Smart Home System for People with Multiple Disabilities Using Zig-Bee

P. Pavan Kumar
PG Student (Embedded Systems),
Department of ECE,
AITS, Rajampet, Andhra Pradesh, India.

K.Naganarasaiah Goud
Assistant Professor,
Department of ECE,
AITS, Rajampet, Andhra Pradesh, India.

ABSTRACT:

Nowadays, home appliances manufacturers are increasingly relying on wireless sensor network and single chip embedded technologies to build smart environment. Many existing systems are already in the market; however, they were designed without envisioning the need of residents with special needs. This work presents a framework that enables the integration and control of devices within a smart home environment for residents with disabilities. The framework supports the integration of multiple control devices for different residents with different disabilities. Moreover, the work addresses the safety of the users by providing warnings and notifications in case of an emergency. A prototype was designed, implemented and tested.

KEYWORDS: *smart home; home area network; wireless sensor network; people with special needs; Zig-Bee*

1. INTRODUCTION

At home, we generally operate (switch on/off) all the electrical and electronics appliances such as fan, light, cooler, air conditioner, and so on through switches of the regular switch board. This manual switching of any home appliance is an inconvenient method for physically disabled or elders or even for normal young guys when frequent switching operation is required.

Nowadays, home appliances manufacturers are increasingly relying on wireless sensor network and single chip embedded technologies to build smart environment. Many existing systems are already in the market, however, they were designed without envisioning the need of residents with special needs. This work presents a framework that enables the integration and control of devices within a smart home environment for residents with disabilities. The framework supports the integration of multiple control devices for different residents with different disabilities. Here we are using a technology known as Zigbee, in which we can wirelessly operate the any home appliances by communicating module with the controlling system.

2. LITERATURE SURVEY

The work in proposes a wireless sensor network based system consists of three major blocks namely; doorbell. The system has various functions to help elderly and

people with special needs. The system consists of a base station, sensor nodes that contain RFID tags, accelerometer and buzzer. Each node monitors a specific home appliance. The system in introduces a Zig-Bee based smart home monitoring system that supports multiple user. The system allows users to monitor their home appliances simultaneously.

3. PROPOSED SYSTEM

The System supports the integration of multiple control devices for different   residents with different disabilities Here we are using a technology known as Zig-   bee. The proposed system consists of four functional wireless sensor nodes: light, fire alarm, door and doorbell, refrigerator and the master controller. The master controller communicates to the nodes wirelessly using Zig-Bee. The control device consists of a Mega microcontroller connected to several I/O. Inputs include keypad and switches Outputs are LEDs, LCD display and buzzer.
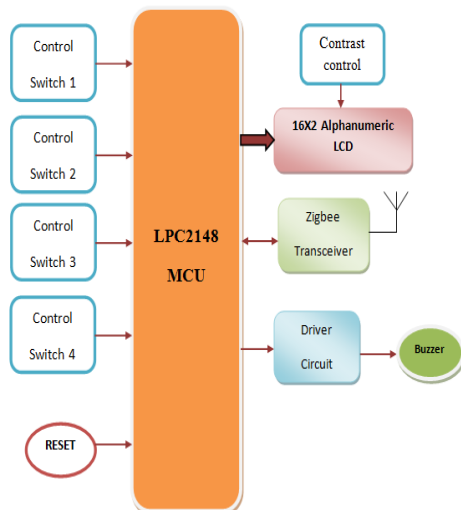
A.BLOCK DIAGRAM

FIG 1: MASTER CONTROLLER UNIT

The master controller allocates the request to the control device capability based on the user special need. For example, if the user is visually impaired, then all notifications from the master controller will be sound based. Different notifications will sound differently. For example, if there's fire, the buzzer will keep running until the temperature goes back to normal.
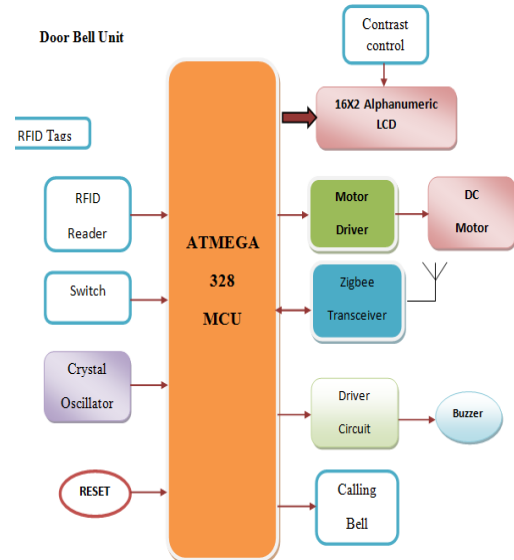

FIG 2: DOOR BELL UNIT

First unit is placed at entrance door for access control. Family members will have a RFID card which should be placed near RFID reader to enter inside. If others want to come inside then they can ring a calling bell. So that the mater can open the door using Zigbee.
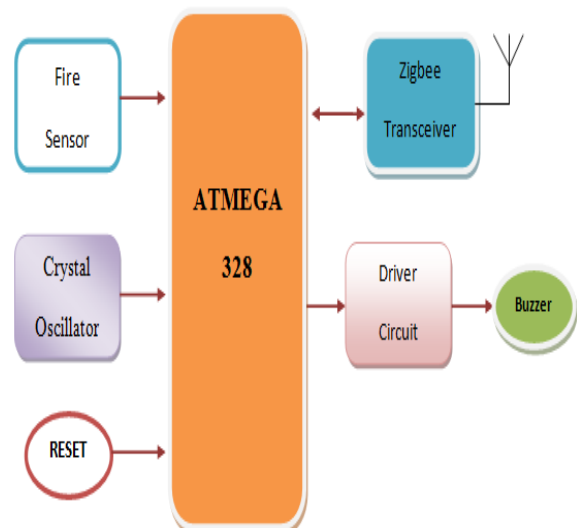

FIG 3: FIRE SENSOR UNIT

Fire sensor unit can be placed near kitchen to notice the fire and also to inform the master about this
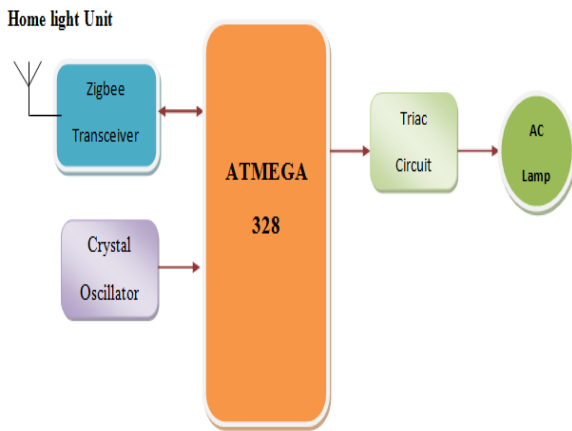
FIG 3: HOME LIGHT UNIT

Lighting can also be controlled using this wireless technology in hall/living room.

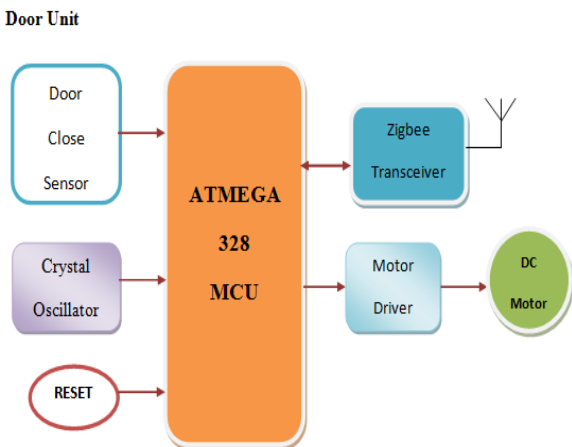This home light is used for operating remotely in our home and it is easily controlled.

FIG 4: DOOR UNIT

A sensor is placed near fridge to monitor the door condition and then informs to the master.

A. MICROCONTROLLER

16-bit/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package. 8 kB to 40 kB of on-chip static RAM and 32 kB to 512 kB of on-chip flash memory.128-bit wide interface/accelerator enables high-speed 60 MHz operation. In System Programming/In-Application Programming (ISP/IAP) via on-chip boot loader Software. Single flash sector or full chip erase in 400 ms and programming of 256 bytes in 1 ms. Embedded ICE

RT and Embedded Trace interfaces offer real-time debugging with the

B.RFID

Radio-frequency identification (RFID) is the use of a wireless non-contact system that uses radio-frequency electromagnetic fields to transfer data from a tag attached to an object, for the purposes of automatic identification and tracking. Some tags require no battery and are powered by the electromagnetic fields used to read them. Others use a local power source and emit radio waves (electromagnetic radiation at radio frequencies).

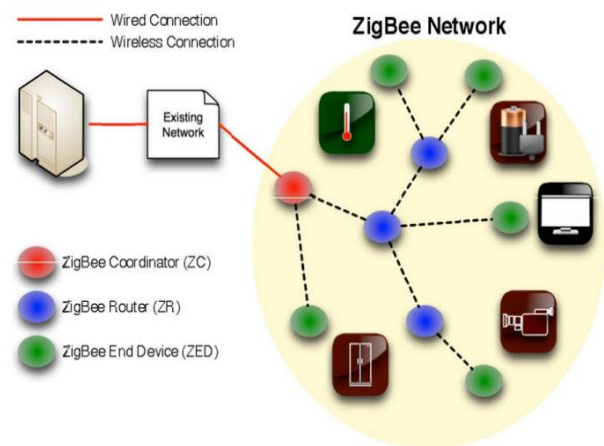**FIG 5: RFID Tags**

C.ZIG-BEE

FIG 6: ZIG-BEE NETWORK

It is the wireless device for transmitting and receiving purpose or simply it called as Transceiver. Zigbee is based on the IEEE802.15.4 protocol. The range of the Zigbee is covered as 100m. It range is 10 times better than Bluetooth device so it can be more preferable one in

wireless device. The data rate is very low for transmission while using this device.

The performance evaluation is divided into two parts: ZigBee mesh floor (horizontal communication) network and BN (vertical communication).

4. SOFTWARE SPECIFICATIONS
A. Windows XP
This is an Operating System (OS) on which all the software applications required for our project are going to be run. This OS is flexible to user to operate and easy to understood. Accessing the software's and using them is very convenient to user.

B. Express PCB:
Express PCB is easy to lean and fast to use. It is an all in one freeware in which schematic as well as PCB layout can be made.

C. Flash magic software:
It is used to burn them. Hex file generated by the compiler into the IC. This is done by using the Hardware kit wherein the IC is placed. It is then connected to the PC via its serial port for burning the code.

5. EXPERIMENTAL RESULTS
1. MASTER CONTROLLER UNIT
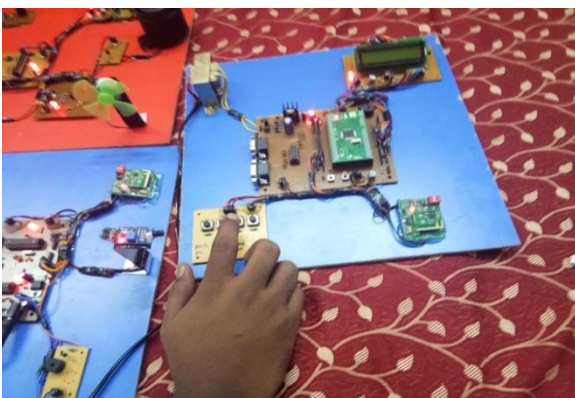
The master controller allocates the request to the control device capability based on the user special need. For example, if the user is visually impaired, then all notifications from the master controller will be sound based.

2. DOOR BELL UNIT
The Doorbell nodes are connected to an RFID tag reader and which allows the node to perform two operations. First, when the user swipes the RFID card that matches that connected to node, the door opens for a specific amount of time then automatically closes.

Fig 6:Door Bell Unit

Secondly, when a person (visitor) presses the door bell, the node will notify the master controller of this event and the master controller will transform into an output action based on the user special need through the control device.

Fig7: Authoriseddoor OPEN

Fig 8: Unauthorized Ring Bell
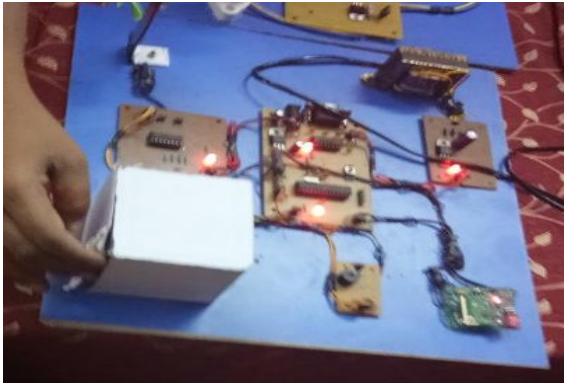
3.FRIDGE DOOR UNIT

Fig 9: Fridge Door

1When the fridge door is open and the LED, fan will rotate& buzzer will give sound. When the door is closed automatically the fan and buzzer will stop. Node waits until it receives the appropriate command from the master controller, check the status of the door, and send the status back to the master controller.

Fig 10: Door Open

4. FIRE ALARM UNIT

Fig: Fire Alarm

The fire alarm node is connected to a fire sensor, LED an X-bee board. The node keeps monitoring the temperature of the surrounding. If the temperature reaches beyond a certain limit, the node alerts the master controller and turn ON the LED connected to the node.
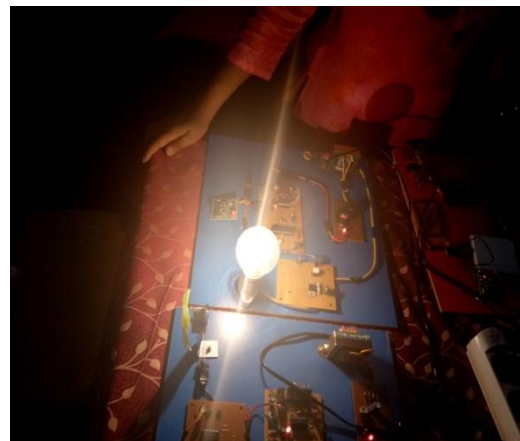
5. HOME LIGHT UNIT

Fig 11: Home Light

Lighting can also be controlled using this wireless technology in hall/living room.

6. ADVANTAGE

i) Cheap in cost: Due to use of wireless network, no wiring is required so cost is reduced.
ii) System is scalable and portable: for adding or removing the features is not tedious work as network is wireless

7. CONCLUSION

Most of the existing smart home monitoring and control systems do not accommodate special needy users to manage their home appliances. A wireless sensor network based system for smart home automation was designed, built and tested to address such missing functionality. The implemented system's major contribution is that it is customized to provide the special need residents with tools and services to monitor and operate home appliances remotely. The implemented system provides home residents with disabilities to take advantage of the advancement in technology. It enables them to perform their daily activities by remotely

monitoring and controlling their home appliances without having to depend on others. The system is programmed so that it can be configured to adjust to the customer's disability providing them with better and convenient lifestyle. It is worth mentioning that the system is scalable and can be extended to include more and different services and tools. The system is portable, compact, affordable and easy to use.

This project is based on Zig-bee and it has been designe and implemented with ARM 7 in embedded system domain, Experimental work done successfully. The result shows that higher efficiency is indeed achieved using the embedded system according to requirement of the user.

References

[1] Garner G. Designing Last Mile Communications Infrastructures forIntelligent Utility Networks (Smart Grids), IBM Australia Limited,2010.

[2] A. Iyer, S. S. Kulkarni, V. Mhatre, C. P. Rosenberg, "A TaxonomybasedApproach to Design of Large-scale Sensor Networks", WirelessSensor Networks and Applications, 1st ed., Springer US, 2008, pp. 3-33.

[3] A. Isilak, "Smart Home Applications for Disabled People by usingWireless Sensor Network", Technical Report Department of ComputerEngineering, Yeditepe University, 2010.

[4] B. El-Basioni, S. Abd El-Kader, and H. Eissa, "Independent Living forPersons with Disabilities and Elderly People Using Smart HomeTechnology " International Journal of Application or Innovation inEngineering and Management, vol. 3, p. 11-28, April 2014.

[5] I. A. Zualkernan, A. R. Al-Ali, M. A. Jabbar, I. Zabalawi, and A.Wasfy,"InfoPods: Zigbee-based remote information monitoring devices forsmart-homes," IEEE Transactions on Consumer Electronics, vol. 55, pp. 1221- 1226, 2009.

[6] S. Bang, M. Kim, S. Song, S. Park, "Toward real time detection of thebasic living activity in home using a wearable sensor and smart homesensors," IEEE 30th Annual International Conference of Engineering inMedicine and Biology Society, pp. 5200 – 5203, Aug. 2008.

[7] M. Hsieh, W.S. Hung, S.W. Lin, and C.H. Luo, "Designing an Assistive Dialog Agent for a Case of Spinal Cord Injury," Ninth InternationalConference on Hybrid Intelligent Systems, pp. 67-72, Aug. 2009.

[8] R. Kadouche, M. Mokhtari, S. Giroux, B. Abdulrazak, "Personalization in Smart Homes for Disabled People," Second International Conference on Future Generation Communication and Networking, pp. 411-415,