Real Time Wireless Communication using Android Platform

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ABSTRACT: Communication is the process of imparting or exchanging of information by using some medium. By considering the constraints of wired communication in the matters of mobility,damage,cost etc., wireless communication is mostly preferred now-a-days. This paper deals with the communication through one of the wireless media, Bluetooth using android applications. Bluetooth wireless technology is a short range communications technology intended to replace the cables connecting portable unit and maintaining high levels of security.By installing an android application, the live audio signals are transmitted to the selected speakers through the switching controller. The switching controller comprises of PIC microcontroller(PIC16F877A), a HC-05 Bluetooth receiver and a RF transmitter, transformer, rectifier circuit and a voltage regulator. The audio signals are transmitted to the Bluetooth receiver. The microcontroller receives this signal and select the speaker to which the audio is to be sent.

KEYWORDS: Wireless, Android, Bluetooth, PIC microcontroller, HC -05 Bluetooth receiver, RF transmitter, transformer, rectifier and voltage regulator.

I. INTRODUCTION

Information and communications technology (ICT) is an extensional term for information technology (IT) that stresses the role of unified communications and the integration of telecommunications (telephone lines and wireless signals) and computers, as well as necessary enterprise software, middleware, storage, and audiovisual systems, that enable users to access, store, transmit, and manipulate information.

In this modern era, Wireless and Telecommunication have become an integral part of each other to provide wireless communication to common man that helps people located in any part of the world communicate easily. Wireless communication technology transmits information over the air using electromagnetic waves like IR (Infrared), RF (Radio Frequency), satellite, etc. For example, GPS, Wi-Fi, satellite television, wireless computer parts, wireless phones that include 3G and 4G networks, and Bluetooth. Bluetooth is a wireless technology standard used for exchanging data between fixed and mobile devices over short distances using short-wavelength UHF radio waves in the industrial, scientific and medical radio bands, from 2.400 to 2.485 GHz, and building personal area networks (PANs). It was originally conceived as a wireless alternative to RS-232 data cables.

A. Uses

Bluetooth is a standard wire-replacement communications protocol primarily designed for low power consumption, with a short range based on low-cost transceiver microchips in each device.Because the devices use a radio (broadcast) communications system, they do not have to be in visual line of sight of each other.

B. Applications

Wireless control and communication between a mobile phone and a handsfree headset. This was one of the earliest applications to become popular. Wireless control of and communication between a mobile phone and a Bluetooth compatible car stereo system.Wireless communication between a smartphone and a smart lock for unlocking doors.

II. LITERATURE SURVEY

K. V. S. S. S. S. Sairam et al has discussed about Bluetooth in wireless communication. It describes about the architecture and implementation of Bluetooth module. It explains about industrial automation via Bluetooth using IISS. An IISS is a device used for controlling and continuously monitorsthe systems in industry. It's usually communicates via interface card in PC. The hardware is connected parallel thus interfaced with PC via transceiver. Thus establish the growing need for Bluetooth technology[1].

Naveen Erasala et al has clearly analysed the Bluetooth technology in various aspects such as hardware, software, network infrastructure etc.Bluetooth devices uses Host Controller Interface (HCI) as a common interface between the Bluetooth host and the Bluetooth core. Higher-level protocols like the Service Discovery Protocol (SDP), RFCOMM (emulating a serial port connection) and the Telephony Control Protocol (TCS) are interfaced to base-band services via theLogical Link Control and Adaptation Protocol(L2CAP) [2].

Erina Ferro et al have discussed the comparison of Bluetooth and Wi-Fi. That is, Bluetooth and Wi-Fi (IEEE 802.11) are the protocol standards in communication for wireless communication within short range up to 100 meters. Bluetooth helps to connect close devices and serves as a substitute for cables whereas Wi-Fi helps towards one on one connection and serves as a substitute of wired LANs. This paper overviews about main communication topologies and their functions [3].

Dr.S.S.Riaz Ahamed et al has described about ZigBee (IEEE 802.15.4) which is wireless mess networking standard in future technology. This ZigBee standard enables security, network and application support services which is operating on top of the IEEE 802.15.4 Medium Access Control(MAC) and Physical Layer(PHY) wireless standards. For next generation ZigBee is being used in automated industry manufacturing, with small transmitters in each and every floor which helps to allow the communication between each devices to main centered computer. Thus the paper clearly gives the future scope of ZigBee in communication [4]

C.Nagarajan et al [3,6,11] has given a clear comparative study between four communication protocols that is Bluetooth (IEEE 802.15.1), ZigBee (IEEE 802.15.4), Ultra-wideband(IEEE 802.15.3) and Wi-Fi (IEEE 802.11)for wireless communication. This paper gives the detailed features of the protocols, their frequency band, maximum signal rate, number of RF channels, modulation type etc. Thus paper helps the engineers to select communication protocols for appropriate application [5].

David J. Love et al has discussed about the overview of technical difficulties in wireless Communication such as channel adaption techniques, frequency division duplexing and the combination of single antenna, multiple antenna, narrowband, broadband, single-user,and multiuser technology. This paper also provide the role of limited feedback in the standardization of next generation wireless systems [6].

Dinesh Khandal et al has developed a new technology called Li-Fi(Light -Fidelity) is a VLC(Visible Light Communication) technology which transfers data through light illumination by taking fibre out of optics by sending data through a LED bulb. The relation between fibre optic thread and Li-Fi is that light signals travel through these fibres in form of light. Thus the paper gives the study of new communication technology [7].

Cheng-Xiang Wang et al has discussed about the fifth generation (5G) wireless communication technology. This paper also discuss about the various promising technologies of fifth generation wireless communication systems like massive MIMO, energy-efficient communications, cognitive radio networks, and visible lightcommunications. Future challenges facing thesepotential technologies are also discussed[8].

Shaoen Wu et al has described the visible light wireless communication for fifth generation (5G). Visible light communication(VLC) defined as a potential access option for 5G wireless Communication. VLC has strengths in energy efficiency and ultra wide bandwidth, but also has weakness in transmission range andobstacles in transmission paths. This paperprovides the latest research on VLC. Thispaper highlights the strengths and weaknessesof VLC in comparison with RF-based communication [9].

Pulkit Swami et al has described about voice and data transmission through Laser light and LDR. There were two sections, transmitter and receiver, both powered by a separate 9V fixed voltage power supply. The transmitter board contained a microphone and a laser torch at opposite ends. The electronics equipment controlled the intensity of the

laser beam according to the output of the microphone. An LDR was in the receiver as a receiving element and the high gain amplifier with a basic audio output stage powers a small speaker[10].

J. K. Saha et al has discussed about audio and video transmission system which ensures live video with synchronized audio wirelessly.LAN, Wi-Fi and GSM network are used for transmitting video and audio data. Raspberry pi enabled with pi camera is used for video capturing. For audio capturing a sound card is introduced. The Wi-Fi is enabled through Wi-Fi Adapter to start the transmission of video and audio data. FFmpeg software is used for streaming. This paper completely overviews about video and audio transmission through Wi-Fi [11].

Deepshika Kuhiteet al has described about real time wireless audio transmission system using Bluetooth and the signal is controlled by transceiverCC2500. Therefore voice signal is a input to the Arduino Nano AT mega 38 controller. The Bluetooth device is paired directly with OVC3860 Bluetooth module for transmitting the data. The transceiver is used for controlling the device using Matlab program which is used to control he signal. Thus the real time audio signal is transmitted via Bluetoothtechnology [12].

III. BLOCK DIAGRAM OF PROPOSED SOLUTION
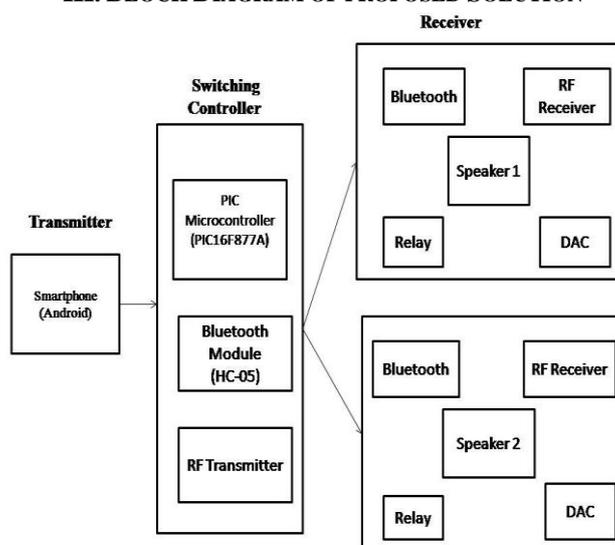
Fig1. Block Diagram of Proposed System

IV. DESCRIPTION OF PROPOSED METHOD

Our solution is that making the android smartphone as the microphone, and with that smartphone the speakers are switched up or changed over and the live audio is transmitted to the speakers wirelessly by Bluetooth using an intermediate device.

An intermediate device is build to change over the Bluetooth connection to the speakers. We have named the intermediate device as the switching controller. The switching controller consists the following such as PIC microcontroller(PIC16F877A), HC-05 Bluetooth receiver, RF transmitter and transformer, a rectifier circuit and a voltage regulator. The speaker setup consists of the following components such as RF receiver, Bluetooth receiver, Relay circuit, Digital to Analog converter(DAC), Amplifier, transformer, a rectifier circuit and a voltage regulator. The smartphone consists of two open source android applications, one is for selecting the speakers and another one is for transmission of audio from the mobile phone's internal microphone to the speaker.

V. HARDWARE REQUIREMENTS

A. Bluetooth Module:

HC-05 Bluetooth Module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Its communication is via serial communication which makes an easy way to interface with controller or PC. HC-05 Bluetooth module provides switching mode between master and slave mode which means it able to use neither receiving nor transmitting data.

Specification:
- Model: HC-05
- Input Voltage: DC 5V
- Communication Method: Serial Communication
- Master and slave mode can be switched

B. PIC Microcontroller:

The PIC microcontroller **PIC16f877a** is one of the most renowned microcontrollers in the industry. This microcontroller is very convenient to use, the coding or programming of this controller is also easier. One of the main advantages is that it can be write-erase as many times as possible because it uses **FLASH memory technology**. It has a total number of 40 pins and there are 33 pins for input and output. PIC16F877A is used in many pic microcontroller projects. PIC16F877A also have much application in digital electronicscircuits.
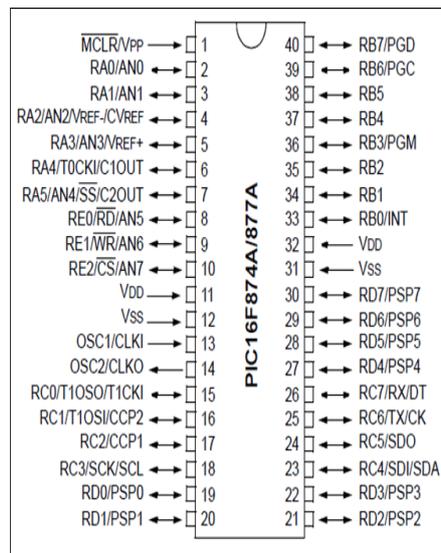
Fig 2. Pinouts of PIC16F877A

C. Power Supply:

A power supply (sometimes known as a power supply unit or PSU) is a device or system that supplies electrical or other types of energy to an output load or group of loads. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.
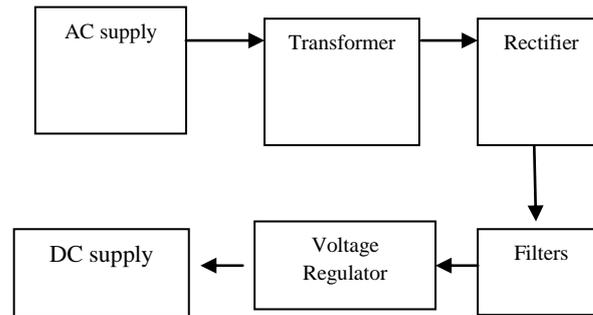
Fig 3. Block diagram of power supply

The main components used in the power supply unit are Transformer, Rectifier, Filter and Regulator.

D. Transformer:
Transformer is a device used either for stepping-up or stepping-down the AC supply voltage with a corresponding decreases or increases in the current. Here, a transformer is used for stepping-down the voltage so as to get a voltage that can be regulated to get a constant 5V.

E. Rectifier:
A rectifier is a device like semiconductor, capable of converting sinusoidal input waveform units into a unidirectional waveform, with a nonzero average component.

F. Filters:
Capacitors are used as filters in the power supply unit. The action of the system depends upon the fact, that the capacitors stores energy during the conduction period and delivers this energy to the load during the inverse or non-conducting period. In this way, time during which the current passes through the load is prolonged and ripple is considerably reduced.

G. Voltage Regulator:
The LM78XX is three terminal regulator available with several fixed output voltages making them useful in a wide range of applications. IC7805 is a fixed voltage regulators used in this circuit.
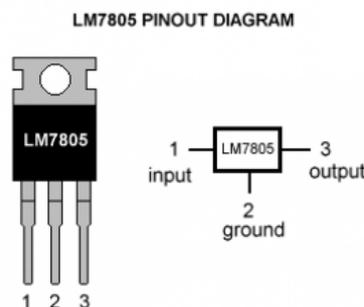
Fig 4.Pinout Diagram of LM7805

H. RF-Transmitter:

The transmitter/receiver (Tx/Rx) pair operates at a frequency of 433Mhz. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected to pin 4. The transmission occurs at the rate of 1Kbps -10Kbps

I. RF-Receiver:

The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. The RF module is often used along with a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder.

VI. SOFTWARE REQUIREMENT

Embedded C

Embedded C is one of the most popular and most commonly used Programming Languages in the development of Embedded Systems. So, in this article, we will see some of the Basics of Embedded C Program and the Programming Structure of Embedded C.

Embedded C is perhaps the most popular languages among Embedded Programmers for programming Embedded Systems. There are many popular programming languages like Assembly, BASIC, C++ etc. that are often used for developing Embedded Systems but Embedded C remains popular due to its efficiency, less development time and portability.

VII. OUTPUT

The smartphone sends the switching signal via Bluetooth to the HC-05 Bluetooth module. The HC-05 Bluetooth module is connected to the RX and TX pins of the PIC microcontroller. The microcontroller receives the signal from the Bluetooth module and selects the speaker setup by sending the switching signal via the RF transmitter to the RF receiver in the speaker arrangement. The RF receiver in turn enables the corresponding speaker by turning on the relay circuit. Then the audio from the smartphone is converted from analog to digital signal and transmitted to the Bluetooth receiver in the speaker setup. The received digital signal from the Bluetooth module is converted into digital to analog by the DAC in the speaker side. The converted analog signal is then amplified and the amplified signal is sent to the speaker as the output.

Fig 5. Switching Controller

Fig 6.Switching Controller with Speaker Setup
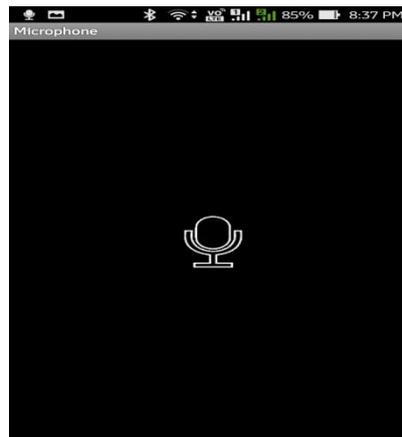
Fig 7.Application to send the audio
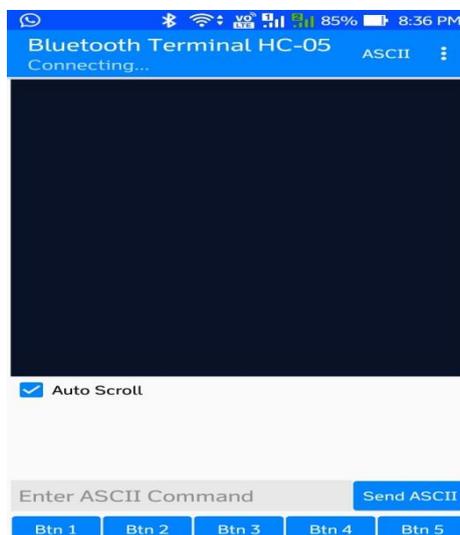
Fig 8. Application for switching the speakers

VIII. CONCLUSION

In this modern era, Wireless and Telecommunication have become an integral part of each other to provide wireless communication to common man that helps people located in any part of the world communicate easily.Deploying any type of network securely is always a challenging act and wireless and telecommunication are no different.
As we all know that the Bluetooth is a default inbuilt feature in almost all android mobile phones. Wireless connectivity can be accessed in a more faster and secured way using Bluetooth. Thus this technology will be more adoptable in the future.

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