Smart Home Using Different Wireless Connectivy's

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Abstract— Due to advancement in technology smart home system comes into picture using different wireless connectivity's which exchanges data wirelessly using short wavelength radio transmission, in this paper we introduced the different wireless connectivity's like Bluetooth ,Wifi,GSM,Zigbee and infrared for controlling and commanding smart home appliances.

Index term-Home Automation, Bluetooth, Zigbee, infrared, Wi-Fi ,GSM.

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1 INTRODUCTION

The home Automation System allows different wireless connecivity's for controlling and monitoring the home appliances using smart phone or tablet. There are different connectivity'sintroduced such as GSM, Wi-Fi, Zigbee and Bluetooth. Each connectivity has different specifications, merits & demerits. According to their merits & demerits they are used for the home automation system. In this paper we are introducing different wireless connectivity's by using their suitable specification.

Bluetooth uses the FHSS and it transmit radio waves in omini direction. It provides more security ,more reliable technology, low cost, easily available in market. The every smart phone /tablet /laptop has Bluetooth adapter.[1][4]

Wi-Fi is the wireless technology which uses radio waves for exchanging data through an electronic device to the internet wirelessly.[2]

Zigbee is a specification for a suite of high level communication protocols used to create personal area networks built from small, low-power digital radios. Zigbee is based on an IEEE 802.15 standard.

The GSM system contains low cost components easily available which cuts down the overall system cost. This system alerts user via SMS providing home security it also allows secure access due to pre-configured number. The ease of deployment is due to wireless mode of communication. GSM technology provides the benefit that the system is accessible in remote areas.[6]

Infrared(IR) is Line of Sight Connectivity which is used for Home Automation by sending signals from IR Remote Control for Controlling the home appliances through it.[5]

2 IMPLEMENTATION

2.1 Bluetooth Connectivity

Figure.1 Bluetooth Module

Bluetooth is a public standard (802.15.1) intended for short-range, low-power wireless transmissions. It is used for connecting consumer electronics such as a wireless keyboard or mouse to a PC. Bluetooth is being used in industry for machine-to-machine communications and other short-range wireless applications. Bluetooth can be used to send data between a fixed device on a machine and a component that is moving or rotating. Also, Bluetooth devices sending serial data can be useful for mobile data acquisition devices.

Bluetooth uses FHSS and operates in the 2.4 GHz band. It shares the same frequency bands as 802.11b/g. It ranges from 10m to 100m. It is less complex and easily available as compare to other wireless connectivity components.
In home automation system we can use the Bluetooth module for controlling and monitoring purpose. Bluetooth provide higher security for smart home.[4]

2.2 Wi-Fi Connectivity

Figure 2. Wi-fi Module

Wi-Fi (Short form of **Wi**reless **Fi**delity) is a wireless technology that uses radio frequency to transmit data through the air. Wi-Fi has initial speeds of 1mbps to 2mbps.Wi-Fi transmits data in the frequency band of 2.4 GHz. It implements the concept of frequency division multiplexing technology. Range of Wi-Fi technology is 40-300 feet.[2]

The controlling device for the automation in the project is a Microcontroller. The data sent from mobile/PC/tablet over Wi-Fi will be received by Wi-Fi module connected to microcontroller. Microcontroller reads the data and decides the switching action of electrical devices connected to it through Relays and Triac switches. The Microcontroller is programmed used embedded 'C' language.[2]

2.3 Zigbee Connectivity

Figure 3. Zigbee Module

Zigbee is used in high level communication protocols used to create a personal area networks built from small, low-power digital radios. Zigbee is based on an IEEE 802.15.4 standard.

Zigbee technology is a low power wireless technology for sensor and control system. Though low-powered, Zigbee devices can transmit data over long distances by passing data through intermediate devices to reach more distant ones, a network with no centralized control or high-power transmitter/receiver able to reach all of the networked devices. The decentralized nature of such wireless and ad-hoc network makes them suitable for applications where a central node can't be relied upon.[3]

Zigbee is used in applications that require a low data rate, long battery life, and secure networking. Zigbee has a specific rate of 250 Kbit/s suited for periodic or a single signal transmission from a sensor or input device. Applications include wireless light switches, electrical meters with in-home-displays, traffic management systems, and other consumer and industrial equipment that requires short-range wireless transfer of data at relatively low rates.

Zigbee networks are secured by 128 bit symmetric encryption keys. In home automation applications, transmission distances range from 10 to 100 meters line of sights, depending on power output and environmental characteristics. Zigbee protocols are intended for embedded applications requiring low data rates and low power consumption. The resulting network will use very small amounts of power individual devices must have a battery life of at least two years to pass Zigbee certification.[3]

2.4 GSM Connectivity

Figure 4. GSM Module

Home appliance control system is based on GSM network technology for transmission of SMS from sender to receiver. SMS sending and receiving is used for ubiquitous access of appliances and allowing breach control at home.[6]

The system proposes two sub-systems. Appliance control subsystem enables the user to control home appliances remotely whereas the security alert subsystem provides the remote security monitor ing. The system is capable enough to instruct user via SMS from a specific cell number to change the condition of the home appliance according to the user's needs and requirements.

The second aspect is that of security alert which is achieved in a way that on the detection of intrusion the system allows automatic generation of SMS thus alerting the user against security risk.[6]

GSM Modem: It is a hardware component that allows the capability to send and receive SMS to and from the system. The communication with the system takes place via RS232 serial port. Cell phone can be attached at the place of GSM hardware but it limits the hardware functionality such as sending or receiving of SMS.

Mobile Device : Cellular phone containing SIM card has a specific number through which com- munication takes place. The device communicates with the GSM Modem via radio frequency. Mobile user transmits SMS using GSM technology.
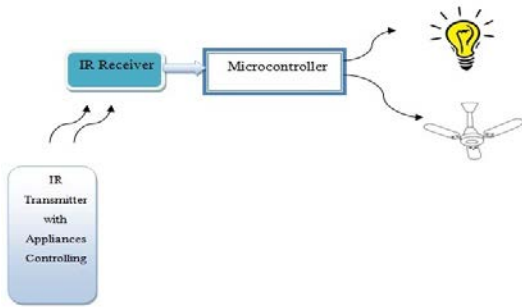
2.5 Infrared(IR) Connectivity

Figure 5. Infrared(IR) Home Automation

Infrared (IR) radiation is electromagnetic radiation whose wavelength is longer than that of visible light (400 – 700 nm), but shorter than that of microwave radiation . It's wavelength spans between 750nm and 100 µm and is employed in short-range communication among devices that conform to the standards published by the Infrared Data Association (IrDA). Remote controls and IrDA devices use infrared light-emitting diodes (LEDs) to emit infrared radiation which is focused by a plastic lens into a narrow beam. The beam is modulated, i.e. switched on and off, to encode the data. The receiver uses a silicon photodiode to convert the infrared radiation to an electric current. It responds only to the rapidly pulsing signal created by the transmitter, and filters out slowly changing infrared radiation from ambient light. Infrared communications are useful for indoor use in areas of high population density. IR does not penetrate walls and so does not interfere with other devices in adjoining rooms. Infrared is the most common way for remote controls to command appliances.[5]
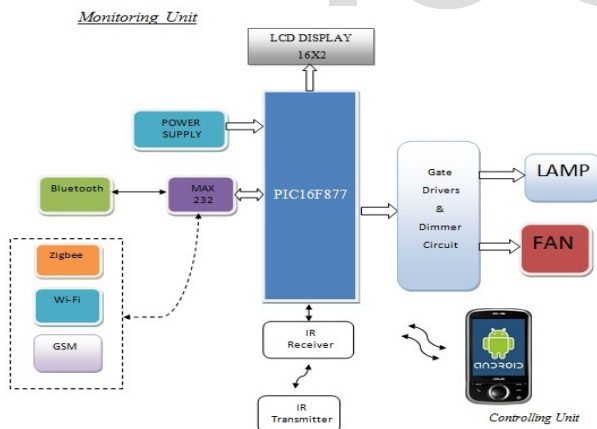
3 GENERAL BLOCK DIAGRAM

Figure 6. Block Diagram of Home Automation using different connectivity's

In this block diagram it shows Home Automation using different Wireless Connectivity's for monitoring and controlling using an mobile unit. In this Paper we have introduced different of connections such as GSM, WiFi, ZIGBEE, and Bluetooth. Each of the connection has their own unique specifications and applications. Among the four popular wireless connections that often implemented in our project, Bluetooth is being chosen with its suitable capability. The capabilities of Bluetooth are more than enough to be implemented in the design. Also, most of the current laptop/notebook or cell phones are come with built-in Bluetooth adapter.

Where the components are communicating through a Bluetooth. The technology may be used for monitoring, switching ON and OFF and Regulate the appliance, according to the programmed criteria. The design consists of Android phone with home automation application, ADK. User can interact with the android phone and send control signal to the ADK which in turn will control other embedded devices/sensors. We have introduced a simple prototype in this project but in future it can be expanded to many other areas.[4]

4 COMPARISON OF DIFFERENT WIRELESS CONNECTIVITY'S

Specification	Bluetooth	Wi-fi	Zigbee	GSM	Infrared(IR)
Standard	802.15.1	802.11b	802.15.4	ETSI (Cellular Phone)	IrDA
Frequency	2.4 GHz	2.4GHz	2.4GHz	900 MHz or 1800 MHz bands.	430 THz-300 GHz
Speed	2 Mbps	11-50Mbps	20-250Kbps	64Kbps-3Mbps	11Mbps
Range	10m	100-1km	10-100m	10-35Km	<10Meters
Advantages	Low Cost&More Security	Low Cost & More Security	Low Cost & Moderate Security	Moderate Cost & More Security	Low Cost & More Security
Disadvantages	Short Range	It is more complex	Low data rate	Low Competence	Line of Sight Communication
Spectrum	ISM	ISM	ISM	GSM	ISM
Power	Low	Medium	Low	High	Medium

Table 1. Comparison of different wireless connectivity's

5 CONCLUSION

In this paper we have explained the different wireless connectivity's for Home Automation Project and among all we prefer the Bluetooth technology because Bluetooth connectivity has low cost, easily synchronized to the mobile phone.

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