SMART AUTOMATION SYSTEM BASED ON WIRELESS AND IoT

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ABSTRACT

Today technologies have changed every aspect of comfort & luxury. Our residential solutions for lighting, safety, audio and video, energy management reflects the superiority in terms of next generation technology which offers safety and comfort. Smart Automation will help you in realizing your dreams and imagination with the help of wireless technologies. The purpose of home automation system using internet and wireless networks is to control the parameters like voltage, current and temperature and monitor it. It helps to improve the performance of control network. IoT (Internet of Things) is fast rising technology which involves interaction among object (things) through internet without human interference. The main objective of using smart automation based on wireless and IoT is to reduce the unnecessary energy consumption of smart home.

Keyword: - *Smart automation, Internet of Things (IoT), Wireless, Energy control, Sensors, Smart living.*

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1. INTRODUCTION

In the past decade, due to the increase in high speed communication networks and increased Internet use, interest in the smart home has grown. The concept of smart home is the environment where information technologies are being employed to assist and support people everyday activities [2]. Smart-houses, which are houses equipped with highly advanced automatic lighting systems, temperature control system, security control mechanisms and many other functions, can be seen everywhere in the world [1]. The importance of building an automation system for an office or home is increasing day-by-day with numerous benefits. The researchers and industrialist are working to develop efficient and affordability automatic systems to monitor and control different machines like lights, fans, AC based on the requirement. Automation fundamentally efficient for use of the electricity and water and reduces much of the wastage and it is also economically beneficial. It has made human life easier and comfortable. Now day's digital devices in home are increasing rapidly due to which there is a need of accessing and controlling the devices remotely.

Internet of Things (IoT) implements the idea of remotely connecting and monitoring real world objects (things) through the Internet. Automation is one of the key applications of IoT. IoT is a network system consisting of electronic devices, software, sensors and networks that connect all concerned network entities together to make the system more valuable and able to provide many more services to users [3]. When it comes to our house, this concept can be appropriately incorporated to make it smarter, safer and automated. The IoT projects focused on building a smart wireless home automation system which sends alerts to the owner by using Internet in case of any intrude and raises an alarm optionally. IoT is a trending concept in which the machines or things are made to interact with the environment by exchanging data and information sensed by the sensors. The devices collect information and data from the surrounding environment by using various latest technologies and then there is a data flow between devices. Typically, IoT provide a variety of protocols, domains, and applications and advanced connectivity of devices, systems, and services which is ahead of machine-to-machine communications (M2M).These protocols and domains are works under the environment of IoT. In all nearly fields of automation right from smart grid to the areas

of smart cities the interconnection of these embedded devices will be very useful. IoT is a concept which is expected to rule the world within a few years.

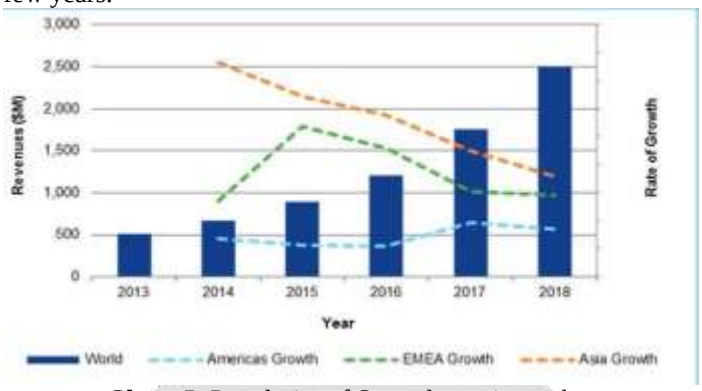

Chart-I: Popularity of Smart home in market

Chart-I shows projected trends in the smart home market in the coming years. The popularity of the smart automation system increases rapidly day by day. Asia-Pacific expected to grow at the highest for smart home market between 2016 and 2018 America is the current leader in the smart homes market, followed closely by Europe and the Asia-Pacific region. The smart homes market is set to achieve double digit growth in developing countries over the next few years.

1.1 Challenges of Home Automation System

There are some of the challenges faced by home automation systems.

- There are cost related issue include high development costs ,high manufacturing costs, high costs of installation, additional service and support costs.
- There is a lack of home automation standards, consumer unfamiliarity with technology, and complex user interfaces.
- It is difficult in achieving security, presence based access mostly sufficient, devices with most security concerns.

With the advancement of time, rapid development in technology and processing power which leads to a significant reduction cost and size of devices. All of these factors have contributed to the popularity of electronic devices today, so people are no longer confused or unsure about the use of the computer, mobiles, or tablets.

2. Literature survey

There are many researches has been made on the home automation system and the use of wireless networks and IoT in the home automation. The first time in 1960s people noticed the high technology in dwelling (house), they did some connection with home automation. Experts measured that by the end of the century people would live in smart homes that contained self-governing domestic machined. Many of the machines in these visions are today technically possible to manufacture of course event though, the present situation is not exactly the same as what the expert's decades ago. From 1980s, many Japanese firms make available their own home automation blueprints, developed demonstration houses and launched proprietary systems [2].

Sriskanthan and Tan Karande in their work have presented an application of Bluetooth Technology for Home Automation. The Bluetooth technology which emerged in late 1990's is used for implementing the wireless home automation system. Different appliances such as air conditioners, home theatres, cellular phones etc., are interconnected, thus creating a Personal Area Network (PAN) in Home Environment. The communication made between several client modules and the host server takes place through the Bluetooth module. But the system does not use the trending mobile technology [8].

Shopan Dey, Ayon Roy, Sandip Das have developed an internet based wireless home automation system for multifunctional devices. They introduce convenient, low cost, wireless solution for the home automation. The revolution of the preliminary simple functionality control mechanism of devices to more complex devices has been discussed. The home appliances are connected through a server to a central node [6].

M. Agalya, S. Nancy and R. Selvarasu have presented the design and implementation of a low cost, flexible and wireless sensor networks solution to the home automation. The system uses Bluetooth technology where the cell

phone is used for interaction between the host server and the client modules. This wireless system can be used by any appliances that need On-off switching applications without any internet connection. There is some drawback of this wireless communication system was found i.e. it support the limited range less than 50m in a concreted building and maximum of 100m range in an open range. The system supports only the symbian OS cell phones [10]. Shahriyar, E. Hoque, M. Akbar, S. Sohan, I. Naim, and M. Khan presented a GSM based communication and control for home appliances. Different AT commands are sent to the Home Mobile for controlling different appliances. The drawback of this system is that a Graphical User Interface (GUI) is not provided to the user. Different AT commands have to be remembered by the users to control the connected devices. Also, the system supports Java enabled mobile phones. The system thus becomes less functional as now-a-days the use of Java enables phones are reducing and the use of Android phones are increasing tremendously [9].
The development of sensor and communication technologies enables the ubiquitous sensing in many living areas of human beings in the first decade of the 21th century. This integration of sensor and communication technologies, known as Internet of Things (IOT) [5], provides the ability to measure and evaluate environmental indicators.

3. Automation system using wireless and IoT

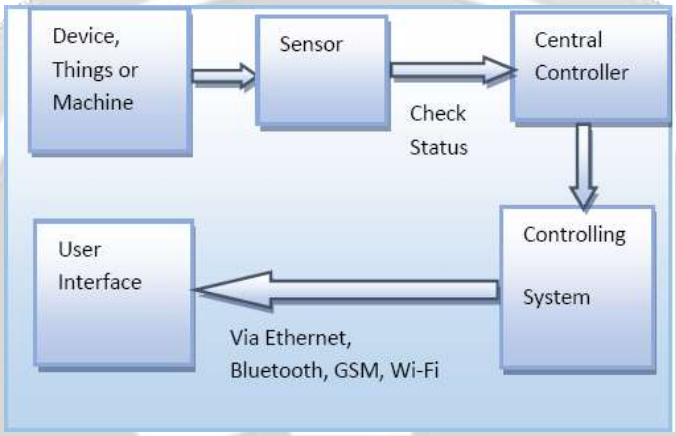

Figure-1: Basic block diagram of home automation

With the use of new technology, Smart automation system makes the household activities more easy, convenient, comfortable, secure and economical. Fig, 2 shows the basic block diagram of home automation, main components of home automation system include:

- **User interface:** that can give orders to control System example monitor, computer, or phone, etc.
- **Mode of transmission**: wired mode (using Ethernet) or Wireless mode (using radio waves, infrared, Bluetooth, GSM) etc.
- **Central Controller:** hardware type of interface which helps to communicates with user interface by controlling home services.
- **Electronic devices**: those are compatible with the transmission mode, and connected to the Central control system (Example a lamp, an AC or a heater, etc.)

3.1 How Wireless Home Automation works

Wireless overcomes distance barriers. Wireless Network simply put, the farther the signal travels, and the more likely it is to degrade. Developers recognized as they designed the new wireless specifications that the distance barrier was broken by making each active device a repeater. Each active wireless home automation device repeats every signal it hears. To achieve this various methodologies used by the different manufacturer. The result is longer distances the signal can travel. The first step to start with home automation is choosing a networking technology. There are some popular technologies used for home automation which are X-10, UPB, INSTEON, Z-Wave, and ZigBee.

X10: has long been the standard by which other home automation technologies are measured. X10 works via home's power line wiring and may experience problems related to wiring distances, phase differences, and line noise. Many enthusiasts believe X10 technology has become outdated and it replaced by the newer and more

adaptable wireless technologies.X10 devices can be more complicated to configure and performance is sometimes unreliable so if you don't know how to use automation and you want to use it then it is good idea to start with some another technology.

UPB: Universal Powerline Bus (UPB) is quite similar to X10 but it is advanced powerline technology to X10. It uses the built-in wiring in home to transmit home automation control signals. It is developed to overcome many of the drawbacks of X10. UPB is not compatible with X10. If you have X10 compatible products and you want your UPB and X10 compatible products to work together you will need a controller that talks to both.

INSTEON: INSTEON is designed to provide connection in between wireless home automation to powerline automation. The INSTEON devices communicate over both power lines and via wireless. INSTEON is compatible with X10, by adding feature of wireless to an existing X10 network. Finally, INSTEON technology supports even home automation novices: even non-technical individuals can set up and add devices to the network.

Z-Wave: This is the original wireless home automation technology; Z-Wave itself set standards for wireless home automation. By making all devices double as repeaters Z-Wave extended the usable range of home automation. Its increased network reliability also enabled commercial applications. The devices of Z-Wave are designed for ease of setup and use. These are come about as close to the main key as the home automation industry allows, especially helpful for beginning enthusiasts.

ZigBee: Similar to Z-Wave, ZigBee is strictly a wireless home automation technology. The technology has been slow to gain acceptance with home automation enthusiasts largely because Zigbee devices commonly have difficulty in communicating with those made by different manufacturers. Zigbee is not recommended for those who are new to home automation unless they intend to use only devices made by the same manufacturer. There is a limitation of distance or range of signals that can be sent and received between components and some security related issues while using wireless home automation system.

3.2Home automation using wireless and IoT

To overcome the problem of limited rang the IoT provides the solution i.e. Devices to connect sensed and controlled remotely across a network infrastructure. The IoT technologies although have evolved recent years, most of the earlier work steered towards adopting the IoT technologies for extremely resource contained nodes like the sensor network node that simply sends collected data to base station and a little work done on applying IoT technologies into embedded devices around human beings including customer appliances [3]. In this evolutionary field of IoT, there are a lot of sensors present which the user needs to have control. To control these sensors a virtual device must be created which in turn provide portability by abstracting each devices and operating systems [5]. The need for the Internet of Things (IoT) technologies for automation system has increased day by day due to the increase in the demand of communication between the home and the outside world. The Key technologies that will drive the future IoT will be related to Smart sensor technologies including WSN, Nanotechnology and Miniaturization.

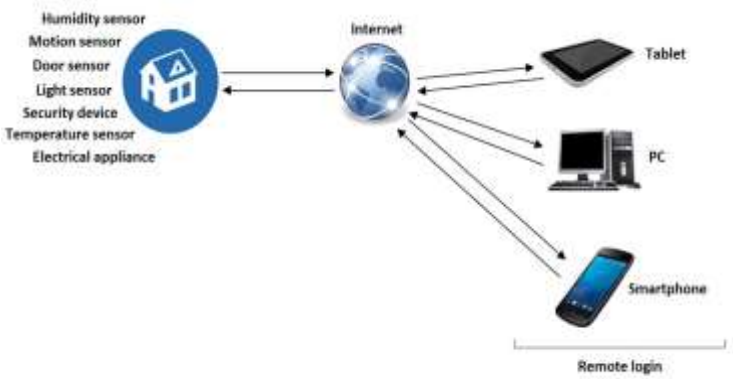

Figure-2: Home automation system using IoT

Figure-2 shows the three layer structure of IoT present by China Communication Standards Association.

- The first layer is the sensing layer mainly used for collecting information example humidity sensor, door sensor, etc.
- The second layer is the network layer used for information transmission and processing by using internet or any other network.
- The third layer is the application layer used for decision making and storage.

The peak advantage of this model is that:

- The functionality of an array of electrical and electronic devices can be controlled with ease.
- Sometimes the busy life and traffic makes it difficult for us to be at work and to be at home at the same time. One of the features of IoT automation makes it possible as it provides home system accessing remotely saving a lot of time.
- Another feature is that turning of lights and fans and other electronic and electrical devices remotely if they are not in use helping to manage the energy consumption of that home.

In addition to that it provides absolute security.

To control these appliances remotely smart devices needs to be synchronized with the main server. The user may use the login id and password to change the status of any appliances saving time, energy and money.

4. Conclusion

The Home Automation System based on wireless and Internet of Things enhances security and supports monitoring and control of devices from any remote location. There are a number of do-it-yourself (DIY) platforms existing for creation of Home Automation system quickly and easily with high performance and low cost. In this explained different home automation system e.g. Web based, Bluetooth-based, email based, mobile-based, IoT over cloud-based. It would be extended to the large-scale environment such as colleges, offices and factories etc. In future home automation will smarter and faster. This Home Automation System is better than all traditional existing Home Automation Systems.

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