An Overview of IOT Based Smart Homes

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Abstract

Internet of Things is the inter-lacement of devices. By making use of internet, IOT performs the logic operations where it forward data and stores the same in the cloud. i.e, IOT is a internet- based platform and cloud is the part of the process. Machine to Machine (M2M) communication is the sub-part of IOT. Currently, the main trend of IOT is to deploy Smart Homes. The characteristics of smart home are automation, multi-functionality, adaptability, interactivity, efficiency. This work deals with the discussion of various smart homes based up on the IOT Protocols and compare them in line with their automation architecture. Comparisons are done depending up on the hardware components and IOT protocols used in the each system architecture . The idea is to suggest best automation architecture in smart homes based on IOT.

Keywords :- *Internet of Things (IOT), Machine to Machine (M2M)*

I. INTRODUCTION

Internet of Things (IOT) is a world of connected things which are operative through the Internet. The main difference between IOT and Internet is that Internet is the mesh of interconnected networks and IOT is an internet of devices.

The definition defined by ITU-T Y.2060 (06/2012)for IOT is, IOT as a global infrastructure for the
information society, it enables advanced services by interconnecting(physical and virtual) things based on existing and evolving interoperable information and communication technologies.

II. IOT ARCHITECTURE

Generally, an IOT architecture has 4-stages. The stage 1 consists of networked things e.g: wireless sensors and actuators. Then stage 2 consists of sensor data ensemble structure and analog-to-digital data switching. In stage 3, edge IT systems perform pretraitement of data and in stage 4, these data is stored in traditional data storage.

III. IOT PROTOCOLS

IOT protocols are broken into following layers to provide some level of organization and they are….

- The protocols which belong to the infrastructure layer are:6LowPAN,IPv4/IPv6,RPL.
- The protocols which belong to the Identification layer are:EPC,uCode,IPv6,URLs
- The protocols which belong to the Comms / Transport layer are: Wi-Fi, Bluetooth, and LPWAN.
- The protocols which belong to the discovery layer are: MQTT, CoAP, AMQP, Web Socket, Node.
- The protocols which belong to the device management layer are: TR-069, OMA-DM.
- The protocols which belong to the semantic layer are: JSON-LD, Web Thing Model.
- The protocols which belong to the multi-layer frameworks are: Alljony, IOTivity, weave, and Homekit.
- The protocols which belongs to the security layer are: Open Trust Protocol (OTrP), X.509.

The protocol which belongs to the vertical specific layer are: IEEE1451, IEEE1888.3-2013, IEEE1905.1-2013, IEEE P1828, IEEE P1856.

IV. SMART HOMES

Smart Home is now weighted as one of the most common/ prominent application of IOT. The important characteristics of a smart home are automation. The main aim of automation is to reduce human effort. In today's world there is great importance to remote controlled systems.

Therefore in automation systems, the use of wireless technologies provides several advantages that could not be deployed with the use of wired networks. The smart home is known as home automation which use latest technologies to make the domestic activities as easy. The house automation system architecture consists following components and they are…

- User interface: It is used to give order and control the electrical equipment in home.
  eg: By pressing the button ion the smart phone , controlling through speech by using commands etc.
- Mode of transmission: Either wired or wireless connections to transmit the control. The protocols

which is used for data transfer and control are Ethernet, MQTT etc.

- Central controller: It is a hardware component which acts as a intermediate between user interface and mode of transmission. Sometimes all the electrical equipments are connected to the central controller also.

  E.g.: Rasberry pi, Node MCU etc.

- Electronic devices: all the electrical equipments in a home, which are compatible with the structure.

  The main benefit of using IOT in smart homes is to control each device in the home remotely. The automation architecture of home may vary based up on the protocols and hardware's used in the system . in the next section, major works carried out home automation is analyzed   and a comparision of architectures for IOT is drawn based on the analysis.

FIG : SMART HOMES

V.   RELATED WORKS

In this paper [1] an efficient implementation using IOT for monitoring and automation system. It aims at controlling electrical equipment in home via smart phone using Wi-Fi as a communication protocol and arduino uno as a central controller.

FIG:ARDUINO UNO

The user here will move directly with a portable system through a web-based interface over the web where as home appliances are remotely controlled through a website. This system also provides a fully smart environment condition and monitoring by various sensors for providing necessary data to automatically detection and resolution of any problem in the devices.

The paper [2] consists of a variety of sensors in the system architecture. By using Wi-Fi module the Intel Galileo connects to the internet and after this connections it will start reading the parameters of the sensors. Then set the threshold level of the sensor. Data from the sensors are sent to the web servers and stored in the cloud. This data can be analyzed at any time from anywhere. If the sensor parameters are greater than the threshold level then the respective alarm will be raised and the required action will be performed for the controlling of the parameters. This model monitors the temperature , gas leakage, motion in the house. The temperature and the motion detection are stored in a cloud. When the temperature exceeds the threshold level the cooler will automatically turn on and when temperature comes to control it will turn off. If there is a leakage of gas in the home then alarm is raised giving the alert sound. The required lights are turned on/off automatically by detecting light outside the house. The user can also monitor the electric appliances through internet. By simply typing the IP address on the web server any electrical appliances in the house are turned off remotely.

In the page [3] home automation architecture based on the remote password operated appliances is mentioned. The system reads the data from Bluetooth module, and initializes the LCD and UART protocol and display the status of the electrical loads on LCD. The system mainly uses two graphical user interfaces. The status of the appliances can be known by using this interface. Any changes in the status of the appliances, will give a immediate intimation by showing it in GUI. The window GUI will act as a server to transmit any data to and form the smart phone. If their is any failure then connection can be reestablished by using USB cable. The user can monitor and control the devices from any remote location to anytime using IOT.

In this paper [4]a protocol standard for smart phones called Home Automation Device Protocol (HADP)was proposed. By using this system aims for the capacity of home automation devices across different platforms. The IFTTT(IF-This-Then-That) service used here to, define a set of devices communication protocols and actions are combined to generate and manage interactions through a central node. This system demands less power consumption and band width requirements are done by using the minimum data packets to trigger an action on a home automation device.

TABLE-1 : COMPARISON OF IOT BASED SMART HOMES

IOT Based Smart Homes	User Interface	Mode Of Transmission	Central Controller	Disadvantages
Survey on efficient IOT based smart home	Smart phone	Wi-Fi or Zigbee	Arudino Uno	• Arudino is used to do respective task only. • Multitasking is not supported. • The maximum distance supported by Wi-Fi is 100m. • Not a friendly user interface and not suitable for disabled or older users.
A survey on Internet of Things based Home automation system	GUI	Blue-tooth	Arudino	• Arudino is used to do repetitive tasks only. • Multi tasking is not supported. • The maximum remote control distance is upto 10m. • Not a friendly user interface for all Type of users
Home automation and using internet of things.	Web Server	Wi-Fi	Intel Galileo	Intel Galileo offers too • Much CPU performance. • The input peripheral support by Intel Galileo is only 1 • Not a friendly user interface for all and remote control up to 100m.
Home automation using internet of things	Smart phone	CoAP	Gateway of router	• Not a friendly user interface for all type of users. • CoAP has a client-server model and it costly compared to MQTT. • This protocol well in constrained devices which has less program memory

VI. INFERENCES

The comparision table menctioned above give a clear cut idea about the limitations of existing IOT based home automation architectures. The correct choosing of hardware's and IOT protocol is very important to increase the effiency of automation architectures and reduce the drawbacks of existing systems. So according to an IOT based home automation system architecture is a friendly user interface like speech , MQTT protocol as a transmission mode and Raspberry pi as a central controller is recommended choice.

The reason for choosing this type of architecture is due to user friendly nature, high speed range of protocol to control the equipments remotely and multitasking capacity of the system. Using speech as a user interface deals with the controlling of electrical equipments through commands like FAN ON, LIGHT ON etc. The main advantage of this type of this system is , all type of users can handle it without any effort especially older people, disabled people etc. and it also reduce the effort of handle the smart phone , computer etc. only requirement for this type of system is a microphone to receive the commands and convert speech into text.

The reasons for choosing MQTT protocol as a transmission mode are its high security nature, central broker concept, good quality of service, last will retain message , and flexiable subscription pattern. MQTT is called as Message Queue Telemetry Transport protocol which has a central broker concept. This protocol is more flexiable than other protocols. Because most of the IOT protocols has a clint-server model and their cost is more. And finally, reasons for choosing Raspberry pi as a central controller are it has an operating system, compared to other central controllers multi tasking is possible with it , and it has its own Wi-Fi module and also its hardware architecture support 4 input peripherals .

VII. CONCLUSION

The architecture which specified here for IOT based smart homes reduce all the limitations of the existing system architecture and capable to give a high speed, multitasking , can be controlled the electrical equipments from anywhere at any time, and a friendly interface for all type of users. This IOT based home automation architecture is a challenge to other architectures because of its low cost capacity compared to others and also its hardware architecture support 4 input peripherals.

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