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Design of Wireless Notice Boards for Long Distance Data Transmission by using Bluetooth and nRF24l01

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Abstract - *A notice board is a surface intended for the posting of public messages, for example, to advertise items wanted or for sale, announce events, or provide information. Notice boards are particularly prevalent at universities. They are used by many sports groups and extracurricular groups and anything from local shops to official notices. Dormitory corridors, well-trafficked hallways, lobbies, and freestanding kiosks often have notice boards attached to facilitate the posting of notices. The notice boards currently in use employ the method of pinning a piece of paper with the message /notice written (or printed) on them. This method uses a lot of resources in that, the paper, the ink for printing, the manual labor to pin it and most particularly the time taken for the notice to be displayed on it. This process was made a bit lighter with the introduction of an electronic notice board where the uses of physical resources such as paper, ink, etc. have been eliminated. But, it uses a wired connection from the transmitter (one who sends the notice) to the board that is not very convenient. As such, our project is a modified version of an electronic notice board, a 'Wireless Notice Board'. Similar to the electronic notice board, only the notices are displayed wirelessly*

The wireless notice board is designed in a very convenient way, such that users can simply send notices using their android device. The project can be divided into two modules, the transmitter and the receiver. The transmitter is to be connected to the user's device using an application which must be installed on the device. The transmitter and the user device are connected using Bluetooth, due to it being the simplest and safest method of wireless communication. Sadly, however, the range of Bluetooth is limited (roughly about 10m) and hence, to increase the range we make use of Radio Frequency (RF) modules on the transmitter and receiver. The message sent from the user device is sent to the transmitter module using Bluetooth. The transmitter module sends this message to the receiver module using RF. The receiver module is connected to a display screen (notice board) which will display the received message. The maximum range of the modules is around 30m which can be extended to 1km using antennas.

Key Words: **Android, Arduino, Bluetooth, MIT App Inventer, nrf24L01, Wi-Fi, ZigBee**

1.INTRODUCTION

Wireless communication technology has been making tremendous progress over the past few years. The ever increasing use of wireless networks servers 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.

The purpose of this document is to provide a detailed description of the processes involved in the making of Wireless Notice Board both with Bluetooth module HC-05 as well as nRF24L01. This document describes the features that are included in this Wireless Notice Board, describing user functionality through different wireless communication devices like Android OS based smart phones and laptops. The main aim is to help evolve the process of displaying notices more efficiently in comparison to the present method which has well-over lasted it's time.

In [1], authors have given a detailed comparative study of different short-range wireless protocols viz. Bluetooth (over IEEE 802.15.1), UWB (over IEEE 802.15.3), ZigBee (over IEEE 802.15.4) and Wi-Fi (over IEEE 802.11a/b/g). Main features and behaviours in terms of various metrics, including capacity, network topology, security, quality of service support, and power consumption are studied for the comparison. Our proposed model consists of three modules i.e. one Transmitter and two Receiver modules. The transmitter module consists of a wireless device such as a smart phones or laptop which has Bluetooth availability. One of the receiver modules is placed in local area where Bluetooth module and the nRF24l01 module are interfaced with an Arduino. The other receiver module is place at the remote end consists of nrf24l01 receiver and is designed for displaying messages on LCD. Primarily16x2 LCD is been used for displaying messages which we can further extend to larger LCD.

2. RELATED WORK

[1]Wireless communication technologies are preferred over wired communication which is considered outdated. The paper classifies various wireless technologies such as RF, Bluetooth and ZigBee. ZigBee is the best technology for close

range communication but has very poor data rate. The maximum data rate is provided by Bluetooth.

[2] MIT app inventor is a visual programming tool for designing and building functional mobile apps android. It is open source and focuses only on logic of programming instead of syntax. Entrepreneurs without knowledge of java can now launch apps in market by using it. There are two main parts of MIT inventor: Designer that decides how a screen may look like and Blocks that decides functionality. Its real time testing capability and easy to use facility attracted around 2 million users in just 18 months of re-launch by MIT.

[3] Bluetooth helps for secured transmission of information. The interference problem still exists as many technologies today use same frequency standard. Bluetooth transfers data at 725Kbps whereas wireless devices with 3G communication scheme are able to transfer data at a speed of 2Mbps. The major disadvantage of Bluetooth is that it has a very short range (roughly of about 10m).

[4] ZigBee emerges as a very good solution for wireless communications with its extremely low cost and power consumption. It has very good scalability, fail-safety and security. However, the drawback is that it has limited data rate with 250 kbps. Nordic's nRF24××× is better over ZigBee. Nordic's solution supports a good data rate and range, and it is very competitive when it comes to price and scalability. It also has very low power consumption.

3. COMPARATIVE STUDY

For short range communications, we need a technology that can provide better performance and ease for the user. ZigBee and Bluetooth are the two great technologies that are efficient for short distance communications [1].

Table -1: Comparison between ZigBee and Bluetooth

Sr. no.	Parameter	ZigBee	Bluetooth
1.	Data Rate	20, 40 & 250kbps	1Mbps
2.	Range	10-100m	10m
3.	Operating frequency	2.4GHz	2.4GHz
4.	Complexity	Low	High
5.	Power consumption	Very low	Medium

The Table 1 compares the two technologies and helps us to understand which one is better.

Thus, we can summarize that fast data transfer, more complexity and faster connectivity to network is provided by Bluetooth whereas ZigBee has the advantage of low power consumption. Also, for short range Bluetooth can be preferred with its better data rate.
Also for ease of user, we can have an application on user phone that can be designed by using Bluetooth protocol in MIT app inventor [2].This designing was not possible if we select ZigBee and we need to find another solution for using ZigBee instead of Bluetooth. Thus, we opted for Bluetooth for short range communications.

4. BLOCK DIAGRAM

The figure 1shows the basic architecture of our system. All of the blocks below are the subsystems in the network and are connected wireless.

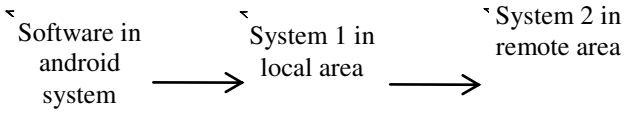

Fig.1: Overall Architecture of system

Firstly, an application is made by using MIT app inventor tool. This application is installed in android phones and is capable of sending text messages to system in local area by using inbuilt Bluetooth of the phone. The android phone must always be in the vicinity of the system 1.

Fig -2: Block diagram for System 1.

The figure 2 shows the block diagram of system 1 which consists of Bluetooth Receiver HC-05, Arduino UNO and the transceiver nRF24l01 which is used as transmitter in this system. The message sent by android phone user is received by the Bluetooth module and the data is delivered to Arduino Uno for further long distance transmission by nRF module

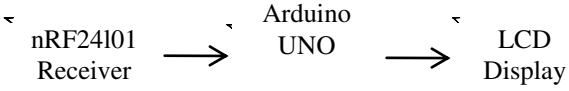

Fig -3: Block diagram for System 2.

The components in system 2 are the nRF receiver, Arduino Uno and the LCD display. The nRF receiver receives the data

wirelessly from nRF transmitter and hands it to arduino which is then responsible for displaying it on LCD display. Thus, by using all the systems together we can have a system in which a user can send the data at a remote location.

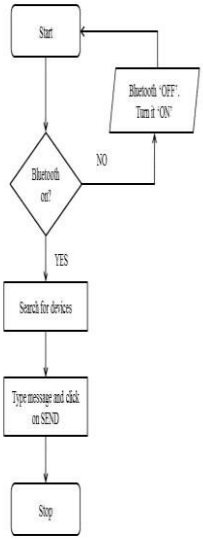

Fig -4: Flowchart of Android Application.

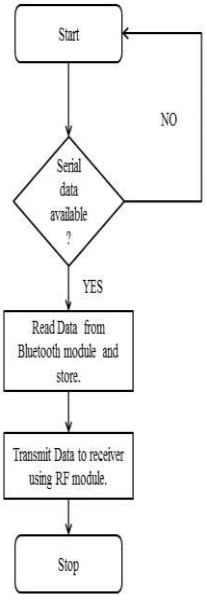

Fig -5: Flowchart of System 1

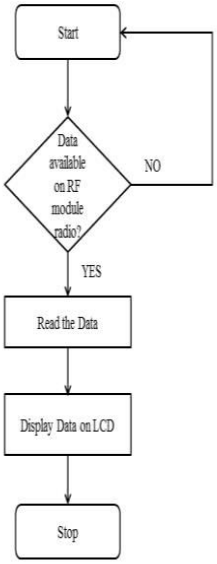

Fig 6: Flowchart of System 2

5.RESULTS

The figure 7 shows the Application software made for the android phone that uses Bluetooth protocol.

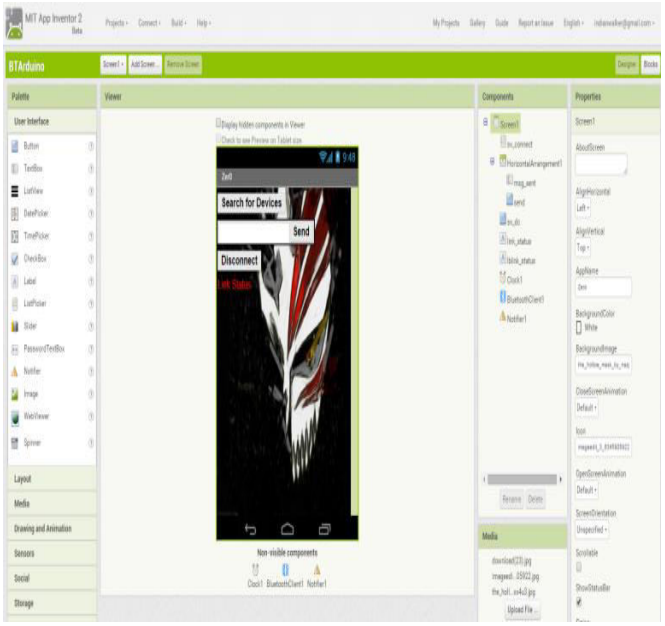

Fig -7: Android Application Design Using MIT App Inventor

Fig -8: Android Mobile Application

The figure 8 shows the completed Android applictation

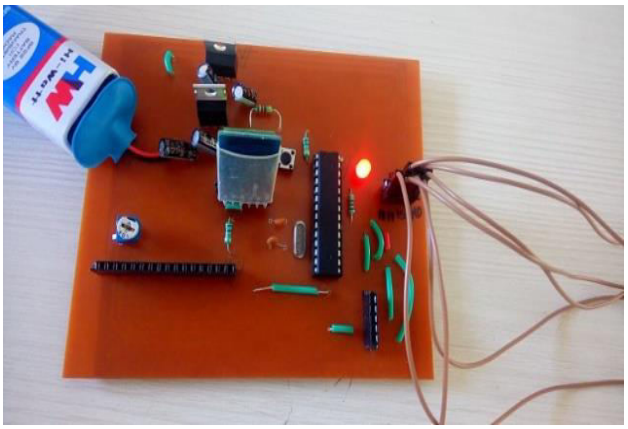

Fig -9: Trans receiver System (System 1)

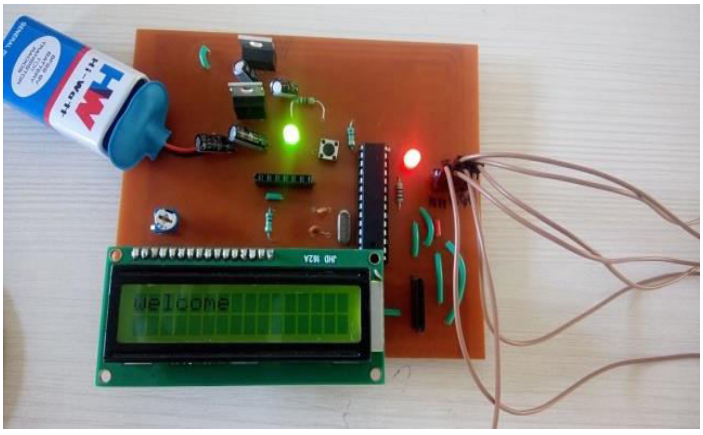

Fig -10: The receiver System at remote area(System 2)

The figure 9 and 10 shows the custom made Arduino PCB for System 1 and System 2. The message send from android phone is received by system 1 using bluetooth via application. The system 1 then sends the message to nRF24lo1 transceiver. The system 2 then collects the message and displays it in the 16*2 LCD display. The nRF24lo1 modules in both system 1 and system 2 uses SPI communication.

6. CONCLUSIONS

Wireless operations permit services, such as long range communications, that are impossible or impractical to implement with the use of wires. It provides fast transfer of information and is cheaper to install and maintain. This paper provides an efficient way of displaying messages on an Electronic Notice Board using Wireless Technology. Electronic Wireless Notice Board is one of the applications where Bluetooth can be used effectively in combination with the nRF. The present model gives the range of about 100m. However, by making use of antennas with nRF we can have a wide range of about 1km.

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