Wireless Control of Electric Motor

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Abstract: **Present work deals with wireless control of electric motor. Electric motor works on electricity and the electric supply is given to it through electronic switch called Relay. Relay action is controlled i.e ON and OFF action is controlled by the SMS sent by mobile handset. The required hardware for implementation of above control includes: Bluetooth device, microcontroller and relay. The SMS sent by a mobile handset with the use of mobile app developed in android studio software. The present work gives basic understanding of widely used Bluetooth technology to the beginners as well as to the students of computer science.**

Keywords: **Bluetooth, Electric motor and microcontroller.**

I.   INTRODUCTION

Electricity and electric signals are transferred from one place to other through conducting wire. If electric signal is transmitted through conducting wire then it is called as wired communication. Similarly if it is transmitted through air i.e not through Wire then it is called wireless communication. Electricity is always transferred through wire and it is never wireless. Wireless communication could be short, medium or long distance[1]. Table 1 gives type of devices and their range of communication.

TABLE I: TYPES OF WIRELESS DEVICES

Serial No.	Name of device	Type of modulation	Range	Use
1	Bluetooth	Line of sight 2.4Ghz.	10 m	Controlling of some devices like computer mouse, speaker.
2	Zigbee	Frequency modulation.	1 km	Wireless sensor network.
3	GSM	Gaussian Phase Shift keying.	31 km-250 km	Mobile handset, controlling electric devices.

Among all communication devices Bluetooth is more common because its hardware do not involve modulation and demodulation circuits. It is a direct non-modulated communication.Fig1.shows The Bluetooth segments. The present article is divided into following sections. Bluetooth technology and devices are discussed in sec-2.

II.   BLUETOOTH TECHNOLOGY

Bluetooth is a standard wireless technology which makes it possible to operates many devices at unique frequency i.e.2.4Ghz.The implication is that Bluetooth unites communication protocols. The name Bluetooth is given to this technology by comparing it with the historical event about unification of two Europian countries Denmark and Norway by the Danish king in the 10th century[2].

Bluetooth is a extension to Universal Asynchronous Receiver Transmitter (UART) Protocol.

UART is packet based protocol with a master/slave architecture. The data file is divided into small packets and then they are transmitted one by one through Bluetooth antenna ,fig.1 shows the format of Bluetooth packets. Bluetooth technology gives clear idea about implementation of wireless technology in device using following four protocols:

1. Cable replacement protocol:

Cable is replaced by a electromagnetic wave with wavelength 12.5mm .In another words the signal carried by cables is now carried by a wave.

2. Telephony control protocol:

Telephone and telecommunication is the traditional method of voice communication. It is electronic communication which operates at two different voltage levels. Bluetooth makes telephony communication possible by use of 'mark' and 'space' levels as shown in fig1.This protocol makes it possible to develop wireless telephone handset.

3. Adopter protocol:

Bluetooth communication is initiated by a handshaking technique i.e. both transmitter and receiver are checked for their availability for communication.

4. Adapted protocol:

Adapter is a electronic circuit designed for transmitting and receiving wireless data. The main electronic units of adapter are : UART processing unit, Amplifier and antenna.
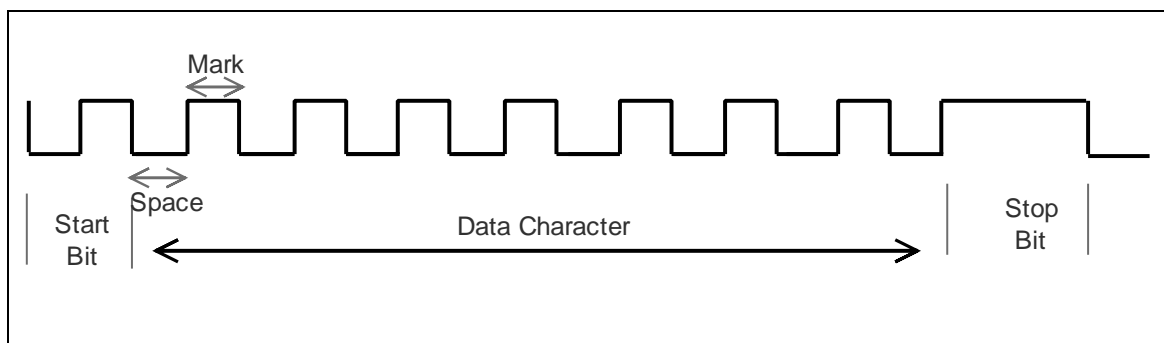

Fig 1: Format of bluetooth data packet

Practical Implementation of Bluetooth Protocols:

Bluetooth technology and its protocols are practically implemented using some electronic components and metallic antenna[3]. Fig 2. shows block diagram of Bluetooth Transmitter and Receiver. The electronic circuit of Bluetooth has three main blocks :

1. Parallel to UART convertor and vice versa:

Parallel to UART circuit adds overhead to the data packet. Overhead include header and footer which are basically used as flags indicating beginning and end of packet. Beginning is indicated by 1 to 4 space bits and end is indicated by 2 mark bits.

2. RF amplifier:

The strength of signal is improved by this section. It increases the power of applied signal.

3. RF transmitter/Receiver:

It is special type of radio frequency amplifier which is tuned at frequency 2.4GHz. It also has a circuit for converting electronics signal into electromagnetic waves. The converted waves are radiated into air by zigzag metallic antenna. Fig 2.A and B shows block diagram of Bluetooth transmitter and receiver.
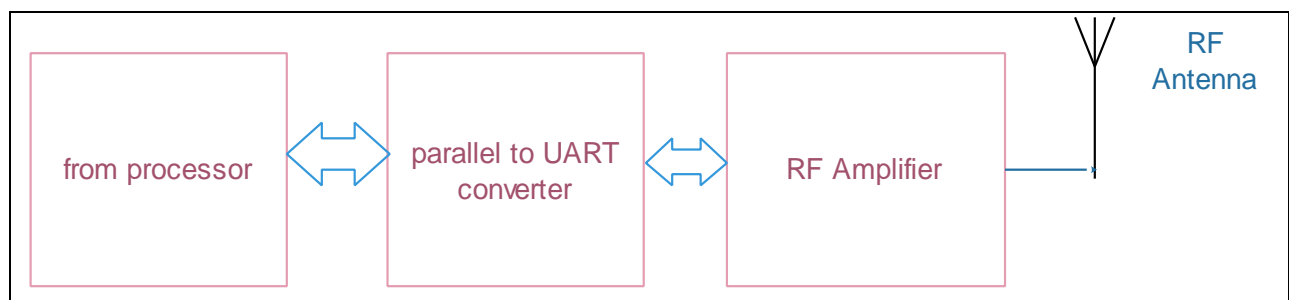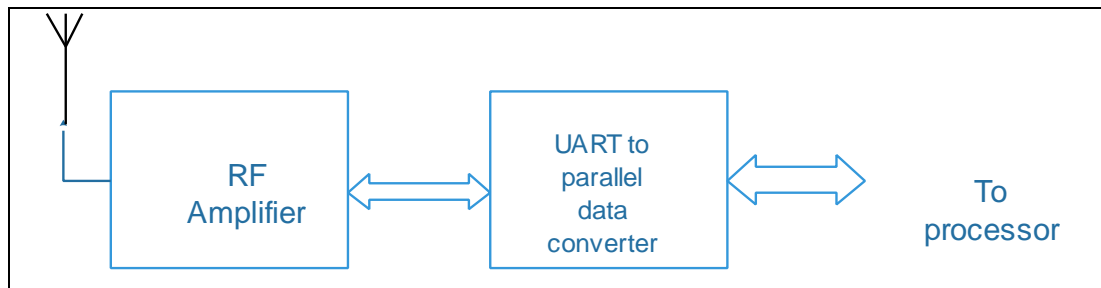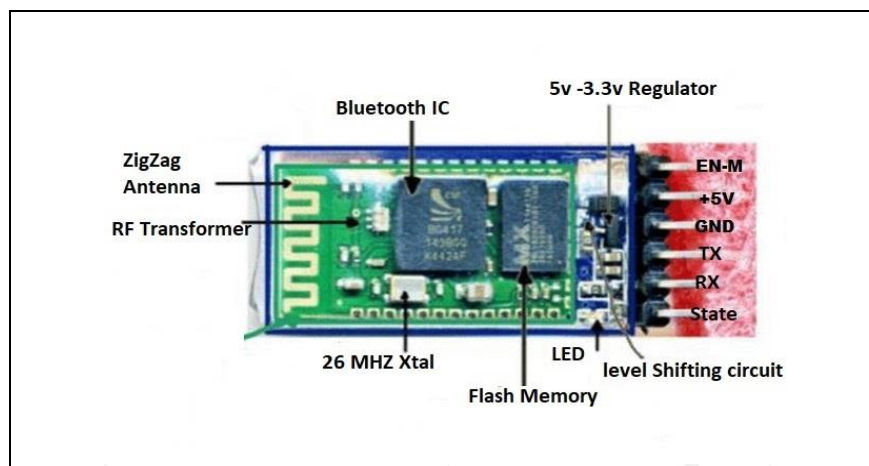

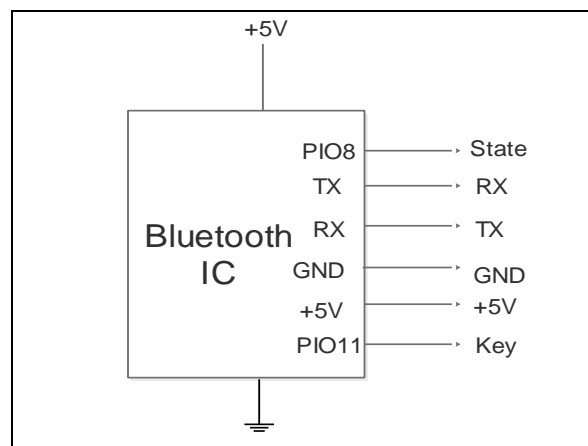**Fig 2A: Block diagram of Bluetooth transmitter**

Fig 2.B: Block diagram of Bluetooth Receiver

III.   APPLICATIONS OF BLUETOOTH

Fig 3A: Block diagram of Bluetooth module

Fig 3B: Circuit connection of Bluetooth module

Bluetooth is frequently used in computer peripherals like mouse, keyboard and printer. It is also used in office equipments like photocopier and cctv cameras. Bluetooth is now popular in electronic hobbyist due to its easy interfacing and availability in the market. Amruta Patil et.al.[4]have used for controlling the tube light and fans(home automations). In the present work we have used it for controlling the power supply to the electric dc motor. Only Bluetooth module is not sufficient for controlling the motor but somewhere circuits are required and they are microcontrollers and dc power supply. Fig 3A and 3B shows the block diagram and circuit connection of Bluetooth module respectively.

Fig 4: Block diagram of Bluetooth controlled electric motor

In the present study we have used HC 05 Bluetooth module and the processor is ESP32 WROOM chip which includes Bluetooth and Wi-Fi units. Fig 4 shows block diag. Of Bluetooth controlled electric motor, here mobile handset works as transmitter and esp32 microcontroller works as receiver.

Software section:

Software is important part of any micro controller system and without it the hardware has no meaning. The software of micro-controller is generally written in Low Level Language like Assembly language which requires the instruction set and also requires cross assembler for translation of low level language into machine level language. Nowadays, micro controller can be written in higher level language like c, java and python. The basic language requirement for micro controller programming is not the advanced programming but the elementary programming using basic data types, some control statements, arithmetic and logical operators and some non-numerical functions. For example Embedded C is suitable for microcontroller programming.

Bluetooth is a communication method and not a programming technique. Its role is to establish a direct wireless connection between two devices and then transfer data in duplex mode. Program executed on the source and destination devices interprets the data received by Bluetooth method .for instance in the present work, a mobile app running on the smart phone sends ON or OFF signal to the electric motor through a microcontroller .fig 5 shows the flowchart for controlling the ON/OFF action of electric motor. Following two programs are required for the control of electric motor.

1. A Mobile app with button ON/OFF: program is written in android studio and installed on android based smart phone.

2. **Embeded c program for motor control***:*

Program written in embeded c for controlling the motor which is executed on esp32 microcontroller.

IV.   CONCLUSION

Wireless communication is a method of Digital data communication. Bluetooth, zigbee and GSM are the three popular wireless technologies, but Bluetooth is prefered because of its pre-access, open source and low cost. In near future, most of the peripheral devices of computer will be Bluetooth enabled. Though it has advantages it cannot be a universal wireless technology because of its low transmission range and requirement of additional battery. Other than computer peripherals it can be used for Home automation and Electric toys. One of such application i.e. controlled toy motor is successfully studied in the present work. The work can be extended for the direction and speed control of the motor.
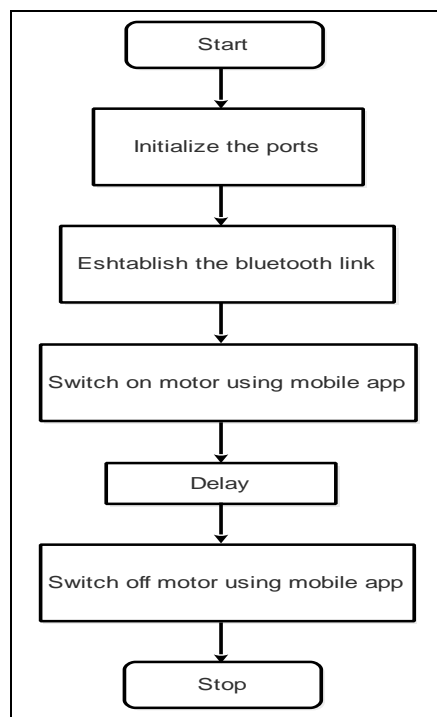

Fig 5: Flowchart of wireless control of electric motor

REFERENCES

[1]   Monika Phogat, Anshul Anand, "An introduction to wireless communication," Int. J. of engineering trends and technology, 12(1), pg 9.-12, (2014).

[2]   K. Sairam, N. Gunasekaran, S.Rama Reddy, "Bluetooth in wireless communications," IEEE communication magazine, pg 19-96, (June 2002).

[3]   Yan Zhuo, Han Xiaowei, Dai Xinxiao, "Design and implement of welding motor control system based on wireless sensor method," Procedia Engineering,. 23, pg 367-373, (2011).

[4]   Amruta Patil, Pooja Potanis, Karishma Katkar, "SMS based home automation system using arduino ATMEG328 with GSM," Int. J. of Engineering trends and technology, 47(7), pg 369-374,(2017).