National Conference on Information, Communication, VLSI Design and Embedded system (ICVE 2K17)
(9 - 10 March 2017)
International Journal of Engineering Research & Science (IJOER)
ISSN: [2395-6992] [Vol-3, Issue-3 March- 2017]

Robotic Car Controlled Using WiMAX

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Abstract— *In this paper, we will deliberate how to control robot controlled car using WiMAX module through a web page. The advantage of using robot controlled car is that a spy camera is interfaced, through which we can stream the videos to the user over WiMAX. And solar cells are used instead of a regular lithium-ion battery so it is not necessary to charge the battery every time.*

Keywords— Robotics, WiMax, Lithium-ion Batter, spy camera.

I. INTRODUCTION

A robot is a machine designed to execute one or more task continuously, with speed and accuracy. Robots can be autonomous or semi autonomous. Robots have replaced humans in performing repetitive and dangerous task. WiMAX (Worldwide Interoperability for Microwave Access) is a family of wireless communication standards based on the IEEE 802.16 set of standards, which provide multiple physical layer (PHY) and Media Access Control (MAC) options. WiMAX was initially designed to provide 30 to 40 megabit-per-second data rates, with the 2011 update providing up to 1 Gbits/s for fixed stations.

1.1 Existing System:

Now a day due to development in technology various newly designed smart homes make use of Wi-Fi enabled robot for various applications. Mostly they are controlled over a Wi-Fi, where the camera has been interfaced and are controlled by a shorter distance.

Various other applications are also done by this robot car like doing various works like switching on or off the light by giving a command over a Wi-Fi network.

1.2 Proposed System

Robotic car is a single device that can be moved from one place to another. Here the controlling is subjected over the WiMAX, where it covers a wide range of 80-90 km. It can be used for the security purpose by installation of camera. We can able to control the car from one place to another without applying any external force.

II. SYSTEM SPECIFICATIONS

2.1 Scope and Purpose of System Specification

The system specification shows the description of the function and the performance of system and the user. The scope of our project is to control over a long distance. The future implications of the project are very good considering the amount of time and resources it saves.

III. SYSTEM DESCRIPTION

The system has two parts namely, hardware and software. The hardware architecture consists of a stand-alone embedded system that is based on ATmega328 Arduino board which is a 28 pin IC. It also consists of L293D which is a motor driving IC and WiMAX modem.

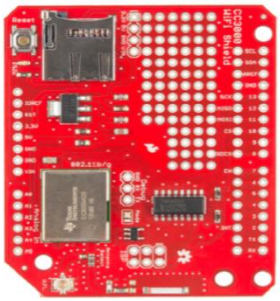
3.1 Hardware Used

The following hardware is used in the project which is explained as follows

3.1.1 Arduino WiMAX shield

Arduino shield containing a CC3000 Wi-Fi module. The CC3000 from Texas Instruments is a self-contained 802.11b/g wireless network processor that makes incorporating internet connectivity into your project simple. Instead of the more standard UART communication method, the CC3000 module utilizes a SPI interface allowing you to control the flow of data as you please. What makes the CC3000 unique is its ability to associate to a Wi-Fi access point using a webpage in the Texas Instruments process called Smart Configuration.

This shield also provides an optional feature that allows you to attach an external antenna, just in case you need a little extra power. This is useful if you want to route an antenna to the outside of an enclosure or to increase your Wi-Fi gain. The board has a U.FL connector for this purpose.



3.1.2 CC3000 Arduino Shield Features

On-board WiMAX Antenna

Optional External Antenna Connection (U.FL)

Supply Voltage: 4.5V - 12V

Host Interface: SPI @ 16 MHz

Throughput (TCP): ~4 Mbps

WEP, WPA/WPA2 (AES and TKIP - Personal) Security Modes

Prototyping Area

3.1.3 WiMAX Antenna

In contrast to the usual wireless-LAN/Wi-Fi (802.11) WiMAX promises

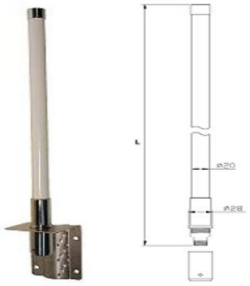
1. Much larger range up to 50km,
2. Connection with non line of sight (NLOS) the latter only up to relatively short distances of up to 5km in rural areas.

The WiMAX standard specifies among other things the transmission layer (modulation, channel access etc.), the useable frequen cy range is given a 2 to 11 GHz.

The actual frequency usage of individual band is defined by the national regulating agencies of each country.

WiMAX will be licensed to providersplanning to offer such services, the actual procedure has not been defined yet. The regulatio n agency is planning a procedure (licensing light) which allows a simplified and fast assignment of licenses, which can limited to regional areas or to other technical parameters.

WiMo will extend the product range for WiMAX antennas in the near future. At first we will offer antennas for the 3.5GHz band, which is most likely to be used for WiMAX in Germany.



3.1.4 Arduino Uno (Or Its Equivalent):

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

3.1.5 Camera:

These modules are a nice addition to a microcontroller project when you want to take a photo or control a video stream. The modules have a few features built in, such as the ability to change the brightness/saturation/hue of images, auto-contrast and auto-brightness adjustment, and motion detection.

The module is admittedly not extremely high resolution - the maximum image size it can take is 640x480 pixels. And it is sensitive to infrared light, which alters the color rendition somewhat. The reason for all this is that it's meant for surveillance, not for nature photography.

Module size: 32mm x 32mm

Pixel size: 5.6um*5.6um

Output format: Standard JPEG/M-JPEG

White balance: Automatic

Viewing angle: 60 degrees

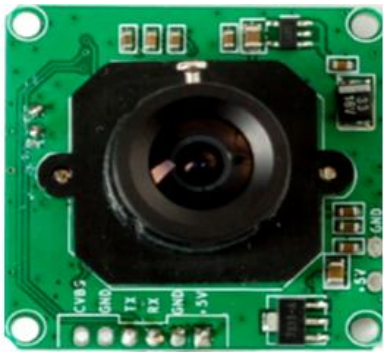
Monitoring distance: 10 meters, maximum 15meters (adjustable)

Image size: VGA (640*480), QVGA (320*240), QQVGA (160*120)

Current draw: 75mA

Operating voltage: DC +5V

Communication: 3.3V TTL (Three wire TX, RX, GND)



3.1.6 L293D

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control two DC motor with a single L293D.

3.1.7 12V DC Geared Motor

The 12V DC Geared Motor can be used in variety of robotics applications and is available with wide range of RPM and Torque.

3.2 Other Components Used:

- Castor Wheel
- Wires
- Breadboard
- Small PCB
- Male Headers
- Female Headers

3.3 Software used

3.3.1 Arduino

The open-source Arduino environment allows user to write code and upload it to the I/O board. The environment is written in Java. The Arduino development environment contains a text editor for writing code, message area, text console, and toolbar with buttons for common functions, and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them. Arduino programs are written in C or C++. Arduino features, capable of compiling and uploading programs to the Board with a single click. Software written using Arduino is called sketches.

3.3.2 Functioning

The circuit is build around an ATmega328controller,WiMAX shield, Camera, motor driver L293D, DC motors M1 and M2 and a few common components. The circuit uses the power supply of 9V from the solar panel to the ATmega328 controller and to the motors. Regulated 5Vsupply for the rest of the circuit is provided by the ATmega328 controller. LED on the board indicates the presence of power supply.

Once the WiMAX shield is connected to the antenna it receives the signal from the base station or the WiMAX modem. The received signal is controlled by the Arduino. The microcontroller is programmed with respective functioning. The webpage is created from the local host, so that we can inter connect WiMAX shield and the server. The 12V DC geared motor is interfaced to Arduino with motor driver.

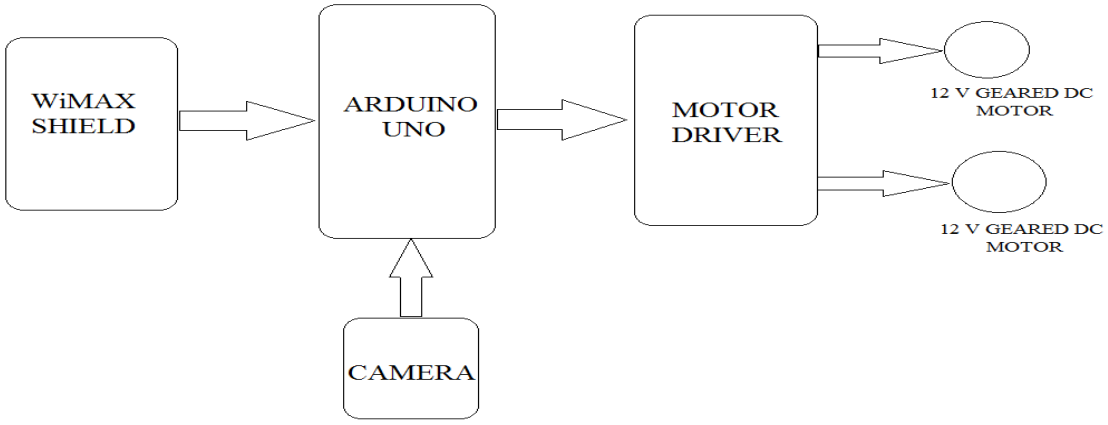


FIG. BLOCK DIAGRAM OF ROBOTIC CAR USING WIMAX

The camera which was installed with the Arduino will interact the environment with the connected webpage of the server. The control is done by clicking the direction displayed on the webpage.

IV. APPLICATIONS

It is standardized, and same frequency equipment should work together.

If we use the switching IC instead of the driver IC we can turn on and off any appliances connected to this toy car. Password protected systems have used in many war conditions and so on.

V. CONCLUSION

This has been a brief review of several wireless technology usages that might be used to control mobile robots. It is important to compare this technology and the bandwidth, frequency, data rate to transfer data among the devices for better development for mobile robot controller. All we need to do is to focus on how to bring the different characteristics of all the wireless technologies together in one portable application. Selection of wireless technologies depends on the type of application to be developed considering the following range, frequency and data rate.

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