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IOT Based Surveillance Robot

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Abstract: **The main objective behind this paper is to develop a robot to perform the act of surveillance in domestic areas. Nowadays robot plays a vital role in our day to day life activities thus reducing human labor and human error. Robots can be manually controlled or can be automatic based on the requirement. The purpose of this robot is to roam around and provide audio and video information from the given environment and to send that obtained information to the user. In this project, one can control the robot with the help of mobile or laptop through Internet of Things (IoT) and also can get the live streaming of video both in daytime as well as at night with the help of wireless camera from the robot. The robot can be controlled both in manual as well as in automated mode with the help of Arduino microcontroller. This robot also uses various sensors that collects data and sends it to the Arduino microcontroller which controls the robot behavior. Along with the obtained live streamed video output, user can also obtain the presence of metal bombs using metal detectors. Thus the action of surveillance can be performed. Further advancement in our project can provide surveillance even in defense areas.**

Keywords: Arduino, Surveillance, ESP8266 12e, IoT, CAYENNE Software.

I. INTRODUCTION

Technology has brought a dynamic and tremendous change in robotics and automation field which ranges in all kinds of areas. Surveillance is the process of close systematic observation or supervision maintained over a person, group, etc. especially one in custody or under suspicion. Thus surveillance is mainly required in the areas such as border areas, public places, offices and in industries. It is mainly used for monitoring activities. The act of surveillance can be performed both indoor as well as in outdoor areas by humans or with the help of embedded systems such as robots and other automation devices. A robot is nothing but an automatic electronic machine that is capable of performing programmed activities thus replacing human work, providing highly accurate results and easily overcoming the limitations of human beings. Thus replacing humans in the surveillance fields is one of the great advancement in robotics.

The robot consists of Arduino Uno microcontroller which acts as the heart piece of the robot. This robot also consists of DC motors, wheel chassis, battery, Wi-Fi module (ESP8266 12e) and various types of sensors such as ultrasonic sensor for obstacle detection, IR sensor for detecting pits. The robot can be either operated automatically or manually. User end communicates with the robot by implementing the concept of Internet Of Things. This can be achieved through CAYENNE software, which is used for IOT developing projects.

The commands are sent to the robot by means of CAYENNE software and they are received by Arduino microcontroller via Wi-Fi module since both are interfaced with each other. Thus the robot can be controlled in a wireless manner. In this project, we use wireless transmitting camera that provides audio and video information that can be received at the user end.

A. Existing System

- Already existing systems use robots that have limited range of communication as they are based on RF Technology, Zigbee and Bluetooth.
- Some existing projects use short range wireless camera.
- Some existing robots can only be controlled with a manual mode which needs human supervision throughout the whole surveillance process.

B. Proposed System

- By interfacing Wi-Fi module with Arduino, we can get unlimited range of operation.
- Robots can be operated in both manual and automatic modes.
- By using Arduino microcontroller, the cost and complexity can be reduced.
- The communication with the robot occurs in a more secured manner.

II. SYSTEM DESIGN

The system consists of two major sections - one is the user section and other is the robot section. In that the user section can possess laptop or mobile for communicating with the robot end. Thus by using a laptop or a mobile the user section can be a portable one compared to those that uses a typical stationary computer system. The communication can be performed with RF technology or by using a Zigbee device or by using a Bluetooth technology, but that comes at the cost of limited range. Thus in order to implement the idea of increasing the range we can go connecting the user section with the internet which is the main concept of Internet of Things. For connecting the user system with the internet, the CAYENNE software is used. CAYENNE software is nothing but an object relational

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mapping (ORM) which is used to design prototypes and develop IOT applications. Thus through this CAYENNE software, we can send commands and can easily control the robotic vehicle.

At the robot end, we are using an Arduino microcontroller placed on the body or the chassis of the robot, which is the integral part of the robotic vehicle. Below the chassis, the wheels are connected with DC motors that are of 30 rpm each. Each motor requires 12v supply, supplied by means of an external battery source. The motors are interfaced with the Arduino through relay driver. Four relay drivers are employed for two motors and they are used for amplification purpose. The microcontroller is coded with IDE software in order to operate the robot in appropriate directions. This is the manual mode operation associated with it. Several sensors such as ultrasonic sensor, infrared sensor are also used which are interfaced with the microcontroller in the respective I/O pins. Ultrasonic sensor operates by reflection principle, that is by transmission and reception of signals obstacles are detected. In short, it follows the principle of bats termed as echo location. Similarly, Infrared sensors are used to emit and detect infrared radiations, so that the surrounding temperature changes can be detected.

III. HARDWARE USED

This surveillance robot requires a lot of essential hardware components for proper functioning. Due to advancement in technology, these surveillance robots are used in remote as well as domestic areas. The main components used in our project and their specifications and functions are as follows,

1. ARDUINO MICROCONTROLLER:

Arduino microcontroller is based on UNO AtMega328. It is used to receive commands sent by the user via the internet and processes according to the code and also used to control the motors. Wi-Fi module ESP8266 is also connected with the arduino so that Wi-Fi facility can be provided to the robot.

2. *DC MOTORS:*

Motors that operate on 12V DC power supply are used. These are rotary electrical machine that converts direct current electrical energy into mechanical energy. The motors used are of 30 rpm speed of operation.

3. *ULTRASONIC SENSOR*

Ultrasonic sensor is a device that can measure the distance to an object (obstacle) by using sound waves at a particular frequency. It provides a 3cm to 3m range. It can work in any lighting conditions. Thus the robot easily dodges obstacles present on its way.

4. *INFRARED SENSOR:*

An infrared sensor is used to sense and determine the nature and aspects of the surroundings by emitting infrared radiation. This sensor has the ability to emit infrared radiation and detects the reflected radiation that is being reflected by an object or the surroundings. The range is between 2 cm to 30 cm and the operating voltage is around 3v to 5v. This infrared sensor is attached to the robot to detect edges present on its path.

5. LEAD ACID BATTERY:

Two 6V batteries are connected in series to provide a 12V power supply for the motors. From these batteries power supply is also given to the arduino and other parts that require power supply for their effective performance.

6. WI-FI MODULE:

The ESP8266 12e module which is low cost, self-contained chip consists of TCP/IP protocol stack that is used to provide network access to any microcontroller. It is highly compact in size and is easily a portable one and thus this is interfaced with the arduino to provide the robot with Wi-Fi facility.

IV. SOFTWARE USED

1. CAYENNE SOFTWARE:

It is an object relational mapping (ORM) framework. It allows a programmer to work with objects abstracted from databases. It is used to design prototypes and IOT based applications as it is a drag and drop project builder thus allowing devices to get easily connected to the internet. Through this software we can easily control the robot with the help of the buttons present in the software. Both manual and automatic mode can be performed with this software

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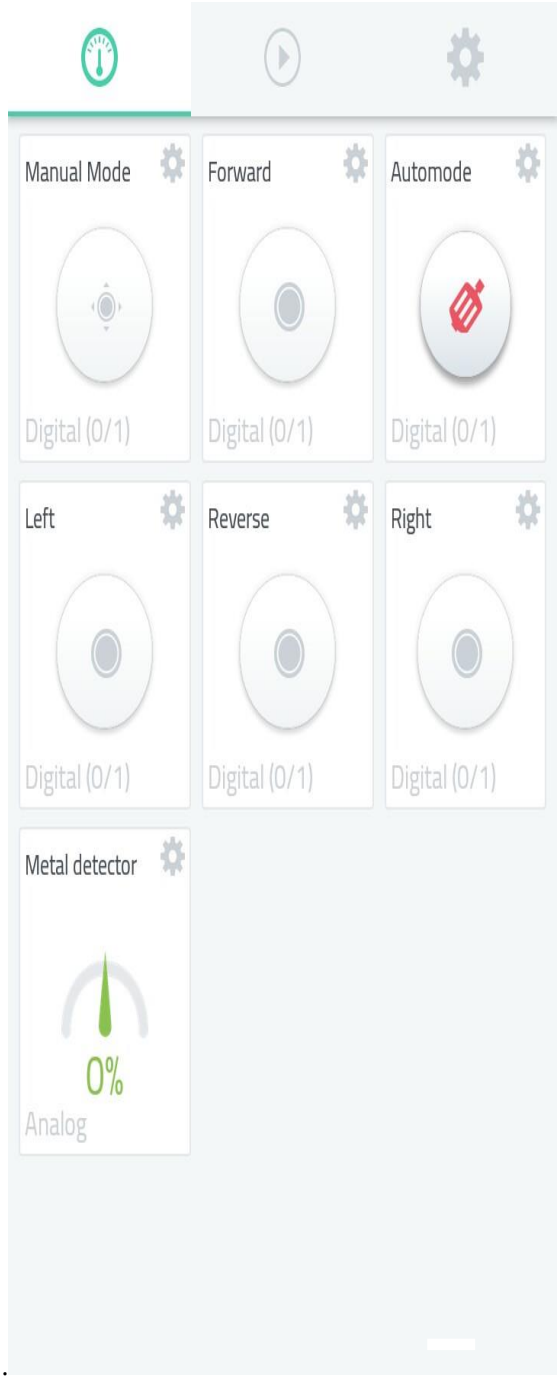
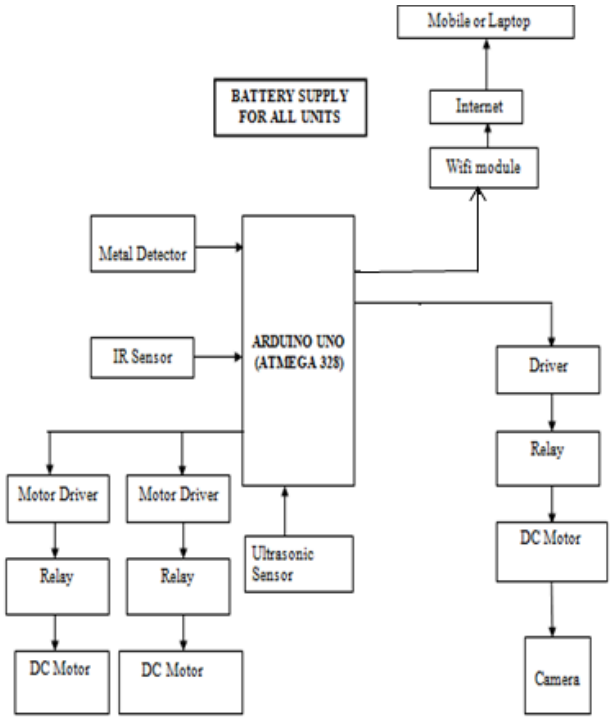


2. ARDUINO SOFTWARE (IDE):

It is open source software that is used to write codes and upload it to the Arduino board. The Arduino IDE contains a text editor for writing codes, a message area, a text console, a series of menus along with toolbar with buttons. The programming codes are known as sketch. The sketches are saved with the file extension .ino. It runs on Windows, MAC and LINUX. Thus through this software we can code for the robotic movements and also for the sensors interfaced with the arduino board.

V. BLOCK DIAGRAM



VI. APPLICATIONS

Following are the main applications of the solar powered multifunctional robot:

- By combining camera features with the robot we can easily monitor indoor as well as outdoor locations during daytime and at night.
- Remote areas can also be explored.
- Used to record and send video output of the required environment.

VII. CONCLUSION

In this paper, the framework for making a robot for surveillance purpose is proposed. It overcomes the problem of limited range surveillance by using the concept of IOT. We can control the robot with the help of laptop/mobile manually. Automatic monitoring can also be done. Our proposed robot is small in size thus maneuvering into area where human access is impossible.

Wireless technology is one of the most integral technologies in the electronics field. This technology is used to serve our project as a supreme part of surveillance act. This provides highly efficient and a cost effective robot that replaces human work and reduces human labor and performing monitoring works in a well effective manner.

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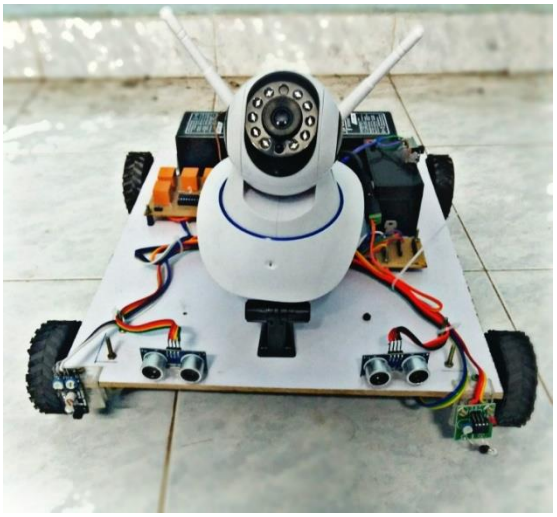

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