

WIRELESS COMMUNICATION USING HC-05 BLUETOOTH MODULE INTERFACED WITH ARDUINO

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Abstract-Wireless communication is the transfer of information between two or more points that are not connected by an electrical conductor. The most common wireless technologies use radio. The different types of wireless communication mainly include, IR wireless communication, satellite communication, broadcast radio, Microwave radio, Bluetooth, Zig-bee etc. In this paper we discuss the wireless communication using the HC-05 Bluetooth module, the bluetooth network topology and interfacing Bluetooth with arduino.

Keywords: wireless communication, Bluetooth communication, baud rate, arduino mega

I. INTRODUCTION

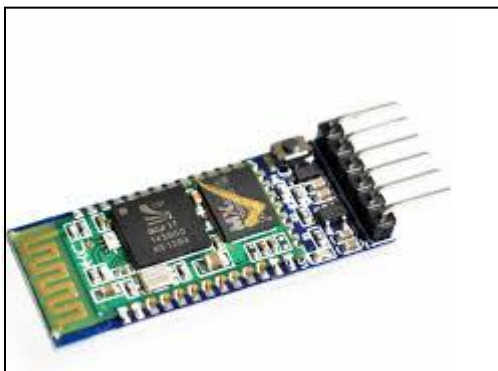


Fig1. HC-05 Bluetooth Module

In to-days world wireless communication is one of the most important medium of transmission of information from one device to other devices. In this technology, the information can be transmitted through the air without requiring any cable or wires or other electronic conductors, by using electromagnetic waves like IR, RF, satellite, etc. The wireless communication technology refers to a variety of wireless communication devices and technologies ranging from smart phones to computers, tabs, laptops, Bluetooth Technology, printers.

Bluetooth is a type of wireless communication used to transmit voice and data at high speed using radio waves. It is used for short range radio communications between many different types of devices, including mobile phones, computers and other electronics. Bluetooth module has a range of around 10 meters and data transfer rate of 3 Mbps.[1]

II. BLUETOOTH SPECIFICATION

Bluetooth is a global specification for a small form-factor, low-cost radio solution providing links between mobile computers, mobile phones, and other portable handheld devices, as well as connectivity to the Internet. The Institute of Electrical and Electronics Engineers (IEEE) has given the IEEE 802.15 standard. Its main strength is its ability to simultaneously handle both data and voice transmissions. A mobile computer equipped with Bluetooth technology, for example, could link to a similarly equipped mobile phone to

connect to the Internet. Multiple Bluetooth units form a Wireless Personal Area Network, called and up to seven client devices.

A Bluetooth WPAN is capable of supporting an asynchronous data link with each client and synchronous voice links with up to three client devices. It provides a range of up to 10m at a transmit power of 1 m watt. The range can be extended to 100m if the transmit power is increased to 100 m watt.

Bluetooth has a data rate of 1 Mbps. Bluetooth is a standard for a small (9mm x 9mm), cheap radio chip to be plugged into computers, printers, mobile phones, etc. A Bluetooth chip takes the information normally carried by the cable, and transmits it at a special frequency to a receiver. Bluetooth chip, which will then give the information received to the computer, phone whatever. Bluetooth offers the most economical solution for low-to-medium-speed device connectivity. It aims at low power consumption and provides security for both stationary and mobile devices. The basic function is to provide a standard wireless technology to replace the multitude of propriety cables currently linking computing devices.[2]

III.WORKING OF BLUETOOTH TECHNOLOGY

A Bluetooth module is a short range device of around 10 meters which provides both sound and data transmission. The Bluetooth transmits and receives at a frequency band of 2.4 GHz which is globally available. The Bluetooth device uses a IEEE 802 standards wherein the connections can be point-to-point or point-to-multipoint. The data transfer rate is 3mbps and the maximum range of a Bluetooth device can be 10-100 meters. The default baud rate is 38400 and other supported baud rates are 9600,19200,57600,115200,230400 and 460800.

Bluetooth can connect up to 8 devices simultaneously. It uses the spread spectrum technology in which each device uses different frequency band and hence the devices do not transmit at same time. When the two devices come in range with each other, the transmission takes place between them.

Bluetooth Low Energy(BLE):

Bluetooth low energy is a wireless personal area network technology designed and marketed by the Bluetooth Special Interest Group aimed at novel applications in the healthcare, fitness, beacons, security, and home entertainment industries. Compared to Classic Bluetooth, Bluetooth Smart is intended to provide considerably reduced power consumption and cost while maintaining a similar communication range.

Mobile operating systems including iOS, Android, Windows Phone and BlackBerry, as well as OS X, Linux, and Windows 8, natively support Bluetooth Smart. [3]

IV.BLUETOOTH NETWORK TOPOLOGY

There are three types of connections in Bluetooth, single slave ,multi slave or scatter net. Multiple Bluetooth devices form a piconet network that is a wireless personal area network. A piconet consists of one hub device along with seven client devices. In order to transmit or receive information with the client it should be in active mode. Only seven clients can be active at a time. In a scatter net, the two piconets are not synchronized (in terms of time and frequency). Each of them operates in its own frequency band, multiple piconets can work simultaneously using frequency division multiplexing.[4][5]

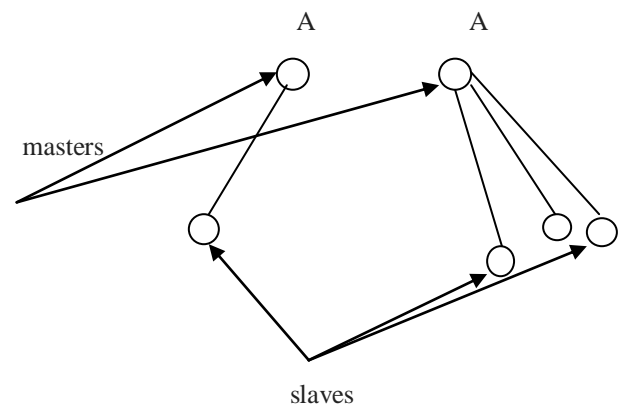


Fig2. Bluetooth Network Topology

V.BLUETOOTH INTERFACING WITH ARDUINO

Bluetooth HC-05 module interfacing with Arduino Mega 2560 board module interfacing with Arduino board. Bluetooth HC-05 module can be easily interfaced with arduino mega board. Connections should be done as the schematic shown below:

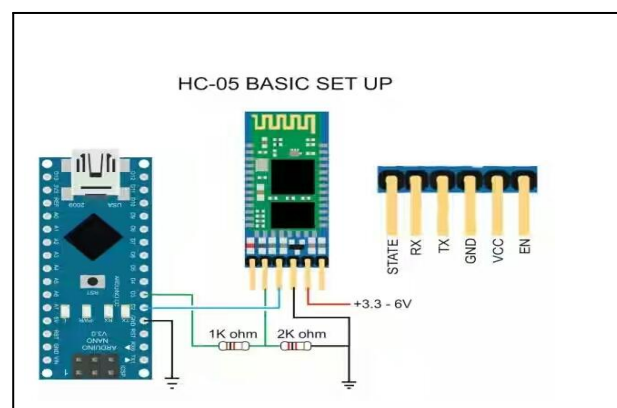


Fig3 . Bluetooth interfaced with arduino mega

Voltage divider is used to drop 5V to 3.3V.

After the completion of the connections , the red led on HC-05 Bluetooth Module will blink continuously indicating that device is ready to pair.

To pair the HC-05 Bluetooth module with computer

1. Go to the Bluetooth icon on computer , right click on Add a Device.

2. Search for new device to pair , Bluetooth module HC-05 will appear as HC-05.

3. Go to HC-05 , click Ready to pair.

4. Enter the password as 1234.

5. Now after pairing is done we can program the arduino microcontroller to send and receive data.

Once the pairing is done led on bluetooth module will blink twice after every 2seconds. [6][7]

VI. BLUETOOTH POWER MODES AND SECURITY

Power modes: There are three power modes available for a bluetooth module. They are sniff mode, hold mode and park mode. These modes are selected depending upon the requirement for a Bluetooth device.

In sniff mode, a device listens to a piconet at a reduced rate. The sniff mode has a programmable interval which provides flexibility for different applications. In hold mode only an interval timer is running and data transfer starts again as the units transits out of hold mode. Park mode is used in the case wherein seven clients can be active at any time.

Security : By default most of the devices operate in an unprotected environment. The link established between two devices in order to exchange information with each other there should provide authentication, this is achieved using encryption keys. This key is known as PIN code, both the devices should have the same PIN code. By default the PIN provided is “0000” or “1234”. After these PIN codes are entered, the two devices are paired and hence now they can exchange information with each other.

VII. APPLICATIONS

1. Handheld device, music players, other electronic systems.
2. Wireless communication of devices like keyboard, mouse, printer , etc.
3. Wireless internet access using Bluetooth Dongle.

4. In medical field like
BLP -for blood pressure measurement.
HTP - for medical temperature measurement devices.
GLP -for blood glucose monitors.
CGMP -Continuous Glucose Monitor Profile
5. In sports field like
HRP –for devices which measure heart rate
LNP-Location and Navigation Profile
RSCP- Running Speed and Cadence Profile
WSP-Weight Scale Profile
6. Short range data transfer

VIII. FEATURES AND ADVANTAGES

Features: Of Bluetooth device

- Typical -80dBm sensitivity
- Up to +4dBm RF transmit power
- Low Power 1.8V Operation ,1.8 to 3.6V I/O
- PIO control
- UART interface with programmable baud rate
- With integrated antenna
- Default Baud rate: 38400, Data bits:8, Stop bit:1,Parity:No parity, Data control: has.

Supported baud rate:

9600,19200,38400,57600,115200,230400,460800.

Advantages: Of Bluetooth device

1. Ease of use.
2. No LOS (Line of sight) required for data transfer.
3. Less power consumption makes its usage very practical.
4. 2.4 GHz radio frequency ensures world wide operability.
5. The data rate is high i.e around 3Mbps.

IX. CONCLUSION

As a conclusion we can say that , despite some of the problems, Bluetooth remains a very promising technology, with plenty of medium and long term applications. This technology is probably the only one which has a good chance to become widely available among mobile devices.

ACKNOWLEDGMENT

We are grateful to the Department of Electronics And Telecommunication Engineering, Don Bosco College Of Engineering for their kind help and support in carrying out with the project.

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