A Review of Home Automation using IoT Applications

H. Santhi, Gayathri.P

School of Computing Science and Engineering, VIT University, Vellore, TamilNadu, India.
hsanthi@vit.ac.in, pgayathri@vit.ac.in

***Abstract*-One of the topics sudden interests gaining popularity day by day is that of home because of its innumerous advantages. One can achieve home automation by simply connecting home appliance and electrical devices to the internet or cloud. The reason for this surge in demand of network enabled home automation is reaching the zenith in recent days for its simplicity and comparable affordability. Platforms based on cloud computing help to connect to the things surrounding everyone so that one can find it easy to access anything and everything at any time and place in a user friendly manner using custom defined portals. Hence, cloud acts as a front end to access IoT. In addition to that, with the never-ending growth of the Internet and its applications, there is much potential and scope for remote access and control and monitoring of such network enabled appliances. Even so, the exciting opportunities to increase the connectivity and relationship of home devices for home automation purposes to the internet are yet to be.**

Keywords: Home Automation; IoT; Internet of Things; Bluetooth; Cloud

I. INTRODUCTION

Safety mechanisms of home appliances and office rooms have utmost importance in modern technology. Home automation or automation of an office is done so with electronics and communication advancement. Fire breaks are to be suppressed well before it reaches the point of creating havoc. Gas leakage is another serious issue to be considered that home automation can suppress by early warning or alert. A sensor eye could be kept to recognize the fire and gas related issues.

Sirisilla Manohar and D. Mahesh Kumar (2015) have stated in their paper that with the increase in development of wireless technologies in communication, integrated circuits, and microelectronic technology, the Wireless Sensor Networks (WSN) has progress greatly. WSN has now combined sensing, communication and computation to a single unit making it possible to use a device with wireless communication.

Mamat Khatu, Neethu Kaimal, and Syedali Azman Rizvi (2015) had a vision to maximize automation by reporting an effective implementation for Iot (Internet of Things) used for monitoring of domestic conditions by ways of ubiquitous low cost sensing system. They mentioned it would create a relay of machines minimizing human intervention with ease of access using remote devices.

A. Advantages
- Error probability reduced
- Ease of access and low cost and power consumption
- Can reduce human effort
- Smarter processing and services
- Can be implemented at any device and automated
- Alert system is quick in case of an emergency
- Eliminates the use of PC for automation
- Helps old age people to control the remote devices
- Simple interface

B. Disadvantages
- Replacing humans is dangerous
- May take time and learning
- Security concerns
- Vulnerable to attacks
- Most of the times range is restricted
- High dependency on sensor devices which makes the system vulnerable if sensor fails

II. RELATED WORKS

Akbar Satria et al. (2015)in their paper have discussed about a device using arduino microcontroller ATmega, Measuring Tool Power and Ethernet Shield. The device is activated with the support of a 5V AC power supply which is converted to DC. The device can then communicate to a smart phone using the Internet. This enables the user to control the device using his phone.

K. Vidyasagar et al. (2015) in their work have taken the use of an MQ-5 Methan Liquid propane gas sensor to sense the presence of Ammonia. This element adsorbs it after ionizing to its constituents. The gas sensor outputs a 4.6V signal when ammonia is detected.

To detect fire a device was constructed where hydrocarbons would burn than other regular combustibles with flammable temperature thresholds. Again ionization is used to detect the fire using smoke sensors. With the help of calculating the interruptions of the free flow of electrons, the presence of smoke is detected. It is followed by a voltage drop at the pins of the sensor.

Rajeev Piyare(2013) mentioned a system in his paper comprising a low cost home monitoring device. The architecture is made up of three parts, Home Gateways, Environment and Remote Environment. Modules of this system were micro Web servers, hardware interface and a software package. Effectively this device will control light switches, temperature sensors, etc.

B. Muralikrishna et al.(2015) had summarized that with the help of any smartphone with a stable Bluetooth connection, home automation can be achieved. The design and construction of the device uses XILINX ISE, Embedded Development Kit, Xilinx Platform Studio (XPS) and a Bluetooth Module (HC-05).

J Sri Varshini et al. (2015) customized a device using RF Module, Xilinx FGPA and a simplified DES algorithm for encrypting data. RF Module is used because of the limited frequency range of 434MHz. We use FGPA to decrypt the encrypted data. The transmission is via an 8-bit transmission line where multiple appliances can be communicated in relay. It also takes the help of the Zigbee Modules.

Pooja N.Pawaet al. (2016)talk about how a Bluetooth module, power supply and a simple crystal circuit with the help of a microcontroller and a display can implement Home Automation. Figure 1 describes the process of Bluetooth based home automation.
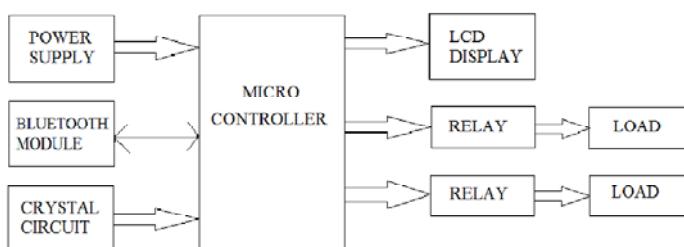

Figure .1Process of Bluetooth home automation device

Daniele Sora (2015) in her works mentioned the use of simple electromagnetic relay with just a coild of wire tightly wound around a soft iron core calculating when to switch on/off based on the flux.

Subhajit Dey and Mili Sarkar (2015) talk about an automatic way of controlling household devices through self control system and human interaction via wifi enabled Cellular devices or a PC. These devices depend on output from their respective sensors thus making them fully automatic as well as increase in its security mode.

Amrutha S et al. [2008] aim to achieve a fully secure, easily adaptable and flexible Home automation system with cost efficient features. Its working is fully based on voice recognition sensors and sms technology and has achieved accuracy of around 75%.

Rahul Godhaet al. (2014) aims towards connecting various sensors all together to form a unified secure and fully automatic system and thus increasing the number of devices connected to the World Wide Web by using wireless communication and low cost sensing devices.

Kaushik Ghosh et al.[2015] have tried to make human life much more comfortable by decreasing human interference with technology by making it fully automatic and eligible to follow voice commands and reminders. This type of technology is much useful for people having disabilities since it provides a secure and flexible environment.

Abhay Kumar and Neha Tiwari (2015) aims to reduce the energy required by home appliances by using energy efficient and managing devices operation modes. They used wireless sensors to collect information such as temperature and weight according to the presence of user in specific room. This device also predicts user's behavior and make necessary changes.

Vishwajeet H Bhinde (2014) aimed at the need of smart and fully automated monitoring condition using Sensors such as light, temperature, humidity sensor used to provide necessary data to automatically adjust comfort level in the home. This provides a lot of advantage in the use of IOT in smart home system.

R.Harinath and S.Santhi (2015) aims to provide solution for Increasing demand of Automatic Home Automation via global System Messaging based controlled using Android mobile phones for secure device control system. This Device will make programming home application system much easier for developers.

P Bhaskar Rao and S.K.Uma (2015) wrote on use of microprocessor and microcontroller to control and monitor usage of appliances using smartphone. They focused on helping handicapped or elderly people to live a more independent life by operation home appliances with their smartphones rather than depending on someone's help.

TABLE I. Comparative analysis of IoT in Home Automation

Reference Id	Problem Addressed	Methodology/Technique used	Merits	Demerits
[1]	Integration of home automation system through IoT	Designing a home automation through reading the internet of the client	Can reduce human effort Error probability reduced	May take time and learning Replacing humans is dangerous
[2]	Internet of Things and Cloud computing can work together can solve the Big Data problems	Used of low sensing system which would effectively create a relay of machines that provide response to each other and require the minimum human interaction	Smarter processing and services Smarter resource sharing	Security concerns Vulnerable to attacks
[3]	Automating the home appliances via Bluetooth in Smart devices	Automation of the home appliances using Bluetooth in smart phone and its implementation	Readily available Can be implemented at any device and automated	Works in the range of bluetooth
[4]	To enable user gain access to electronic devices via their smart phones	To solve the addressed problem the author has developed an app through which the devices will be controlled.	Easy interface and usage.	Others can use the same app too. Functionality depends upon the features in the phone.
[5]	Home monitoring through home system	The proposed system is implemented in two parts software and hardware and both are integrated to get the desired home automation system.	Devices and environment can be controlled Increases life quality for the elderly	Relies heavily on the knowledge of the use of smart phones
[6]	Bluetooth based home automation using FPGA	HC-05 is the Bluetooth module used to control the appliances that are connected to FPGA board	Help elderly Alert system is quick in case of an emergency	Range is not too big May function improperly in some cases.
[7]	RF module based home automation	The RF module which implements through FPGA board uses multi loop technology	Involves low cost Low power usage Less complexity	Design process is difficult as it involves cryptography
[8]	Use of android application to communicate with cloud services	The system is implemented through use of wireless sensor networks and then connecting them.	Eliminates the use of PC for automation	High dependency on sensor devices which makes the system vulnerable if sensor fails
[9]	Home automation system for the elderly	The proposed system is implemented through XBee transceivers that maintain RF wireless communication between master control panel board and	High performance Use of sensors creates high awareness in the users	The transceivers may intercept signals from other devices and stop functioning.

			remote cotrol
[10]	Home automation system using Bluetooth and GSM	The proposed is implemented through a mobile application and interfacing that with the mobile device through Bluetooth and GSM	Helps old age people to control the remote devices Easy to use interface	Range is limited Signal might be weak sometime which may lead to improper functioning
[11]	Cloud based home automation system	This system is implemented using Digilent chipKIT Uno32 and Arduino Uno.	Can be accessed via internet from anywhere in the world.	Pubsubclient library is not available for all chipsets used
[12]	Home automation for renewable self energy consumption.	The proposed solution is based on a device, that enables a change electric energy source system such as both photovoltaic and classical energy grid.	Energy consumption is reduced and this power is utilized further	Difficult to design the electrical circuit and the switch relay
[13]	Implementing home automation using cloud services and Bluetooth devices.	The system is implemented through Pachtube service which allows sophisticated applications and graphs to be built off user's data points	System's dependence on mobile service provider is decreased	Since it involves cloud networking the data may be susceptible to hacks and threats
[14]	Application of remote Bluetooth system for elderly	In this system when we operate the loads on app in the mobile that information will be passed to the microcontrollers via Bluetooth module and the right amount of load is activated through relay	User authentication is required so its safe	The interface developed might not be that user friendly also the ide used to develop require in depth familiarity
[15]	HAS using android	The system is implemented using android platform with including Bluetooth APIs and microcontroller AT89C51	Doesn't use air time Rich features	Range is not that good
[16]	Need for automation of the surrounding environment.	Personifying use of mobile phone, using Home Automation System (HAS) by automating an 8 bit Bluetooth interfaced microcontroller.	Allows increasing human work efficiency and comfort hence HAS furnishes a good paradigm for any Automation System	Can't be operated from remote area
[17]	Problem faced by visually challenged in operating home appliances.	The Use of Micro electromechanical Systems (MEMS) accelerometer for sensing the accelerations of hand in motion in the three directions that is (x, y, z) and finally using Radio Frequency (RF) protocol to transmit to wireless sensors.	This product will improve the quality of life of all the people with disabilities	Focused on specific number of people.
[18]	Energy crisis due to increase in per capita resource consumption.	Use of Linky (ERDF project - France) for exchange of sensor information among smart grid network and devices within the house	Continuously monitor and optimize the smart grid network so as to increase overall energy efficiency.	High cost and less throughput
[19]	Problem faced by visually challenged in	The system will consist of a relay circuit,a voice recognition	Enables people suffering from	The voice recognition

	operating home appliances.	module, an adjustable bed and anArduino uno microcontroller. The voice will command the Arduino drives to correspond load.	quadriplegia or paraplegia to control various home appliances just by the voice commands according to the need and comfort.	module needs to be trained initially so that it can be used to recognize commands
[20]	Energy crisis due to non utilization of renewable sources of energy.	Using ZigBee technology to monitor energy used by home equipments and power line communication .	Efficient energy saving resulting in energy cost reduction	High cost and less throughput
[21]	Need of security mode in fully automated home devices	Using PC and mobile phone to control home appliances automatically and receiving safety messages.	The owner gets alerted when any intruder enters when the system is online	Lead to high energy consumption
[22]	Increasing need of devices with artificial intelligence to improve lifestyle of people.	Flexible , secure and adaptable home appliance controlling device via voice recoganization and SMS technology	Increase human-technology interaction to ease our day to day work	Less signal strength and can't be used from remote location.
[23]	Need to fulfil privacy and security concern while building home security systems	Access control for home application devices so as to connect various sensors into a unified secure system.	Formation of an integrated system consisting of various sensors interconnected via wireless medium.	Might interfere with working of home appliances
[24]	Increasing need of devices with privacy requirements fulfilled.	Attracting with remote appliances using web connectivity, arduino and IP connectivity.	This technology will make human life easier and much more comfortable	High Cost factor
[25]	High wastage of energy in home devices due to inefficient managing devices	Wireless sensing element is used for observing parameters such as temperature and weight due do user's presence.	Optimizing energy consumption by home appliances while conforming comfort level	Can't be used in mass market
[26]	Need of smart and fully automated monitoring condition.	Sensors such as light, temperature, humidity sensor used to provide necessary data to automatically adjust comfort level in a home.	Gives a lot of advantage in the use of IOT in smart home system	High energy consumption.
[27]	Increasing demand of Automatic Home Automation	Global System Messaging based controlled using Android mobile phones for secure device control system.	Device will make programming home application system much easier for developers	Requires short message service for communication
[28]	Requirement of cheap and flexible home control system.	Use of microprocessor and microcontroller to control and monitor usage of appliances using smartphone.	Doesn't require PC connectivity and offer complete communication protocol.	Only operates when devices are at remote location.

[29]	Need to unify security systems to secure access over personal information .	By applying access level code to each device connected to the sensor and thus maintaining a centralized database.	More home appliances can be connected can be connected to the internet easing their software updates.	Can word for only devices located at remote area
[30]	Requirement of data transfer among client and various home appliances via web	Using light weight Constrained Application Protocol to enable secure transfer of data file among actual motors, wireless sensor and respective gateway.	Enables the user to completely monitor and control each and every functionality using actuator modules	High cost factor

III. CONCLUSION

Home automation or automation of an office is done so with electronics and communication advancement.Platforms based on cloud computing help to connect to the things surrounding everyone so that one can find it easy to access anything and everything at any time and place in a user friendly manner using custom defined portals. Hence, cloud acts as a front end to access IoT. So, the exciting opportunities to increase the connectivity and relationship of home devices for home automation purposes to the internet are yet to be.

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