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A REVIEW ON WIRELESS ELECTRONIC NOTICE BOARD USING BLUETOOTH AND ZIGBEE

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Abstract

Notice board is a primary thing in any institution/organization or public utility places like bus stations, railway stations and collages. But sticking various notices day-to-day is a difficult process. The Notice board is a common display for effective mode of providing information to the people, but this is not easy for updating the messages instantly. This work deals about an advanced Hi-Tech wireless notice board using Atmel's ATmega32 microcontroller and different wireless technologies (Bluetooth and Zigbee) and their performance analysis based on the parameter such as range, BER (bit error rate), RSSI (Received signal strength indicator), signal attenuation and power consumption. The notice board receives serial data from wireless module receiver and displays it on the graphical liquid crystal display. a common communication receiver hardware for notice board having compatibility with both wireless modules i.e. Bluetooth and Zigbee. KS0108based 128x64 graphical LCD as display element. The idea behind this work is to provide its users with a simple, fast and reliable way to put up important notices in an LCD where the user can send a message to be displayed in the LCD.

Index Terms: *Android, Bluetooth, Electronic notice board, GLCD, Zigbee, AVR*

1. INTRODUCTION

Next generation wireless systems will provide the user with a broad range of services assuming that the different types of wireless technologies will work transparently and without any major interoperability issues. The main objective of the project is to develop a wireless notice board that displays notices when a message is sent from the user's android application device. Remote operation is achieved by any smart-phone/Tablet etc., with Android OS, upon a GUI (Graphical User Interface) based touch screen operation. While the user sends the message from the Android application device, it is received and retrieved by the Bluetooth device at the display unit. The Bluetooth or Zigbee access password will only be known to the user. It is then sent to the microcontroller that further displays the notice sent from the user on to the electronic notice board which is equipped with a LCD Monitor display. It uses an Arduino system (AVR microcontroller) to control the operation. Wireless communication systems have made a significant move to overcome such problems. Bluetooth, RF, Zigbee, WI - Fi and GSM, are easily available wireless technologies suitable for short, medium and long range wireless communication. It describes a basic approach of transferring characters using android application developed to establish a chatting system between android platforms based two cell phones. A Bluetooth based car control system using Android device is elaborated in. It explains the communication

between android phone and Bluetooth module and also describes the development of android application to interface,

Bluetooth module of mobile phone and transmitting instructions to the car controller which controls the car

according to the received instructions. The user sends the message from the Android application device, it is received and retrieved by the Bluetooth device at the display unit. The Bluetooth access password will only be known to the user. It is then sent to the microcontroller that further displays the notice

sent from the user on to the electronic notice board which is equipped with a LCD Monitor display. It use a microcontroller system to control the operation.

Wireless technology has been making tremendous progress over the past few years. The ever increasing use of wireless networks serves as an indicator of the progress in the area of wireless networks. The demand for wireless technology is increasing not only in industrial applications but also for domestic purposes. Some benefits of wireless technology are as follows:

i) Complete the Access Technology Portfolio

Customers commonly use more than one access technology to service various parts of their network and during the migration phase of their networks, when upgrading occurs on a scheduled basis. Wireless enables a fully comprehensive access technology portfolio to work with existing dial, cable, and DSL technologies

ii) Goes Where Cable and Fibre Cannot

Nature of wireless is that it doesn't require wires or lines to accommodate the data/voice/video pipeline. As such, the system will carry information across geographical areas that are prohibitive in terms of distance, cost, access, or time.

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iv) Involves Reduced Time to Revenue

Companies can generate revenue in less time through the deployment of wireless solutions than with comparable access technologies because a wireless system can be assembled and brought online in as little as two to three hours.

v) Provides Broadband Access Extension

Wireless commonly both competes with and complements existing broadband access. Wireless technologies play a key role in extending the reach of cable, fibre, and DSL markets, and it does so quickly and reliably. It also commonly provides a competitive alternative to broadband wireline or provides access in geographies that don't qualify for loop access.

2. PROPOSED SYSTEM

The proposed model consists of two modules i.e. one or more Transmitter and one receiver module. The receiver module consists of interfacing Bluetooth via serial interface to the Zigbee module. The receiver module placed at the remote end consists of Zigbee module interfaced with a microcontroller for displaying messages on LCD. Password based Authentication is employed on the Transmitter side in order to provide access control to only authorized users. Primarily LCD is been used for displaying messages which may be further extend up to larger LCD. The system is comprised of both software and hardware. Software area includes the Bluetooth android application development and code algorithm for microcontroller to receive and display a notice on graphical liquid crystal display. The hardware area includes the development of receiver hardware using ATmega32 microcontroller and its configuration with both modules. The developed system reflects the minimum requirements to realize the wireless notice board.

2.1 Bluetooth Communication

Bluetooth(HC-05) is a standard for short range, low power, low cost wireless communication that uses radio technology. Although originally envisioned as a cable-replacement technology by Ericsson (a major cell phone manufacturer) in 1994, embedded Bluetooth capability is becoming widespread in numerous types of devices. They include intelligent devices (PDAs, cell phones, PCs), data peripherals (mice, keyboards, joysticks, cameras, digital pens, printers, LAN access points), audio peripherals (headsets, speakers, stereo receivers), and embedded applications (automobile power locks, grocery store updates, industrial systems, MIDI musical instruments). Bluetooth establishes a robust and communication-wise wireless link which is designed by using adaptive frequency hopping and fast acknowledgement. It operates in the ISM (industrial, scientific and medical) band at 2.4 to 2.485 GHz. The frequency hopping among 79 frequencies at 1Mhz interval provides high immunity with radio frequency signal.

Following are the advantages of Bluetooth:

- i) Easy to install
- ii) It makes connecting to different devices convenient
- iii) It is free to use if device is installed in it

2.2 ZIGBEE

Zigbee is the IEEE 802.15.4 standard based communication protocol used to develop personal area networks for medium range digital radios providing secure networking, long battery life with low data rates (250kbps). Zigbee is the

module that uses Zigbee protocol, we have used Zigbee pro S1, a 60 mw wireless module, with XBIB-U-DEV board to establish the data communication between computer and notice board. This board provides an easy serial interface (well-known UART) to Zigbee module with computer using XCTU software. The XCTU is a configuration and utility software for Zigbee modules that enables of firmware up gradation, update of communication parameters and performing range testing. XCTU also provides transmission and acknowledgement (receiving) of the characters and transmission success in percentage and transmission of single packets that could include ASCII or HEX code of any specific character with their RSSI (Received Signal Strength Indicator).



Fig- Zigbee Module

The technology defined by the Zigbee specification is intended to be simpler and less expensive than other wireless personal area networks (WPANs), such as Bluetooth or Wi-Fi. Application includes wireless light switches, electrical meters with in home displays, and other consumer and industrial equipment that requires short-range low rate wireless data transfer. Advantages of the Zigbee are as follows:

- i) The Zigbee has flexible network structure
- ii) It has very long battery life
- iii) It is low power consumption
- iv) It is easy to install
- v) It supports large number of nodes i.e. 6500 nodes approximately

2.3 Microcontroller

A microcontroller (or MCU for microcontroller unit) is a small computer on a single integrated circuit. A microcontroller contains one or more CPUs (Processor cores along with memory and programmable input/ output peripherals. Here 8 bit ATmega32 microcontroller are used. The Atmel ATmega32A is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega32A achieves throughputs close to 1MIPS per MHz. This empowers system designed to optimize the device for power consumption versus processing speed. The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers..

2.4 LCD Display

2.5 UART

A universal asynchronous receiver/transmitter (UART), is a computer hardware device for asynchronous serial



Fig-2: LCD Display

communication in which the data format and transmission speeds are configurable. A dual UART, or DUART, combines two UARTs into a single chip.

2.6 RF Module

A radio frequency (RF) module is a small electronic circuit used to transmit and receive radio signals on different frequencies. Digi produces a wide variety of RF modules to meet the requirements of almost any wireless solution, such as long range, low cost, and low power modules. The most popular wireless products are the Zigbee RF modules. XCTU is compatible with Digi's Zigbee and XTend RF modules and XLR PRO. For a complete list of XCTU compatible modules.

Comparison of Bluetooth and Zigbee is as shown in table below. This table shows the features, ratings and another characteristics of both the sharing media i.e. Bluetooth and Zigbee.

Table -1: Comparison of Bluetooth and Zigbee

Sr. No.	Standard	Bluetooth	Zigbee
1	IEEE Spec.	802.15.1	802.15.4
2	Frequency Band	2.4 GHz	868/915 MHz, 2.4 GHz
3	Max signal rate	1 Mb/s	250 Kb/s
4	Nominal range	10m	10-100 m
5	Nominal TX power	0-10 dBm	(-25)-0 dBm
6	Number of RF channels	79	1/10; 16
7	Channel bandwidth	1 MHz	0.3/0.6 MHz; 2 MHz
8	Modulation type	GFSK	BPSK (+ASK), o-QPSK
9	Spreading	FHSS	DSSS
10	Coexistence mechanism	Adaptive freq. hoppi	Dynamic freq. selection

3. HARDWARE DEVELOPMENT

Above figure is the block diagram of wireless notice board using bluetooth and Zigbee. The physical component of the system developed in the in form of block structure. The receiver comprises of microcontroller, graphical display and one of the wireless receiver module either Zigbee or Bluetooth. Hardware has been developed using the chemical etching. As the block diagram shows if they using notice board for long range then Zigbee receiver is required and there is a need of computer to access it and in case of for short range notice board Bluetooth can be used and it they can access cell phone. The hardware setup in the running mode, with Zigbee, is as shown in figure.

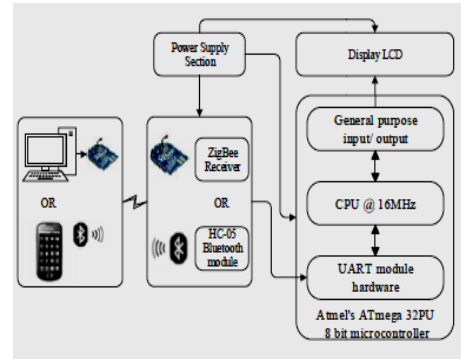


Fig-3: Hardware Block Diagram

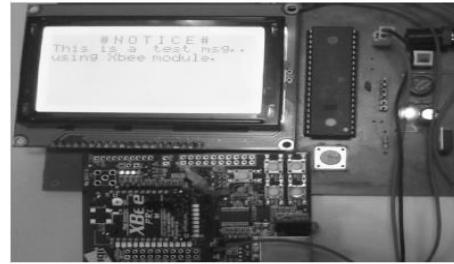


Fig-4: Running Hardware Receiver with Zigbee Receiver

Displaying a test notice transmitted from PC using XCTU software. The developed notice board system has following feature that make it preferable and ideal for notice deployment in offices, small work places and industries.

- The system developed is very economical since it is used low cost microcontroller and affordable LCD display.
- The microcontroller switches to sleep mode if there is no character reception in 2 minute interval for power saving purpose and will re-switch to active mode at new character.
- Only authorized person can access notice board since notice board after sending star notice board character (CTRL+S).

The device is capable of acquiring and displaying character as soon as it receives the notice over graphical LCD. The system is capable of large notice through scrolling display of 128 characters per screen. For perfect visualization the brightness of graphical LCD can be controlled using potentiometer

3.1 Notice Updating Using Bluetooth

Using Bluetooth the system is fully functional till 33 feet range. Bluetooth module have negligible initialization time and power requirement of system is minimum and system will work at 8V/120mA source without any interrupt.

3.2 Range Test using Zigbee

Using Zigbee is a battery way to access the notice board. It works fine till moderate range in both outdoor and indoor environment. Outdoor test has been performed in the line of sight (LOS) alignment keeping the both Zigbee modules 1m above from the ground. The outdoor range may vary when the height of the ground changes or any obstruction come between the module. The RF signal will be attenuated when it penetrate the object thus the indoor environment always resist to pass the RF signal resulting small communication range in comparison to outdoor environment.

As they considering the minimum detectable signal strength (RSSI) -96 dBm, the maximum transmission range is 170m and outdoor maximum achieved is 250m. As the distance between the transmitter module notice board

increases the packet loss increases very sharply. Zigbee also provides the facility of node information through which range could be extended so far.

4 SOFTWARE DEVELOPMENT

Zigbee can transmit or receive data using a terminal software but analysis of data and other features of wireless modules feature can't be explored by using simple terminal software. The terminal software doesn't allow to Zigbee to find the new radio modules, plotting RSSI, information about packet loss ,and range test thus they are using standard XCTU software for Zigbee.

4.1 Android Application Development

In which the android application is developed for android based mobile phone by the MIT APP Inventor software .Using this application this can get connect with developed notice board and also using this the matter which access in the notice can be edited. and it also help for searching the Bluetooth (HC-05) module, creating a pair and send the data character by character. It will also display the received character that is sent back from the notice board to mobile phone also. So, by this android application the data can send character by character successfully.

4.2 XCTU Software

XCTU is a free multi platform application designed to enable developers to interact with digi RF modules through a simple to use graphical interface. It includes new tools that

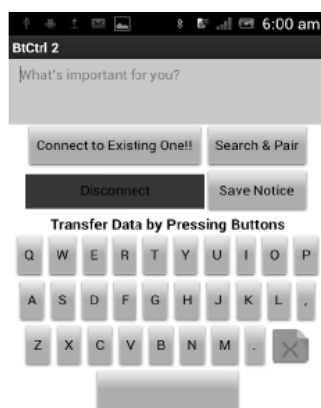


Fig-5: Android Application Snapshot

make it easy to set up, configure and test Zigbee RF modules. XCTU includes all of the tools a developer needs to quickly get up and running with Zigbee. Unique features like graphical network view, which graphically represents the Zigbee network along with the signal strength of each connection, and the Zigbee API frame builder, which helps to build and interpret API frames for Zigbee being used in API mode, combine to make development on the Zigbee platform easier than ever.

5. CONCLUSION

In this paper a low cost, offices/industry usable, portable wireless notice board successfully studied. The graphical LCD displays transmitted character and it is functionally satisfied all definition of notice board. The developed notice board is may be a prototype or implemented system, made considering the minimum system requirement and this work have interminable possibilities for further up-gradation like using a larger color display with long range Zigbee wireless node connection to enhance the range of operation. In this work by introducing the concept of wireless technology in the field of communication they can make their

communication more efficient and faster, with greater efficiency it can display the messages and with less errors and maintenance. The main objective of this is to learn how to make faster and efficient notice display system using the known sharing media.

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