Implementation Of Zigbee Based Home Automation System Using Voice Recognition

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Abstract:

Home automation is a key to having effective energy efficiency in our house. Home automation may include centralized control of lighting, HVAC (heating, ventilation and air conditioning), appliances, security locks of gates and other systems, to provide improved convenience, comfort, energy efficiency and security. Today it has to be updated with the rapidly changing technology to ensure vast coverage, remote control, reliability, and real time operation. Deploying wireless technologies for security and control in home automation systems offers attractive benefits along with user friendly interface.

In this proposed work, a novel automation system for smart home is implemented. The proposed system consists of a control console interfaced with different relays using ZigBee model CC2520 with the AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. Then we have analyzed regarding the data rate and coverage area of zigBee technology in indoor and outdoor applications.

Index terms: Voice control system, MCU (Microcontroller unit), ZigBee, relays, indoor and outdoor applications

I.INTRODUCTION:

The demography of the world population shows a trend that the

elderly population worldwide is increasing rapidly as a result of the increase of the average life expectancy of people. Caring for and supporting this growing population is a concern for governments and nations around the globe. Home automation is one of the major growing industries that can change the way people live. Some of these home automation systems target those seeking luxury and sophisticated home automation platforms; others target those with special needs like the elderly and the disabled.

Intelligent home, also known as the smart home, is moving towards the wireless remote control, multi-media control, and high-speed data transmission. The key technology of intelligent home is compatible to household controllers and it can also meet the transmission requirements through home automation **[1].**

The system should be reasonably cheap, easy to configure, and easy to run. The proposed system consists of microcontroller unit along with zigbee technology for command transmission. The system has been tested and verified. The verification tests included voice recognition response test, indoor ZigBee communication test.

Comparison of different technology

There are many different wireless protocols out there, but the ones that most people have heard of are Wi-Fi and Bluetooth because these are used in devices that lots of us have, mobile phones and computers. There is a third alternative called ZigBee that is designed for control and instrumentation. The benefit of Wi-Fi is that it can connect to an existing network hub or router, which means that a PC doesn't have to be left on to access a device using WiFi. Remote access products like IP cameras use WiFi so they can be connected to a router and accessed across the Internet. WiFi is useful but not simple to implement unless

you just want to connect a new device to your existing network.[3]

Bluetooth is generally used for point to point communication, although Bluetooth networks can be established quite easily. Typical applications we are all familiar with allow data transfer from mobile phones to PCs. Bluetooth wireless is the best solution for these point to point links, as it has high data transfer rates and, with the right antenna, very long ranges of up to 1KM in ideal circumstances. The commonest application we deal with is replacement of serial cables by using a serial to Bluetooth converter on one end e.g. solar panel array, and a USB to Bluetooth adapter to connect to a laptop or PC on the other end. These types of link are very easy to setup, often by just pressing a pairing button on the units to create a permanent Bluetooth link. Bluetooth can also be used to create small ad-hoc networks, often with one USB to Bluetooth convertor as the master and up to 4 serial to Bluetooth adapters as slaves. Have a
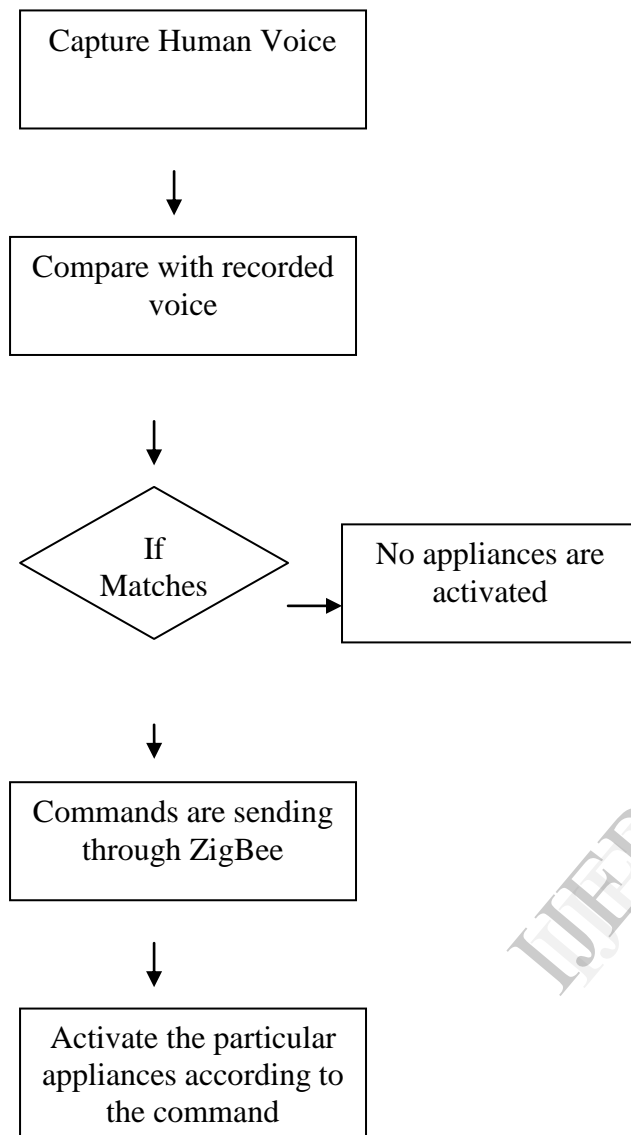
look at our Bluetooth Wireless Guide for more information.

II. PROPOSED SYSTEM

General block diagram of the proposed system is shown in Fig 1. It explains the whole story about the devices installed and their communication protocol in the system.

This system can be categorised as two parts: the hardware part and the software part.The overall system consists of hardware parts such as microcontroller,relay and home appliances and uses the software keiluvision for compilation.

Flow Diagram

```
┌─────────────────────────┐
│  Capture Human Voice     │
└─────────────────────────┘
            │
            ↓
┌─────────────────────────┐
│  Compare with recorded   │
│         voice            │
└─────────────────────────┘
            │
            ↓
        ◇ If ◇              ┌──────────────────┐
        Matches    ───────> │ No appliances are │
                            │    activated      │
                            └──────────────────┘
            │
            ↓
┌─────────────────────────┐
│  Commands are sending    │
│     through ZigBee       │
└─────────────────────────┘
            │
            ↓
┌─────────────────────────┐
│ Activate the particular  │
│ appliances according to  │
│     the command          │
└─────────────────────────┘
```

Hardware design

Hardware part of the system consists of zigbee module (transmitter and receiver), ATMEL 89S52 microcontroller, relays and home appliances. The ZigBee network is a PAN (personal area network) network, comprises of zigbee transmitter and zigbee receiver. ZigBee is a very reliable communication protocol using mesh networking topology for the reliable transmission of data between sender and receiver.Communication between microcontroller and zigbee node are done by USART(universal synchoronous asynchoronous transmitter and receiver).

User equipment (mobile or PC) should have voice recognition sotware which gives instruction to microcontroller unit. By using pc/mobile the speech commands are recognized, control charterers are sent to the specified appliance address through ZigBee communication protocol. Each appliance that has to be controlled has a relay controlling circuit

The CC2520 is TI's second generation ZigBee® /IEEE 802.15.4 RF transceiver for the 2.4 GHz unlicensed ISM band. This chip enables industrial grade applications by offering state-of-the-art selectivity/co-existence, excellent link budget, operation up to 125°C

and low voltage operation. In addition, the CC2520 provides extensive hardware support for frame handling, data buffering, burst transmissions, data encryption, data authentication, clear channel assessment, link quality indication and frame timing information. These features reduce the load on the host controller. In a typical system, the CC2520 will be used together with a microcontroller and a few additional passive components.

The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the Indus - try-standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory pro-grammar.

III.SOFTWARE DESIGN:

Our proposed system consists of keiluvision software and speech recognition software. keiluvision software is used for compiling the typed embedded c coding used in our system. apeech recognition software is used to get the control signal from user and give it to zigbee transmitter. According to that information received from zigbee receiver MCU passes control signal to the relay which is connected in our home appliances. Voice recognition unit using HM 2007. It consists of HM 2007 IC, SRAM and keypad. Voice is recorded and then recognized. The HM2007 is a CMOS voice recognition LSI (Large Scale Integration) circuit. The chip contains an analog front end, voice analysis, regulation, and system control functions. The chip may be used in a stand alone

IV.EXPEREMNTAL SETUP AND CICUIT DIAGRAMS
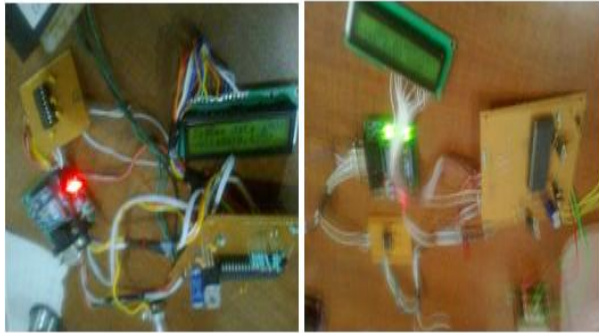
Implemented Transmitter and Receiver model

(a) Transmitter module with Zigbee base PCB   (b) Receiver Module with Zigbee base PCB

The above are few of the pictures that represents our module. In this we are making use of Zigbee - C2530 for transmitting and receiving the commands from zigbee transmitter to home appliances. Here the transmitter sector consists of a microphone and a Zigbee transmitter unit. The voice commands such as "Light ON" are given as input to the transmitter unit. The signal is then transmitted to the corresponding Zigbee receiver.

Zigbee works in the range of 10-100 meters without any distractions and without any use of any repeaters, for further extended distance repeaters has to be used to get the best results without any distractions. On the receiver end the transmitted command is received & it is compared with the list of commands that are already stored. The receiver unit consists of 89S52 microcontroller & a relay unit. Based on the input command the corresponding operations will be carried out like turning ON the light & so on. The home appliances such used can be lights, fan, door locking system & so on. On comparing with other home automation techniques, the main advantage of using Zigbee based automation is that it consumes only less power.

The following is the circuit diagram showing the interfacing of relay with microcontroller, here ULN2803 is used as a driver circuit that acts as an intermediate between the microcontroller & the relay

circuit. The driver circuit transfers the information back and forth between the microcontroller and relay circuit and thus acting as an intermediate.

The following is the tabulation that consists of step by step commands & their corresponding process that can be carried out and their status of relay.
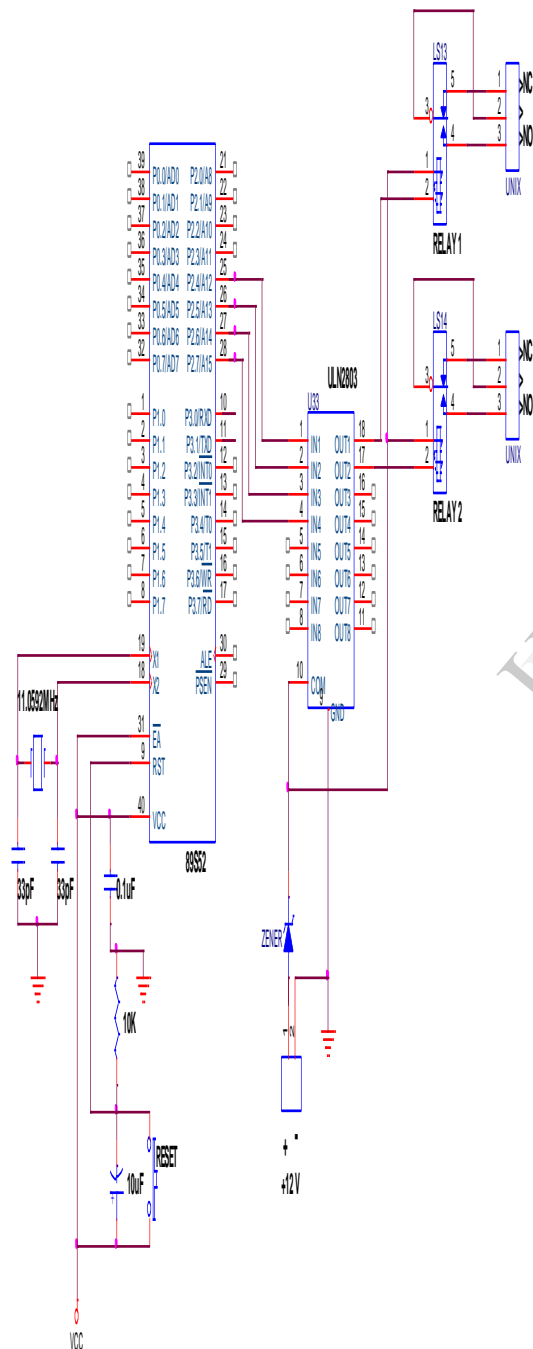
Process tabulation

S. No	Input(voice)	Execution of program	Status of relay
1	FAN ON	Relay which is connected to the FAN get closed, if the voice is matched with recorded voice in microcontroller	ON

2	FAN OFF	Relay which is connected to the FAN get opened if the voice is matched with recorded voice in microcontroller	OFF
3	POWE R ON	Relay which is connected to the LIGHT get closed , if the voice is matched with recorded voice in microcontroller	ON

This can not only be implemented of home use but also in industries & institutions that requires more manpower. Since the Zigbbe can be used for longer distance & since multiple nodes can be controlled be same Zigbee transmitter unit, this can be implemented in industries. This module can be implemented in any industries based on their needs, since this module is very flexible to use it can be used based on their needs. In industries this can create a revolution. This will help in reducing the cost as well as it can replace the manpower for such basic needs. This will also help in increasing the speed of operation & also reduces the possibilities of errors. The following are the photographic representation of future implementation of Zigbee based automation unit in industries.

**In Industries application scenario**

V.RESULTS AND DISCUSSION

In this section we are comparing some parameters of Bluetooth and zigbee technologies using some data described in the graphical representations below.
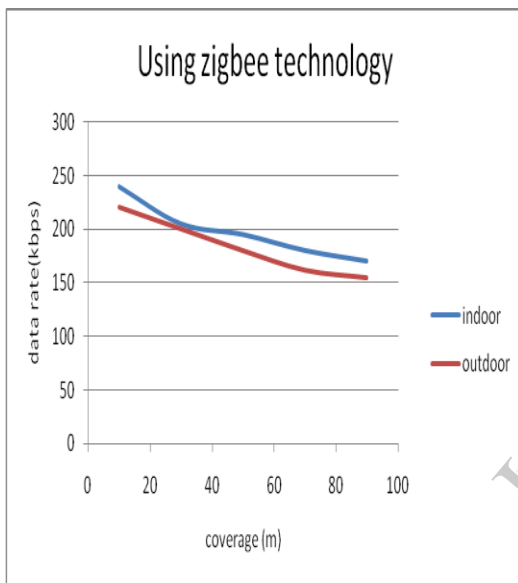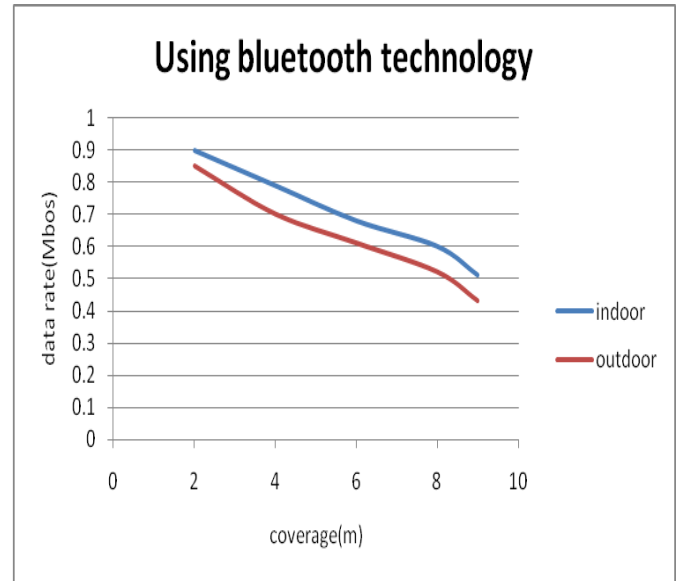

The above graph illustrates that using Bluetooth technology it is clear that even though the data rate is high in Bluetooth the coverge area is low when compared with zigbee tehnology.

From the above graph thus we come to the conclusion that data rate of zigbee communication is much better when comparing indoor use with outdoor use.
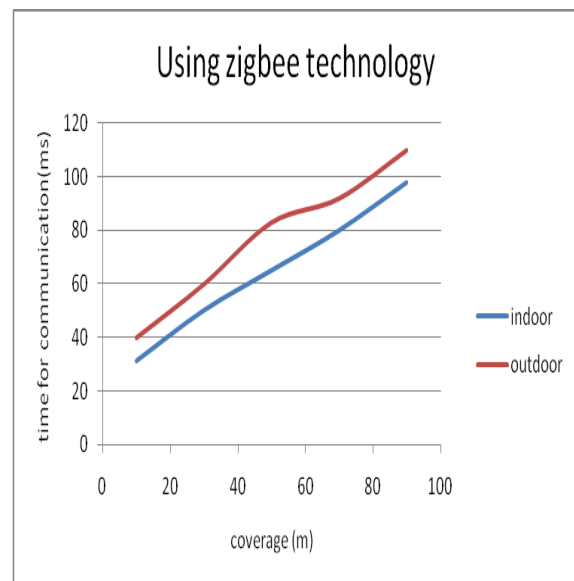
The above graph describes that if the coverage area increases, response time also increases. Since the delay time here is measured in milliseconds it doesn't produce much delay.
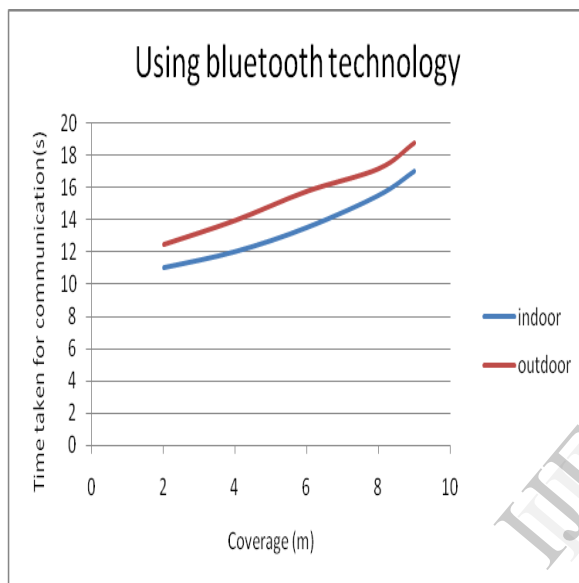
This graph implies that the time of response increases with increase in distance. But on comparing with zigbee technology, the delay time is high. And also the time here is measured in seconds not in milliseconds like zigbee.

VI.CONCLUSION:

Wireless communication is a cheap and easy way to provide network communication at places where there is no wired infrastructure. In addition, because the communicating entities can freely move, one can place the monitoring system wherever it is required without the cost incurred with cabling when adopting the wired communication approach. In this paper, a cost-effective ZigBee-based monitoring system for home application was proposed. A demonstration system was constructed with a low cost and high performance microcontroller, energy metering IC and ZigBee module.

This device presented here fulfill the required data rate ,data transmission speed and less power consumption which can be analyzed From the above outputs, we have analyzed regarding the data rate ,data speed and power consumption for different coverage area of zigbee technology ,in indoor and outdoor applications. And also the same parameters are compared with other technology. By this we have concluded that zigbee technology

take less time for transmission with high data rate in indoor applications

.As a conclusion, for home automation system zigbee technology is better than other technologies.

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