REST Architecture in ARDUINO Based Home Automation System

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Abstract: Internet of things (IOT) imagines a world where every device at any place can be connected. It creates a world where the lights can automatically turn on, door gets opened automatically on the arrival of the family member and remains locked whenever any stranger arrives, coffee automatically brews off when the morning alarm goes off and many more applications. Internet of things is not the internet but it could be called as the network of the devices which are connected to the internet.

We have proposed the details of how we can automate the home appliances using ARDUINO and REST architecture. The result also shows how the use of ARDUINO and REST architecture is beneficial as compared to other available resources in the field of Internet of Things.

A deep discussion of its application is also presented here.

Keywords: IOT, Home Automation System, ARDUINO, REST, Security, Energy Efficiency.

Introduction:

The Internet of Things (IoT) is an arrangement of interrelated processing gadgets, mechanical and computerized machines, articles, creatures or individuals that are given interesting identifiers and the capacity to exchange information over a system without obliging human-to-human or human-to-PC connection [1]. A thing, in the Internet of Things, can be a person with a heart monitor implant, a farm animal with a biochip transponder, an automobile that has built-in sensors to alert the driver when tire pressure is low -- or any other natural or

man-made object that can be assigned an IP address and provided with the ability to transfer data over a network. Kevin Ashton, cofounder and executive director of the Auto-ID Center at MIT, first mentioned the Internet of Things in a presentation he made to Procter & Gamble in 1999.

According to various types of communication is possible through IoT like machine to machine, machine to human, human to machine, or machine to any storage. This communication can be either within the network or across the network as per the need [2].

Background

The term "Internet-of-Things" is utilized as a key phrase for covering different points identified with the expansion of the Internet and the Web into the physical domain, by method for the limitless course of action of spatially scattered devices with embedded Identification, detecting and/or incitation abilities. Internet of-Things imagine a future in which digital and physical entities can be linked, by method for suitable data and correspondence innovations, to empower a radical new package of applications and services. Study shows that around two

billion people around the globe use the Internet for surfing, exchanging mails, enjoying multimedia contents, playing games, interacting through social networking applications and many other jobs.

As more and more people are accessing this world-wide technology for sharing information, conversation and utilizing it for many other day to day tasks, a big deal is coming forward in this regard which will provide a platform where machine will coordinate directly with the smart objects and perform tasks without any human intervention [3]. Smart connectivity with existing network and the subject oriented calculations using the resources of the network is the essential part of IoT [4].

The term IoT was authored by Kevin Aston in 1999. Kevin Aston is a British innovation pioneer who helped to establish the Auto-ID focus at the Massachusetts Institute of Technology (MIT). The MIT from work at the Auto-ID focus was working in the field of arranged radio recurrence recognizable proof (RFID) and detecting advancements [11, 12]. The lab comprised of seven

research colleges situated in four distinct landmasses. Subsequently a wide range of gadgets were associated and IoT was instituted. Web of things was seventh in the arrangement of ITU web reports initially propelled in 1997 under the title "difficulties to the system". In 2005, 6.3 billion individuals living on earth and 500 million gadgets were associated with the web i.e. less than 0.08% for every person. ThusIoT yet dint exist. By explosive growth of smart phone and tablet PC‟s, number of devices connected to the internet increased. Thus by prediction made by the Cisco Internet Business Solution Group (CIBSG) by 2015 25 billion and by 2020, 50 billion devices would be connected to the internet.

Proposed Work

We can automate the home appliances using ARDUINO and REST architecture. The result also shows how the use of ARDUINO and REST architecture is beneficial as compared to other available resources in the field of Internet of Things. We have also explained here how various smart devices could be combined with the use of technology to develop a smart system which could be controlled by any android tablet or the device through url. With the help of the proposed tools, techniques and architecture we tried to develop a cost effective, simple, and user friendly system capable of automating the home appliances. We used a voice recognition application on the smart device to operate the appliances through voice. This application best serves the handicapped person as they are not capable of going to the switch board to switch on or off the devices. Proposed system will allow them to do so by just telling smart device to what to do. Many works is being done in the field of automation. Here the main focus is to develop a user friendly and cost effective system which is easy to use and install at real time.

Restful web server is a REST based web architecture where everything is a resource. Restful server is highly maintainable, scalable and is lightweight, mostly used to create API for web based applications. REST is the acronym of Representational State Transfer. It is a web based architecture which uses HTTP protocol for data communication. It depends on the resources and treats every component as a resource which can be accessed by the common component using http standard methods [9]. REST server provides access to

the resources and the rest client accesses and presents the resources. Each resources involved will be identified by their respective URIs or their global IDs. Various representations used by the REST are Text, JSON and XML. Out of these JSON is most commonly used representation. As discussed earlier, each components involved are treated as resource. Here, resources can be a text file, html pages, dynamic data, **videos** or may be images. REST server can simply provide access to these resources and the client can easily handle and modifies these resources according to their requirements. A resource in the REST can be treated as an object of the object oriented programming language or as an entity of the database. Once we recognize these resources then its representation can be easily decided using

the standard format. Rest does not impose any restriction on the format of a resource representation. One can get any representation format for the same resource like to the server. These representations may be in the form of JSON representation or it can be XML representation. It is the responsibility of the REST server to pass the resource to the client in the format that the client understands [9]. Restful web server makes use of the **HTTP** protocol as a medium of communication between the client and the server. Client sends message in the form of http request and the server responds to it in the form of http response and this request and response method is called messaging. The content of the message can be the message data and metadata.
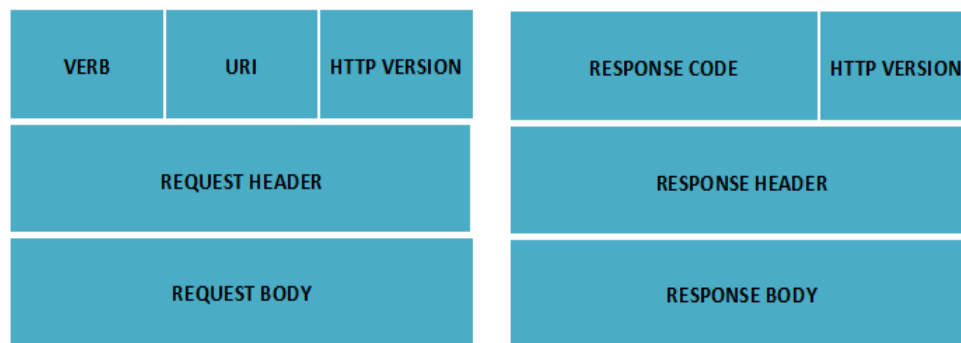

Figure 1 HTTP REQUEST & RESPONSE

REST-MOST SUITABLE FOR IoT

RESTful web service does not have any official standard unlike the SOAP-based web services. Whenever the client references to the web resources using the URL, representation of the resource is returned, which in turn places the client application in the state. While using the same with IoT Platform, sensors get the information with the help of RFIDs which is then sent with a MIME type format [9]. Here a sensor or the information of the sensor could be seen as a resource on the web, one can also find a way to connect to the resources, if required. RESTful web service is the best way to combine HTTP and web service, in addition to it, creates a URL to each resource which makes it easy for the client to use these URL set to get what is required.

Arduino Based Home Automation System successfully defines REST Architecture. The Architecture of the system is shown in **figure 2**
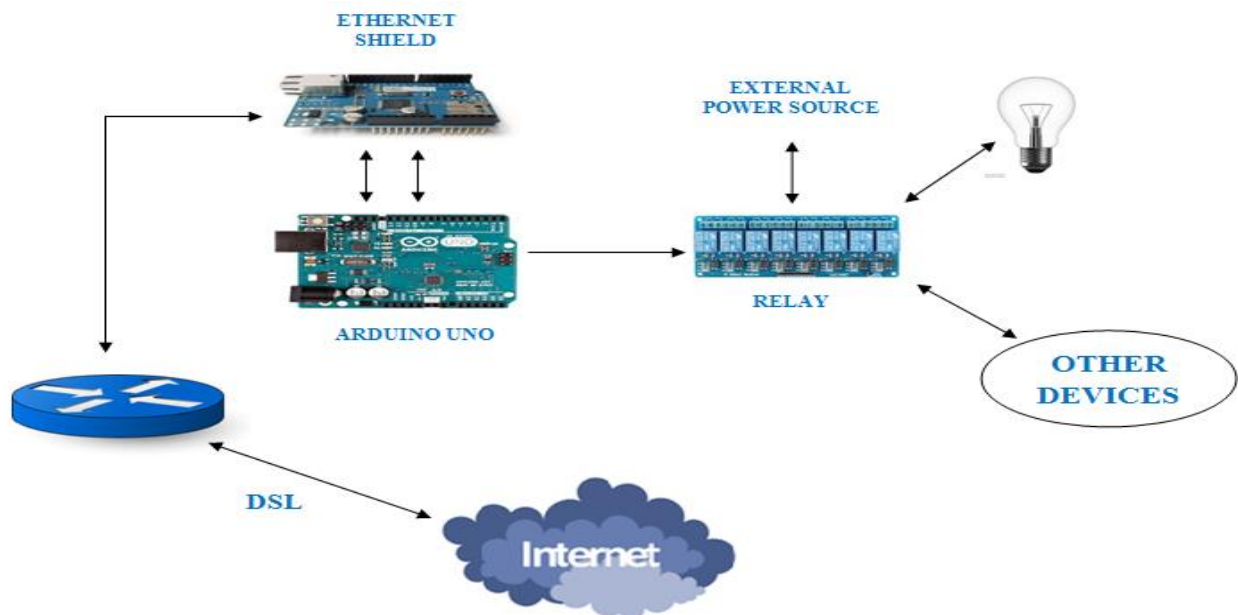

Figure 2 Architecture of Home Automation System

In this system we used an Arduino UNO board with Ethernet Shield to provide local network connectivity (Here android tablet is connected on the same network wirelessly).We designed an android application which is capable of recognizing the voice and work according to the command that is given through voice. We programmed Arduino UNO in the way that the user sends commands from the Android tablet to the Arduino Board. The Arduino in turn transmits the instructions to the devices connected via relay. We implemented our code using built-in Arduino functions, libraries to support the desired interface. We also adapted some codes from variety of sources.
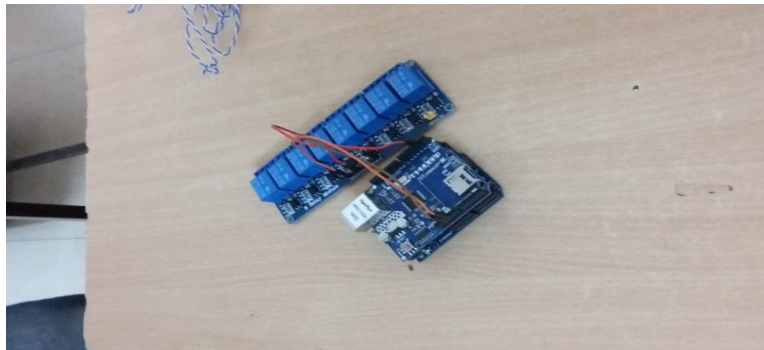

Figure 3 Connection between Arduino, Ethernet Shield & Relay Modules

Conclusion

This thesis is about the implementation of IoT in different areas in order to improve the security, quality of service and standard of living of the people. We have implemented the concept of IoT to automate the home appliances. This type of work successfully defines IoT, where the emerging future will be able to connect everything and everyone.

We have seen from the result that the IoT is successfully implemented to automate three appliances of the room. REST architecture is used in this automation system. The developed system is very much user friendly as well as cost effectively which could be easily adopt by the common man. The proposed system will be particularly helpful for the older persons and for the persons with disability. As, the application developed will run by just our finger tips. It doesnot require the person to

get up and cover a distance to switch on the gadgets. Also this small intervention could also be removed with the application of sensors in the existing system. This part is being kept as the future work by us.

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