Smart Home Automation

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Abstract— The "Home Automation" concept is an approach to wirelessly control the home appliances. The terms "Smart Homes", "Intelligent Homes" are associated with this kind of system and has been used to introduce the networking concepts based appliances and devices in the house. Smart homes and home control system ideas have grown along with the enhancement in technology and the constant improvement of the living standards of humans. Home automation Systems represents a great research opportunity in developing new ideas in the fields of engineering, architecture and computing. The people using home automation can access the use of appliances anytime and from anywhere, making our houses become more and more automated and intelligent. The Smart Energy initiative fulfils these abundant needs by providing an adoptable and sustainable experience by linking new and useful digital technologies to the requirements of consumers.

Keywords—Home Automation System, Sensor,User Fiendly,Microcontroller

I. INTRODUCTION

Automation is a technique, practice, or system of functioning or controlling a hardware process by electronic devices with the decrease in human involvement to a minimum. The elemental for building an automation system for an homes, offices or factories is increasing daily with various benefits. Industrialists and researchers are working upon constructing an efficient, optimised and affordable automatic system to track and control different machines like lights, fans, AC as well as functionalities like door locking and security based on the requirement. Automation makes not only a productive but also an economical use of electricity and water resources and confines wastage.

IoT allows people and mechanisms to get connected anytime, from anyplace and with anyone, supremely using any network and any service to the users' benefit. Automation is another very significant implementation of IoT technologies. It is the observance and tracking of the energy utilization and controlling the work-environment in buildings, schools, offices and museums by using different types of sensors and actuators that track lights, temperature, and humidity.

As the smartphones are continuously increasing in its trendiness and also because of its smooth functionality the demand for advanced and responsive mobile applications is increasing day by day in people's daily routine. Web services utilization is the most extensive and also a feasible way for providing remote service access or driving the applications to make them communicate with each other.

II. HOME AUTOMATION

The home automation popularly referred to as Smart Home is the residential extension of building automation and pledges to control and monitor the lighting, heating, ventilation, air conditioning systems (HVAC), appliances, and security. The home automation system comprises of the following primary components mentioned below:

User interface: as a device like a computer, or smartphone, for example, that can give orders to control System.

Mode of transmission: wired connections (example Ethernet, Fiber optics) or Wireless (radio waves, Bluetooth, GSM) etc.

Central Controller: It is hardware interface that communicates with user interface by managing and changing domestic.

Electronic devices, such as a lamp, an AC or a fan, which is compatible with the transmission mode, and connected to the Central controller. In the implementation of home automation using raspberry pi the mobile device play an important role. The mobile technology provide essential surveillance to our home and make it smart.
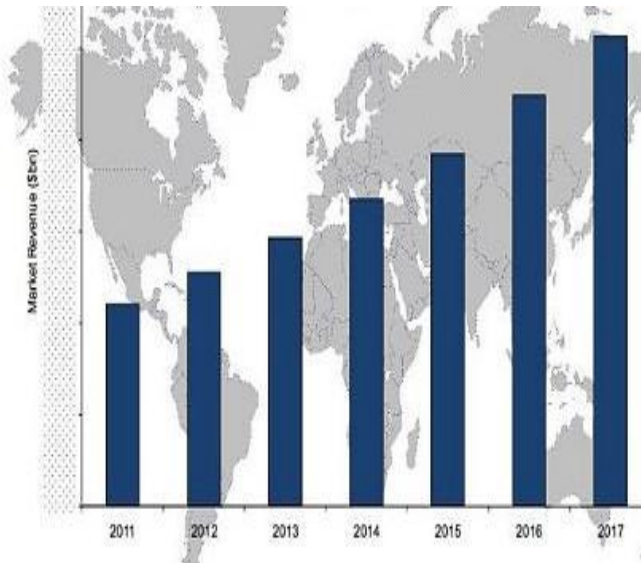
Figure 1: : Popularity of Smart Home in market

III.   FEATURES

In recent years, wireless systems like Remote Control have become in demand in household networking. Also in automation systems, the use of wireless technologies dispense several advantages that could not be attained with the use of a wired network only. Some following are better explanation of this:

1)Reduced Installation Cost :
Installation costs are suggestively reduced since no cabling is necessary.

2) Internet Connectivity:
Control appliances from anywhere in the world with the use of mobile phones to control smart home.

3) Expandable:
With the Equate of Wireless network is especially useful when, due to New or changed requirements, an extension of the network is necessary.

4) Security :
Easily add appliances to generate an cohesive smart home security system and built-in security ensures integrity of smart home.

The work of John J. Greichen [12] debated some of the early challenges faced by home automation systems. These contain high manufacturing costs, large development costs, high installation costs, added service and support costs, lack of home automation standards, consumer unusualness with method: technology, and compound user interfaces. With the progression of time, fast development in technology and processing power which leads to a significant reduction in device cost and size. All of these aspects have added to the popularity of electronic devices today, so people are no longer confused or hesitant about the use of the computer,

mobiles, or tablets. By using GSM Module we can sends the messages of help to the people.

IV.   SYSTEM DESIGN

In this section, are discussed different Home Automation System with their technologies and the features, benefit and limitations they have.

The Home automation system that uses Wi-Fi technology consists of three main components; web server, which represents system core that controls and monitors users' home and hardware interface module (Arduino PCB (ready-made), Wi-Fi shield PCB, 3 input alarms PCB, and 3 output actuators PCB.), which provide suitable interface to sensors and actuator of home automation system. The System is better from the scalability and elasticity point of view than the commercially available home automation systems. The User may use the same technologies to sign in to the server web based application. .If server is connected to the internet, then the remote users can access the web based application through the internet using their suitable web browser.

The application has been developed based on the android application system. An interface card has been developed to ensure communication between the remote user, server, raspberry pi card and the household appliances. The application has been installed on an android based smartphone, a web server, and a raspberry pi card. Android application on the smartphone issues instructions to the raspberry pi card. An interface card has been included to update signals between the actuator sensors and the raspberry pi card.

Cloud-based household appliance monitoring and controlling System is designed. Design and implementing of a home gateway to collect metadata from home appliances and sending it to the cloud-based data server to store on HDFS (Hadoop Distributed File System), processing them using MapReduce and using it to provide a monitoring function to Remote user are primarily included.

Arduino microcontroller is to accept user commands to execute through an Ethernet shield. Our household network uses together both wireless ZigBee and wired X10 technologies. This system trails a smart task scheduling with a heuristic approach for the Resource-constrained-scheduling problem (RCPSP). The mobile device can be either wired to the central controller using USB cable or communicated with it wirelessly, within the scope of the home. Arduino contains the web server application that interfaces through the HTTP protocol with Web-based Android application. The system is highly agile and scalable and aso expandable.

The household network which supervises the appliances and sensors and transmits data to the cloud-based data server which manages the information and delivers services for users by transmitting data and receiving user commands from mobile application. The planned system has good modularity and configurable features with very low power consumption in cost and energy efficient way.

Application developed using the Android application development platform is controlled and monitored from a remote location using the smart home app and an Arduino Ethernet based micro web-server. The sensors and actuators or relays are directly interfaced to the primary controller. Proposed design proposals are the control of energy management systems such as lighting, heating, ventilation, air conditioning, security, fire detection and intrusion detection with siren and email notifications.

Embedded system Raspberry Pi is to serve as a communication doorway between mobile devices and Konnex-Bus (KNX) home automation systems. Store the information of all appliances and sensors within a Smart Home, instead of using separate profiles. This ensures energy-consumption to get reduced, compared to a standard desktop computer.

Compassion of System :
Here is the comparison of different home automation systems by considering its Central Microcontroller, Communication interface, User interface, provided features and their benefits.

Evolution of System :
i)Raspberry Pi:
It is a credit-card-sized single small microcontroller computer.

Python is the primary programming language. It is easy to learn and is fairly suitable for real world applications. There are two major types of Raspberry pi- first one is Model A has 256 Mb RAM, 1 USB port and no network connection and Model B has 512 Mb RAM , 2 USB ports and 1 Ethernet port. It has a Broadcom BCM2835 system on a chip which substitutes an ARMl176JZF -S 700 MHz processor, Video Core IV GPU, and a micro SD card. The chip precisely offers HDMI and there is no VGA support. Arduino can positively work with Raspberry Pi Computers.

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Figure 2: Raspberry Pi3 Board

ii) Relay Module:
A relay is an electrically operated switch uses for AC appliances. Most of the Realys use an electromagnet signal to mechanical signal to operate a switch, but other operating principles are also used, such as solid-state relays.They are used when it is necessary to control a circuit board by a separate low-power signal, or when several circuits must be controlled by a same signal. The firstly relays were used as amplifiers in long distance telegraph circuits. They re-transmitted and repeated the signal coming in from one circuit and it on another circuit. Relays were extensively used for telephone exchanges and early computers to perform logical operations.
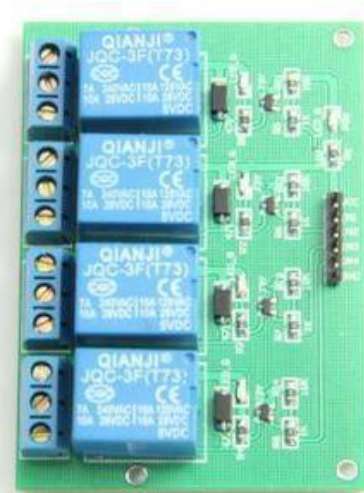

Figure 3: Relay Module

Pin description
 Input:
Vcc : positive voltage supply
Ground : ground
 IN1-IN4 : relay control port

Output:
 Connect a load.
 DC 30V/10A.
 AC 250V/10A.

iii)Arduino:

It is a microcontroller mini board, not fully computers. In this, codes are simply executed without any hindrance. It is an 8 bit Atmel AVR Microcontroller which includes of 32K and 512K of on-board flash memory, 2K of RAM, runs at 8-84MHz clock speeds with voltages of 2.7V-12V. Programming is done using C and has no operating system of its own.

V.   CONCLUSION AND FUTURE SCOPE

Based on surveyed study of the contrast of home automation, systems are offered. Microcontroller, user interface, a communication interface and their performance factors are connected. There are a number of do-it-yourself platforms available that permit to create Home Automation systems quickly and easily with low cost and high performance e.g. Raspberry pi, Arduino, other microcontrollers, etc. In this review explained are diverse home automation systems e.g. Web based, email based, Bluetooth-based, smartphone-based, SMS or text message based, ZigBee-based, Dual Tone Multi Frequency-based, cloud-based and Internet based. In future home automation will evolve to be more smart and fast. It would be stretched to the large-scale environment such as colleges, offices, schools and factories etc.

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