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Research Article
Android controlled robot with image transfer

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Keywords

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Bluetooth technology,
DC Motors,
wheels,
Adruino micro-controller and Bluetooth module.

Abstract

The developed robot can capture images from its area of vicinity and transfer it back to the system connected to it via Bluetooth technology. It can be used for a better surveillance system, since the camera is mounted on the moving robot rather than fixed cameras. It uses a Bluetooth technology to get the control over the robot. The robot can be remotely controlled using the app created. Movement of the robot can be controlled using the app (left, right, up and down button). Robot is built out of basic hardware requirements such as DC Motors, wheels, Adruino micro-controller and Bluetooth module.

Introduction

In today's fast world where leading quick lives have become imminent, security has become one of the main concerns. With anti-social elements using technology to commit crimes, it has become more important that we develop technologies that help us detect security threats[1] and curb them. One of the popular branches of technology that helps man achieve this end is robotics[2]. Robots are developed to accomplish a lot of tasks with accuracy and quickness that a human being cannot achieve all the time. Hence the idea behind this project is to make a robot that is able to take videos of every nook and corner of its vicinity, including dead zones that cannot be monitored using fixed cameras. The robot can also get accessibility into spaces that cannot permit human entry helping the user understand the exact reason for the cause of a problem or concern if any. The robot can be remotely controlled through an app running on android phone connected via Bluetooth[3].

Given that mobile phones have become an inseparable part of our lives today, it is easier, efficient and convenient to remotely control the robot through an android application from a smart phone rather than use a remote. Because of the ease with which the android app can be installed on any android-supported smart phones, the robot can be controlled with any android-supported phones instead of being dependant on a single remote.

1.Existing works

A Bluetooth or Wi-Fi controlled robot[4] is developed to rescue more people struggling from the rubble of the collapsed buildings in case of natural disasters. This developed robot with slight modifications can also be used to navigate in different places like coal mines and nuclear plants.

A robot is implemented with Bluetooth technology[5] in it. The robot moves around by itself using an algorithm. PC acts as a server cum master. The sensors on the robot transmits the signals to the master for processing and then the server sends command back to the robot.

A mini robot is constructed for gas LP detection[6]. The robot is controlled using a mobile device. This application will receive a signal when the robot detects the LP gas concentration, the device produces an alarm and sends a signal to the robot so as to make it stop. The communication between robot and the mobile device is done through Bluetooth technology.

A robot is implemented with Bluetooth technology[7] to give it the capability to move around autonomously . The mobile robot will act based on the algorithm stored on the server. All the reading of the sensors are processed by the server and the command is send back to the robot.

Android based wireless gesture controlled robot[8] is implemented. This robot is used in places where direct human intervention is not possible. A color segmentation based gesture controlled robot along with an ultrasonic sensor to monitor the 3D spatial coordinates in region of operation. The robot is controlled using Bluetooth technology.

2.System architecture

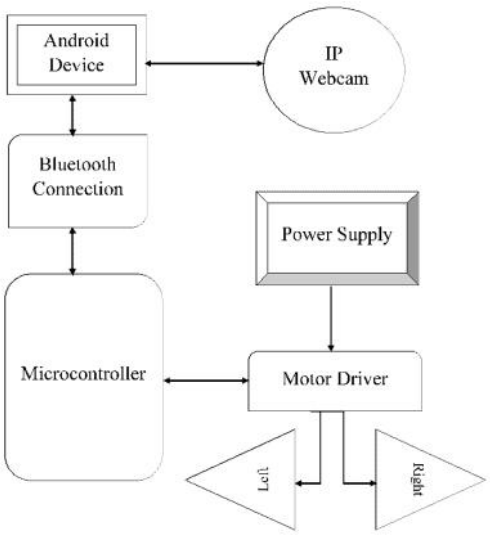

Fig. 3.1 Block diagram

The android controlled robot has various modules as follows: an app running on an android phone (which is used as remote control), a Bluetooth module, Adruino micro-controller, DC Motor.

i) Android app

In this project, we are using a mobile phone as remote control to control the robot. The first step towards development of this project is development of mobile app. Android is an open- source operating system that runs on mobile phones. Eclipse is the software that is used to create android app for this project. Using java language an app is created with right, left, up and down arrows. This is used to control the movement of the robot in respective directions.

ii) Bluetooth module

Bluetooth serial communication module has two work modes: order-response work mode and automatic connection work mode. And there are three work roles at the automatic connection work mode. When the module is at the automatic connection work mode, it will follow the default way set lastly to transmit the data automatically. When the module is at the order-response work mode, user can send the AT command to the module to set the control parameters and sent control order. The work mode of module can be switched by controlling the module PIN input level. Bluetooth Serial module's operation doesn't need drive, and can communicate with the other Bluetooth device that has the serial.

iii) Arduino Uno

Micro controller used here is Arduino Uno. This is capable of receiving inputs from various sensors and controls motors, actuators etc. Signals from the smartphone are received as packets and are given as input to the arduino. C language is used to code the programs in Arduino controller. Since Arduino is pre-programmed to take decisions/ produce output based on the inputs, it controls the motor that is connected to it and make it move based on the key pressed. It processes the input received and provides output to the DC motor (helping it move).

iv) DC Motor

Another module used is a DC Motor. DC motor receives inputs from the Arduino microcontroller and moves the robot to various directions. Micro processor provides processed inputs to the motor to help it move based on the key pressed.

3. Working principle

A Bluetooth module is used in the robot to connect it with the network. The robot works with the help of microcontroller that is been programmed in **c** language. The connectivity of robot with the Smartphone is made possible with the help of Bluetooth module. An android app is been developed in eclipse using java and is used as the remote control. The signals in the form of IP packets sent from the phone is received at the other end using Bluetooth module. These signals are then transferred to Arduino microcontroller which is been pre-programmed to make the robot move based on the signals received. Arduino microcontroller receives the signal and converts them into commands which is given to the motor and makes it move accordingly.

Android is an open source operating system which is used in smart phones. Android is based on Linux kernel. Android app with 4 keys: up, down, right and left keys are developed. Movement of the robot is controlled by Android app. Movement is based on the key pressed. Programming is done on the basis that if right key, left key, up key or bottom key is pressed the robot moves right, left, up and backwards respectively.

4. Connectivity used in the project

We are choose Bluetooth interfaced with Arduino to control our robot. HC-05 is the component used in this project in order to enable the Bluetooth connection with the phone. Bluetooth technology helps us to get the connection for around 10 meters (33 feet). HC-05 is a class-2 Bluetooth module which can be configured as Master or slave. Bluetooth technology uses UHF (Ultra High Frequency) radio waves that helps the users to control the flow of data as per his/her need. Bluetooth technology is based on UHF which helps us to build a PAN (Personal Area Network). The frequency of UHF for HC-05 is 2.4 GHz ISM (industrial, scientific and medical) radio band. HC-05 is based on GFSK (Gaussian Frequency Shift Keying).

5. Hardware configuration

This section describes the configuration of the robot in detail. The hardware components used are:

i) Arduino Uno microcontroller

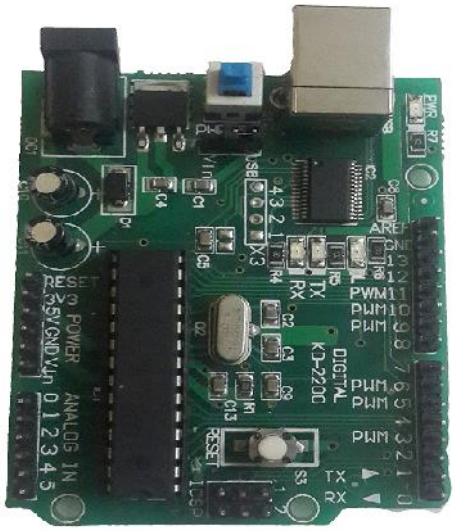

Fig 5.1 Arduino Uno

This is a microcontroller that is based on ATmega328. It has 14 digital I/O pins starting from 0 to 13, 6 analog inputs A0 to A5, 5V output, 3.3V output, ground connection. It operates with the voltage of 5V. It can take upto 20V of input voltage. It has 2KB SRAM, 1KB EEPROM.

Through the USB port it has, connect the USB cable with your laptop. We need a software that suppports Arduino programming. Programming is done in c language.

ii) Motor driver

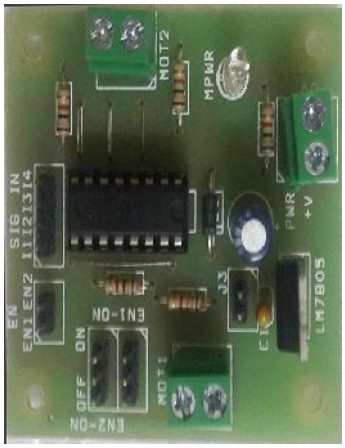

Fig 5.2 Motor driver

Motor drivers are bascically used to control the motors used in the robot. We have used L293D DUAL H-BRIDGE motor driver board in our project. This is a perfect motor driver that is used to control the motors of the robot. It can control 2 motors in different directions.

Motor

We are using DC motors. Motor works on the principle that when electric current passes through a coil placed in between North and South Pole of a magnet, there will be a torque induced on the coil and it rotates. It's a device that converts electrical energy into mechanical energy. Wheels of the robot are connected to this motor so as to move in various directions.

iii) Bluetooth Module H-05

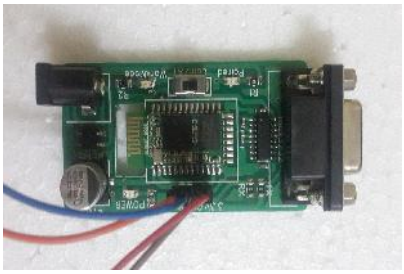

Fig 5.3 H-05 Bluetooth Module

HC-05 are benefitted for its usability, price and capability. It can transfer data at a rate of maximum 2.1Mbps to minimum 160Kbps. The connection through this is simple and easy and it also supports encryption with a password. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature). It can be connected to any device that supports Bluetooth or which has a Bluetooth. It's easy to interface it with the Arduino board.

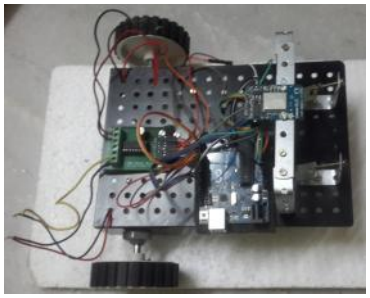

Fig 4.1 Moving robot

6 . Experimental results

A. Control through bluetooth

To get the control over the robot Bluetooth technology is used. HC-05 is the Bluetooth module that is used to get the robot connected to the Bluetooth network. HC-05 is getting directly connected with any android phone which has an application to control the robot.

B. Transfer of images

An application named IP Webcam is used to display the images captured by the phone camera fixed on the robot. Images from the phone is uploaded into the server and in turn is received by the IP Webcam application connected to the network. Live images are displayed on the IP Webcam.

7. Conclusion

Through this project we were able to make a better surveillance system by fixing a camera on the robot and transferring the images to the connected Smartphone. Connectivity between the robot and the Smartphone is made possible through Bluetooth technology. Also we could transfer data between robot and the Smartphone easily and efficiently. It could also take images from places where we humans cannot enter. This works better than traditional surveillance system that was done using fixed cameras at different positions. Since camera is placed on the moving robot vehicle it could take pictures all around its vicinity and transfer it back to the system connected.

Future work on this project will be devoted to make the robot more effective, efficient and usable. It can have more sensors which would enhance the applications into various sectors. Some of the sensors can be light sensors which could determine presence of light in a place where humans cannot enter. It can also have a GPS which would tell us the exact location of the robot. It can have a microphone which can be used to record voices as well. Since the connectivity used here is Bluetooth, it has its own distance coverage limits. It cannot be extended to kilometers apart. So in order to overcome this problem instead of using Bluetooth we can use a Wi-Fi or GPRS system that can be used to get the control to much longer distance.

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