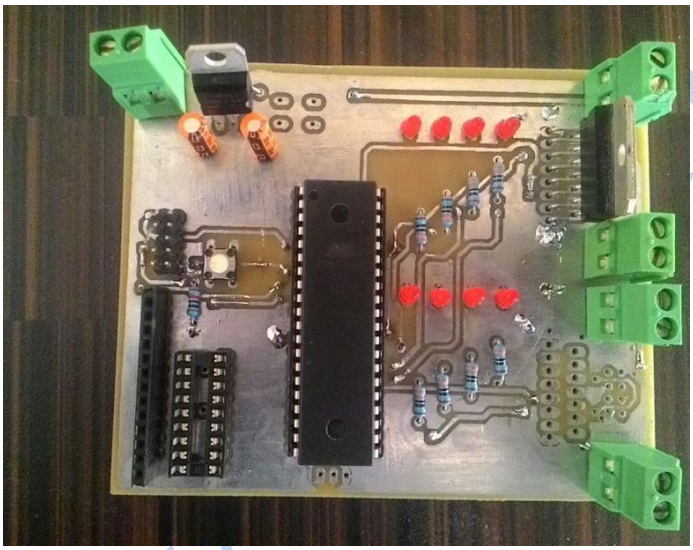

Fig. 4 Receiver Hardware

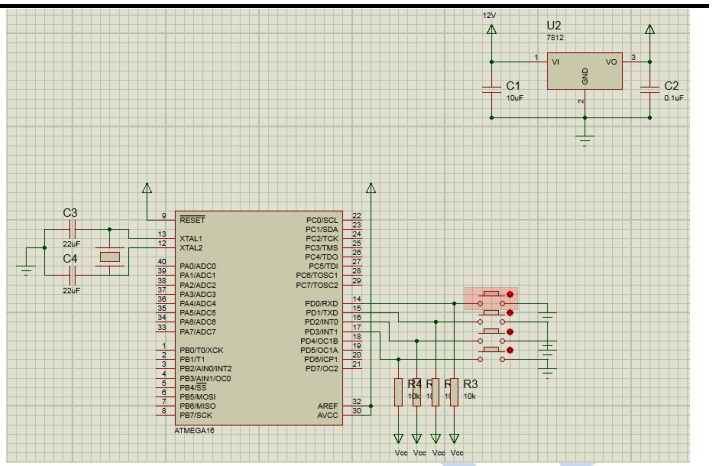

Fig. 5 Transmitter Simulation Results

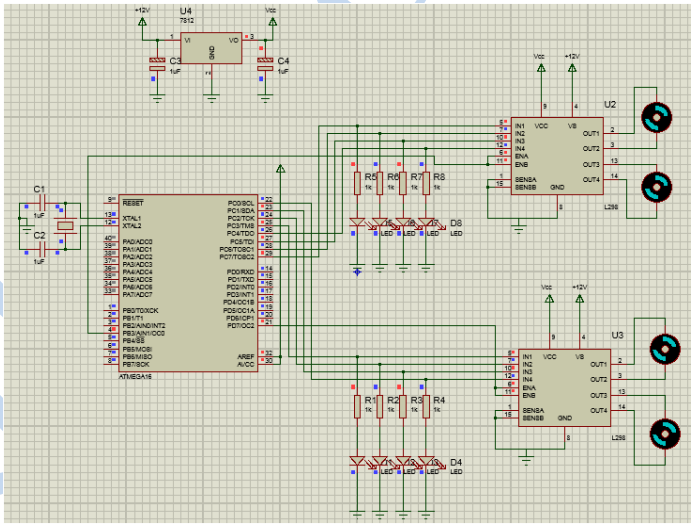

Fig. 6 Receiver Simulation Results

CONCLUSION

In our paper, the robot can perform a general inspection which can be difficult for humans. We have presented the design and partial results of our Wireless Inspection Robot. We have also proposed to extend its application in multimedia surveillance network, an emerging field in Internet of Things.

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