

A REVIEW ON IoT BASED SMART HOME AUTOMATION SYSTEM

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Abstract:- Internet of Things is getting a dynamic launchpad for next century. This next generation technology provides users with new advanced functionality that often renders the past technology, opening a new window of internet to users. During the past ten years a number of research groups around the world have been investigating the use of internet for smart living and now we have entered a new era of computing technology i.e. “IoT”. Term IoT stands for intelligently connected devices and system which comprise of smart machines leading to smart world. Nowadays every time we link up with Smartphone and even we do most of our daily tasks via mobile, thus this IoT feature helps the people of all generations to do the tedious task in an easy way via single mobile click. This paper aims to provide a comprehensive overview of the IoT scenario and its enabling technology in the field of smart home automation system. It also includes IoT’s contribution to device communication- their security, betterment and ease of doing things in a smart way on a click.

Keywords: Home automation system (HAS); Internet of Things (IoT); M2M; Smart home; Wi-Fi network;

I. INTRODUCTION

“Internet of Things”: A web of elements—each distributed firmly with sensors—which are interlinked to the Internet [1]. Internet of Things (IoT) explains basic phenomena for the capability of these interlinked devices to perceive and gather data from around the world and spread globally throughout the internet where it can be treated and employed for many useful applications. The IoT comprises of mobility of smart machines, interacting and communicating with other machines. Nowadays people across the world are connected to each other through various communication links and major among one of them is “Internet” [2]. We live in the world of 4G and are moving towards 5G. Every one of us is directly or indirectly connected with Internet for everything i.e. online transactions, internet messaging like paytm and whatsapp/hike etc. A study conducted by one of the famous research service provider [3], expects that the amount of smart home devices including all smart gadgets shipped will grow from 83 million in 2015 to 193 million in 2020.

TABLE I. COMPARATIVE ANALYSIS

Sr. no	Parameters	Existing system	Proposed system
1.	Access to multiple users	Not Possible	Possible
2.	Automation Configuration Capability	Not Available	Available
3.	Circuit complexity	High	Comparatively Less
4.	Cost of the system	Normal	High (affordable)
5.	Wi-Fi	Externally Connected	Inbuilt
6.	Priority Assignment	Not Available	Available
7.	Debugging Capability	Low	High

The Internet of Things (IoT) is preparing to transform the way we live from work to entertainment and also transportation. And as IoT is becoming mass handy, it has started to emerge with space. It has attracted many people so far due to its impact in improving daily lives and society. The creativity of this idea is infinite with much potential to increase lifestyle of our lives. As the next world relies on the Wi-Fi and Bluetooth (or we can rename this as Machine to Machine (M2M) or Device to Device (D2D) it can be called future internet and that’s what IoT is all about.

II. SMART HOME AUTOMATION SYSTEM

A technology is defined as smart home technology if any pair of appliances, devices or system connects to a common network that work independently as well remotely. Such thing helps us to increase the safety and accessibility house operations. i.e. Home TV, LED’s, Refrigerator, CCTV all are connected to a common system and controlled from your smart-phone. Due to digital innovation presently IoT is

everywhere in this smarter world. It's the outcome of IoT; we can see many smart devices around us. Basically smart homes are the residential extension of building automation and involve the control and automation of lightning, heating, ventilation, air conditioning (HVAC), appliances and security. For example today many buildings have sensors which attempt to save energy. People nowadays also have smart phones with sensors for running many such useful applications as home automation. Above all of these, one such probability is a catholic mentality and reality utilization connected to the internet. In home automation sensing & actuation, the form of an IoT podium will become a utility itself. Such appliances will be personalized to digitize daily life activities [4]. Smart home automation will not only control energy or security but incorporate self comfort, energy savings, and health and wellness aspects into convenient spaces. Smart homes contain multiple connected devices such as home entertainment consoles, security systems, lightning access control and surveillance. Intelligent home automation system is incorporated into smart homes to provide comfort to homeowners. Home automation system represents & reports the status of linked devices in an self generated user friendly connections allowing the user to interact and regulate various devices. Some of major technologies used by today's home automation system are Bluetooth, WiMax, wireless LAN (Wi-Fi), ZigBee and GSM [4]. This paper reviews application and technologies in field of smart home automation system. Below mentioned figure depicts the devices that differentiate the normal home with smart home. The security alarm, door control, lighting control are some major features.



Fig. 1. Automated Home

III. APPLICATIONS OF SMART HOME AUTOMATION SYSTEM

A. HVAC: Heating Ventilation & Air Conditioning

The main aim of smart HVAC is to possess a unit that is capable of knowing what all is happening on a building, keeps record of everything, maintains cooling, saves bucks and

mollify any problem cohorted with misuse. Smart HVAC can also help in reduction of intricacy for the residents and operators. By dwelling some complexity to smart HVAC system, you are on right path for originating a better environment. The features of smart HVAC includes:-

- Smart HVAC is a wireless power carry-off system for Air Conditioners.
- Smart sense ventilation system improves Indoor Air Quality (IAQ)[5] throughout home automatically & efficiently.



Fig. 2. HVAC control through handset

So smart HVAC allows users to change their cozy settings with the internet or cellular network like telephone. This is not just limited to the homeowner when they are at home but also they can control their HVAC appliances when they are at work or out of station. They will also be well aware about better IAQ because this system reflexively gives you the reminder through an e-mail or text notification on your mobile phone.. Example: Digi Smart and system. Air Duct Cleaning (ADC)[6] product are in the market now for the above purpose. Duct cleaning persuasively refers to the rinsing of various heating and cooling system elements of forced air systems, composing of the supply and revert air ducts and registers, grilles and diffusers, heat swappers, heating and cooling coils, constrictate drain pans (drip pans), fan motor and fan housing, and the air administrating unit of housing.

B. APPLIANCE CONTROL & INTEGRATION

It includes lightning (bulbs, LED's), smart switches, smart speakers, smart lock, smart doorbell.

1) Bulbs & LED's:

Smart bulb are those having inbuilt battery modules that allow them to keep on shining when your lights are switched off or when there is a power failure. They also use build in microphones to listen for your doorbells, if they hear ring they'll turn on to help create impression that you're here. They have an additional battery module with features such as Wi-Fi or Bluetooth. Example: Beon's bulb and Philips smart LED's.



Fig. 3. Smart light

Smart switches plugs & sockets:

Even it's not the device but the sockets, a place where we insert our product, is smart enough to obey your command. These switches have on/off outlet that lets you automate both sockets and comes in variety of finishes. You are able to control it using android app which boasts extra functionality on android and windows device. The iOS has separate app for smart switches but the function is entirely same. Example: 'Insteon Switches'



Fig. 4. Smart Switches

2) Smart speakers:

Earlier the multimedia speaker used for Horn, Music or Sound purpose only. Now in respect of IoT speaker's term is not limited to sound or entertain only. Its more than that it talk to you and obey your commands.



Fig. 5. Smart speaker

Let's took a review:

- It's not only provided the sound voice but listen to you and provide assistance like Google Home/Amazon echo or siri in Apple or Bixby in Samsung. It combines wireless audio with voice control and home automation.
- They are wireless as well having Bluetooth/wifi routers.
- These speakers can be controlled via android app which can be installed from Google play store.
- Example: 'Sonos' has long been the king of the hill in Wi-Fi audio and best Wi-Fi speakers & music system of year 2016.

3) Smart locks:

By this review paper, we can describe how your locks become smart, can you imagine this via we have intelligent locks that can sense, that can obey your command, These locks are smart enough to take decision, Wi-Fi enables, controlled via internet. The lock connect plug onto a power outlet and brings the link between the Bluetooth lock & your home Wi-Fi network. Once the connection is successfully made, you can have access to lock from anywhere and everywhere you are linked with the internet. Example: 'August' Bluetooth smart lock'.

4) Smart Doorbell:

Another awesome product related with IoT is the doorbell via that you can see and speak with visitors at your door, from anywhere. Each doorbell is equipped with an HD camera with night vision led's and smart motion detection [8]. These doorbell comes

up with 30 days free cloud recording or just \$30 for annual recording.



Fig. 6. Smart Doorbell/Speaker

- For this equipment you have to install the app in your smartphone. LED indication shows its working.
- Example: ring video doorbells.

5) Smart Smoke Detectors:

In Device-to-device (D2D) communication for example like in case of smoke detectors: the sensed device informed detectors, which propagate fire. After that it sends signals to the sprinkler as well other Smoke and other heat venting system to extinguish the fire. All above possible because of the bidirectional communication between the smoke detector and the internet. When your smoke alarm sounds, you will get a push notification wherever you are. Plug any smart smoke detector into your wall & it will listen for the specific frequency of smoke & CO detector & send you an alert when it hears something.

Example: Nest Protect, Leo Smart Alert.[9]



Fig. 7. Leo Smart Alert smoke detector

IV. MOTIVATION

The reason behind to write about IoT based smart home system is its benefit to the disabled people as well the elder one in our day to day life as they faced a lot of problem as compare to the healthy one. While deaf people cannot hear the door bell, person having short height face difficulty in on/off lights, a person suffered from memory loss or disease Alzheimer's can forget the gas open in the kitchen[7], when they are alone at home. With the help of technology and internet we can help them so that they overcome their difficulties. The system can allow the user to control many features or automate them. Smart home system able to monitor the environment regarding the radiation level or pollution level via Arduino an air sensor device that ensure safety and alert people when level of pollution or gas in the air is beyond the limit.

V. ADVANTAGES

- Hand control - The biggest benefit of installing smart appliance in your home is that you can control this via mobile apps on your mobile device easily on lightening, AC, garage door, water usages etc. thus all control at your fingertips
- Convenience – You can manage all home devices from one place. It provides flexibility for adding new appliance and devices no matters their size. If we have family member who are elderly or disabled, smart home technology escalate their standard of living, as they can control via their voice command or even gesture. One can have control over the linked home gadgets from any solitary machine having internet connectivity [8].
- Energy Efficiency- Smart home automation will permit the gadget to operate with lesser amount of energy requirement. For example, using a harmonic resistant capacitor, it regulates the ampage of high power gadgets such as HVACs, computers, microwaves and washing machines. It can be also somehow managed by using lesser amount of energy possible.

- Real time notifications – As smart home application are monitored via Smartphone's, thus all the home appliances that linked with the device provide real time notification and monitored via a mobile click
- Security – The main aim of IoT based home tools is the surveillance and security the following devices like cameras, motion, door locks and light sensors all are connected with a single device that monitored from a remote location. That's the reason it helps in observation and quick decision without any hurdle.

VI. LIMITATIONS

- Internet – As home based smart automation completely dependent on the internet. In crust of loss of internet connectivity, the user can't perform their well defined tasks on time. The alternate for this is that you can develop a local server.
- Power supply – After the Internet connection another major utility the leading power supply for the appliances at all moments. If power supply is lost or switched off, system no longer be controlled by the user. Thus proper power backup system must be there
- Expensive -- Although no matters we love smart equipment that are for our home and love to buy them. But still as the market is emerging nowadays these IoT based home automation system are too expensive out of the reach of common men.

VII. CONCLUSION AND FUTURE WORKS

This paper has been addressed an overview of IoT technology and its various use in the field of smart home automation system. By applying IoT to smart devices various quick-witted services can be formed. The creation of features of smart home automation would be embellished by applying IoT. There are many driving factor that increases interest to switch from conventional automation to IoT based i.e., Smart home automation system as it provides very effective measures of delivering new life to various consumers. *According to professional sources by the year 2020, there will be 50 billion devices linked to the Internet. Now the question arises that how the people and firms will dominate over this extraordinary fortune?* [9]

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IX. BIOGRAPHY



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