INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH & DEVELOPMENT

ISSN 2278 – 0211 (Online)

Home Automation & Smart Homes……Convenient Living

D. Sarala
ICT Coordinator, Department of Physics & Electronics, St. Ann's College for Women, Hyderabad, India

Abstract:
In the present 21 st century many people are looking for the methods to improve life conditions, comfort and at the same time the simplicity of handling with domestic electric appliances. Automation through mobile is a desired option when the user is outside the premises, where the appliances need to be controlled. Unlike other hand-held units, a mobile can be easily operated by the visually impaired and physically challenged persons also. To provide security to the network so that nobody else makes a call to the mobile circuitry and misuses the facility, an authentication code is provided. This paper discusses the different features of home automation

Keywords: *Automation, comfort, visually impaired, physically challenged, networks, security*

1. Introduction

Home automation refers to controlling the domestic appliances like fan, light, a.c. etc without the intervention of the inmates of the house. Smart home applications employ microcontrollers to monitor ovens, washing machines, lighting, refrigerators, and HVAC facilities (Heating/Ventilation/Air-Conditioning) with respect to temperature or humidity and to adjust accordingly to meet the home owner's requirements

In the present ubiquitous computing environment, people prefer wireless technologies to physical movement to control and operate the home appliances.

Automated system provides increased flexibility and security compared to the manual one, especially for the aged and the differently abled. If there is a theft in the locked house and the inmates are informed by the SMS/ What 'Sapp, they can have remote picture of the situation from the video cameras fitted inside the house in real time. With the help of laptops, smart phones etc. the instruction can be given to turn on the microwave, geyser etc. So that by the time one reaches home after a tiring day's work, hot food would be ready.

The home automation integrates all the devices that need to be controlled at home to a PC/laptop, connected to wireless network and are accessed remotely.

2.1. Home Automation for the Disabled and the Aged

Those who are visually impaired have devices in their smart home that are voice activated, and those who are hearing impaired have systems that alert them visually with a touch screen. Mobility impairments cover not only those who are in wheelchairs or use mobile assistance, but also people who suffer from arthritis. In this case, devices which are networked in the home can be controlled without actually having to touch a button. Another way in which smart home technology can assist those who are mobility impaired is through the use of handheld devices. In this case, handheld personal computers can activate technology from anywhere in the house.

2.2. Door Entry Systems

A smart home will be motorized door which opens for approved users by their thumb being scanned. The lights inside the home will be automatically on after the door opens and switches off, once the door is closed. Voice messages and commands can also be used to control the appliances. It can be fitted with locating device which follows the user into the different rooms of the house.

2.3. Speech Recognition and Fall Detection System

Teleherence system that uses web and phone technology to optimize care plans. It uses text-to-speech and speech recognition along with landline, cell, smart, SMS (text messaging), and VOIP phone technology. It can be very beneficial for the disabled who cannot manage themselves especially in the toilets. If a person falls accidentally and not in a position to get up, with their voice recognition activated, caretakers can be alerted.

One obvious use of the Teleherence system concerns medication management. Clients could be called as needed with instructions for taking medications. These calls could be followed 10 minutes later asking if the person took the pill. These follow-up calls could continue until a yes response was received. If the care plan objective concerned safety, a video for checking on home safety could be provided. These videos could be replayed as often as needed and rescheduled to reinforce the education whenever necessary. An additional use is to involve a client's support system in their care. For example, someone who visits the elderly person could be called periodically and asked for their input on how well the client is doing. If the discrepancy between what the client is reporting and what the support system person is reporting becomes too great, an alert could be triggered to the care manager or a more extensive check up survey could be triggered that tries to determine what is happening in this particular situation. Teleherence is able to chart responses over time and these charts could be available online to family or support group members

2.4. Emergency Calls/Alarm Systems

Although there are many systems are available, they may not come handy, if a disabled person falls accidentally, as they do not remember or have no proper knowledge to use them in such situations**.**

2.5. Wireless Technology

For example, vital functions (pulse, blood pressure, etc.) are read out in short time intervals using a wrist transmitter with a probe. The information is sent to an evaluation system, which automatically sends an alarm signal to the emergency service station, in case of strong deviations of standard values.

2.6. Entertainment

Smart home boasts an impressive array of smart devices that are connected to the homes network and are designed to monitor all aspects of daily life. Example of these devices includes a smart mailbox, capable of sensing when the post arrives, and a smart front door complete with RFID tag for keyless entry.

A smart home entertainment systems provide high quality audio and video distribution throughout your house. For example, the user can access his entire CD collection in every room via one music servers with the album cover art displayed on his touch panel. A standardized communication system between different AV devices allowing to control multiple compatible home entertainment devices from the TV to the Blu-ray player or home entertainment system – with just one remote. One needs to connect the devices together using HDMI cabling. Once connected, the devices will simply pair and recognize one another allowing your TV remote to control other compatible devices.

2.7. Wireless Sensors

The wireless sensor network is composed of a large number of sensor nodes consist of sensing, processing, transmission.

Sensor nodes coordinate among themselves to produce high-quality information about the physical environment. Each of these scattered sensor nodes has the capability to collect and route data either to other sensors or back to an external base station(s), mobile or tablets. A base station may be capable of connecting the sensor network to an existing communications infrastructure or to the Internet where a user can have access to the reported data

2.8. Body Sensors

Body sensor devices play an important role in healthcare applications, to obtain information of an elderly person or a patient's body condition. Actually there are two type's internal sensor devices and external sensor devices: Internal Sensor Devices: For internal types of body sensors, ingestible capsule and implanted sensors can be used.

2.9. External Sensor Device

External types of body sensors include wearable and detachable electrical signaling devices. For example, Pulse Oximeter sensor measures heart rate and blood oxygen saturation. For blood oxygen saturation, the sensor detects colors of beams based on hemoglobin molecules. The sensor uses two beams on finger or earlobe then calculates the amount of beam rejected by hemoglobin. Moreover, a heart rate is measured by contracting and expanding of blood vessels. Also, Electrocardiograph sensor checks the cardiac information. Sensors detect cardiac rhythm then electrocardiograph obtains the information signal from the contraction and extension of the cardiac muscle. In addition, skin temperatures are detected by dermal body temperature sensor.

2.10. Internal Sensor Devices

For internal types of body sensors, ingestible capsule and implanted sensors can be used. For International Journal of Application or Innovation in Engineering & Management (IJAIEM) Web Site: www.ijaiem.org Email: editor@ijaiem.org Volume 3, Issue 4, April 2014 ISSN 2319 - 4847 Volume 3, Issue 4, April 2014 Page 17 instance, a core temperature sensor embedded in an ingestible capsule that is easy to swallow can measure a core body temperature. Also, some implants sensor can check medical information by using implant chip. These may diagnose conditions such as Parkinson's disease and paralysis. The VeriChip [29] is a small RFID chip sized grain of rice that is implanted under the skin. In addition, Endoscope sensor that is swallowed by patient measures internal body conditions by using various kinds of information.

3.1. DTMF Technology

The DTMF stands for 'Dual Tone Multi-frequency' which is one of the techniques for converting the analogue signal to digital using DTMF decoder. The DTMF decoder circuit mostly used in mobile communications system which recognizes the sequence of DTMF tones from the standard keypad of the mobile phone. The main reason for the use of DTMF is that one can control a maximum of twelve (if 3x4 type DTMF keypad is used) to sixteen (if 4x4 keypad is used) devices simultaneously by means of a single remote system.

Figure 1

3.2. Principle

DTMF keypad is placed out on a 4 cross 4 matrices, in which each row represents low frequency, each column represents high frequency, with DTMF, and each key passed on a phone generates two tones of the specific frequencies one tone is generated from a high frequency tones and low frequency tone. These tones are converted to digital form using DTMF decoder circuit. These codes are the address of the destination which is read and preceded by the computer that connects the caller to the destination

If any button is pressed on the mobile phone keypad, then it will generate two frequencies. These tones are called row are column frequencies. Normally row frequencies are low frequencies and column frequencies are high frequencies. These column frequencies are slightly louder than the row frequencies to compensate for the high-frequency roll off of voice audio systems.

The main objective of this project is to control the home applications like light, electric fan or some electronic gadgets by using DTMF techniques. DTMF encoder is present in mobile

3.3. Procedure

When a key is pressed on the mobile phone while call is in progress, the other person will hear some tones corresponding to the keys pressed. These tones are based on the DTMF (Dual Tone Multi Frequency) technology. Data is transmitted as pairs of tones. The receiver detects the valid frequency pair and gives the appropriate BCD code as the output of the DTMF decoder IC.DTMF signal can be tapped directly from the microphone pin of cell phone device. The signals from the microphone wire are processed by the DTMF decoder IC which generates the equivalent binary sequence

Button	Low DTMF frequency (Hz)	High DTMF frequency (Hz)	Binary coded ou		
			Q1	Q2	Q3
1	697	1209	0	0	0
2	697	1336	0	0	1
3	697	1477	0	0	1
4	770	1209	0	1	0
5	770	1336	0	1	0
6	770	1477	0	1	1
7	852	1209	0	1	1
8	852	1336	1	0	0
9	852	1477	1	0	0
0	941	1336	1	0	1
*	941	1209	1	0	1
#	941	1477	1	1	0

Figure 2: Table showing DTMF Low and High frequency tones and decoded output

When a key is being pressed on the matrix keypad, it generates a unique tone consisting of two audible tone frequencies. For example, if the key '1' is being pressed on the phone, the tone that is heard consists of a 697 Hz & 1209 Hz sine signal. Pressing key '9' will generate the tone form by 852 Hz & 1477 Hz. The frequency used in the dial tone system is of audible range suitable for transmission over the telephone cable.

On the telephone exchange side, it has a decoder circuit to decode the tone to digital code. For example, the tone of 941 Hz + 1336 Hz will be decoded as binary '1010' as the output. This digital output will be read in by a computer, which will then act as an operator to connect the caller's telephone line to the designated phone line. The telephone exchange center will generate a high voltage signal to the receiving telephone, so as to ring the telephone bell, to notify the receiving user that there is an incoming call.

Digit	**Low-Group Frequency**	**High-Group Frequency**
1	697	1209
2	697	1336
3	697	1477
4	770	1209
5	770	1336
6	770	1477
7	852	1209
8	852	1336
9	852	1477
0	941	1336
*****	941	1209
#	941	1477
A	697	1633
B	770	1633
C	842	1633
D	D 941	1633

Table 2: High-Group and Low-Group Frequencies corresponding to the digits

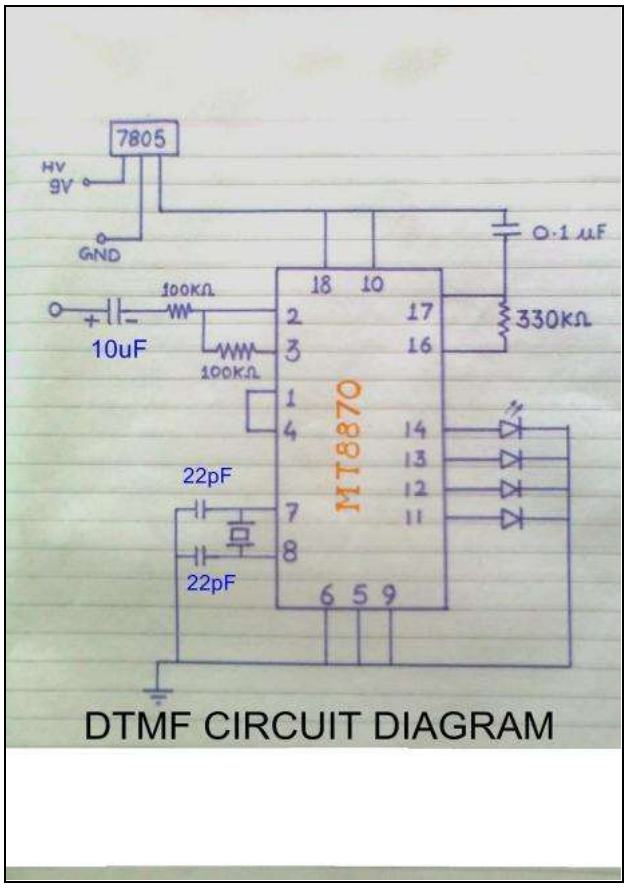

Figure 3

The MT8870 is a complete DTMF receiver integrating both the band split filter and digital decoder functions. The filter section uses switched capacitor techniques for high and low group filters; the decoder uses digital counting techniques to detect and decode all 16 DTMF tone-pairs into a 4-bit code. External component count is minimized by on chip provision of a differential input amplifier, clock oscillator and latched three-state bus interface

The Circuit:
The decoder IC is an electronics circuit which is consisting of an inbuilt op -amp and to separate low and high frequencies, the output of an operational amplifier is given to the pre-filters. And it passed though the code detector and frequency circuits. The tone which is generated from the mobile is sent through a capacitor and the resistor of the DTMF.

- Pin1 is a non-inverting pin, which is connected to the pin 4.
- Pin3 is the output of the operational amplifier, which is feedback to the pin 2.
- The pin 7 and pin 8 is connected to the crystal oscillator of both pins.
- Pin 15 is the data interconnection pin.
- The procedure of the signal from the frequency detection to digitalization, is done steering circuit that consists of resistor, capacitors, receiver and transmitter and etc.
- 11, 12 pins are output pins that are connected DTMF pins. Then DTMF is connected to relay.
- Relay output is connected pb0 and pb3 pins of microcontrollers.
- PD0, PD1 are output pins of controller that are connected to the relays.
- Relay output is connected to the load.

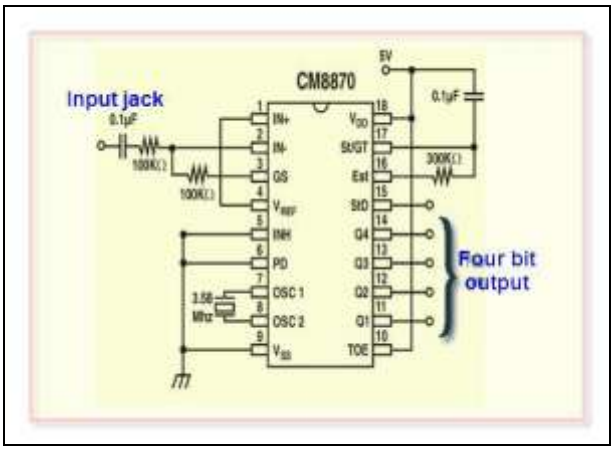

Figure 4

4. Present trends in India

Bangalore houses about 10 per cent smart homes in the total property market. The cost of a smart home largely depends on the accessories home owners choose to incorporate. This could range from lighting control and regulation systems, automatic curtain control functions, security and fault monitoring, operations, indication and visualisation, remote access and control to central automation, etc. Apartments with such accessories cost anywhere from Rs 1.5 to 4 crore.

Convenience is one of the biggest reasons that people build and purchase smart homes. ABB i -bus smart home systems offer enhanced energy-efficiency, for example, lights can shut off automatically when no one is in a room, the thermostat can be set to 'let the indoor temperature drop', during the day, before returning it to a more 'comfortable level', just before residents walk in.

Worlds Open Protocol ISO/IEC 14543-3 KNX www.knx.org

"About Us". Insteonsmartgrid.com. Retrieved 2009-11-20.

All of these automated tasks, along with modern, energy-efficient appliances, combine to save electricity, water and natural gas, thereby reducing the strain on resources. One can operate smart homes using an iPad/iPhone or a touch panel.

5. Future Scope

The house that can predict and make decisions in the absence of inmates is the new definition.

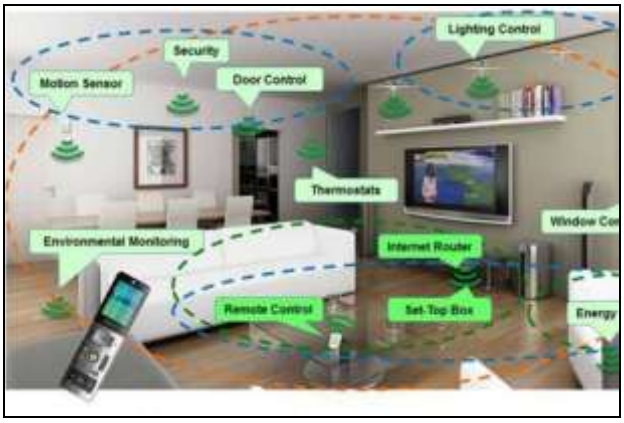

Figure 5

6. Smart Home Using ZIGBEE Technology

The smart home ecosystem will combine a variety of applications, with the set-top box acting as a centralized home hub. Not only will the set top box handle the entertainment such as television, movies, gaming and remote purchasing, it will also be the entry point for the home's phone, internet, telecommunications and Smart Home services.

7. Conclusion

DTMF controlled monitoring system offers a low cost, easy access solution. It is simple, economical and can be configured with password protection also**.** DTMF tones can be transmitted over GSM links and hence, we can control different devices over a large distance wirelessly. Power wastage is reduced if the devices can be switched off remotely when not in use.

By making use of a camera, we can also check the status of any appliance at home from a distant location, like an office for

example.

- Pin1 is a non-inverting pin, which is connected to the pin 4.
- Pin3 is the output of the operational amplifier, which is feedback to the pin 2.
- The pin 7 and pin 8 is connected to the crystal oscillator of both pins.
- Pin 15 is the data interconnection pin.
- The procedure of the signal from the frequency detection to digitalization, is done steering circuit that consists of resistor, capacitors, receiver and transmitter and etc.
- 11, 12 pins are output pins that are connected DTMF pins. Then DTMF is connected to relay.
- Relay output is connected pb0 and pb3 pins of microcontrollers.
- PD0, PD1 are output pins of controller that are connected to the relays.
- Relay output is connected to the load.

8. References

i. "About Us". Insteonsmartgrid.com. Retrieved 2009-11-20. Worlds Open Protocol ISO/IEC
ii. 14543-3 KNX www.knx.org"Home automation costs". Totalavcontrol.co.uk. Retrieved 2010-02-18.
iii. "U.S. Patent 613809: Method of and apparatus for controlling mechanism of moving vessels and vehicles". United States Patent and Trademark Office. 1898-11-08. Retrieved 2010-06-16.
iv. William C. Mann (ed.) Smart technology for aging, disability and independence : the state of the science, John Wiley and Sons, 2005 0- 471-69694-3, pp. 34-66"
v. Http://www.smartcomputing.com/editorial/article .asp? Article=articles%2
vi. Http://www.drdobbs.com/184404040;jsessionid= IM5NJPJYWXAOFQE
vii. Http://as.wiley.com/wileycda/wileytitle/productcd -0471711551.html
viii. Pingali, G. and Jain, R., "Electronic Chronicles: Empowering Individuals, Groups, and Organisations", IEEE International Conference on Multimedia and Expo, 2005, pp. 1540–1544.
ix. Hightower, J. and Borriello, G. "Location Systems for Ubiquitous Computing," IEEE Location Aware Computing, Aug. 2001.
x. Ullmer, B. and Ishii, H., "Emerging frameworks for tangible user interfaces", IBM systems journal, Volume 39, Numbers 3 & 4, 2000. [5] Want, R. and Weiser, M., "Activating everyday objects". Xerox PARC, Elizabeth Mynatt College of Computing, http://sandbox.xerox.com/want/papers/ aeo-nist-jul98.pdf [6] Abascal, J., "Ethical and social issues of the 'teleservices' for disabled and elderly people" in Berleur, J. and Whitehouse, D. (Eds.) "The Ethical Global Information Society. Culture and democracy revisited". Chapman and Hall, 1997. [7] Intelligent control Pingali, G. and Jain, R., "Electronic Chronicles: Empowering Individuals, Groups, and Organisations", IEEE International Conference on Multimedia and Expo, 2005, pp. 1540–1544.
xi. Hightower, J. and Borriello, G. "Location Systems for Ubiquitous Computing," IEEE Location Aware Computing, Aug. 2001.
xii. Ubiquitous Computing," IEEE Location Aware Computing, Aug. 2001.
xiii. Ullmer, B. and Ishii, H., "Emerging frameworks for tangible user interfaces", IBM systems journal, Volume 39, Numbers 3 & 4, 2000.
xiv. Want, R. and Weiser, M., "Activating everyday objects".
xv. Xerox PARC, Elizabeth Mynatt College of Computing,
xvi. http://sandbox.xerox.com/want/papers/ aeo-nist-jul98.pdf
xvii. Abascal, J., "Ethical and social issues of the 'teleservices' for disabled and elderly people" in Berleur, J. and
xviii. Whitehouse, D. (Eds.) "The Ethical Global Information Society. Culture and democracy revisited". Chapman and Hall, 1997.
xix. http://www.polar-electric.com/DTMF/Index.html
xx. "Home automation costs". Totalavcontrol.co.uk. Retrieved 2010-02-18.
xxi. http://www.deccanherald.com/content/372941/da wn-smart-home-era.html