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CONTROLLING SMART DEVICES THROUGH SPEECH AND IOT

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ABSTRACT

The Internet of Things (IoT) shall be able to incorporate transparently and seamlessly a large number of different and heterogeneous end systems, while providing open access to selected subsets of data for the development of a plethora of digital services. Building a general architecture for the IoT is hence a very complex task, mainly because of the extremely large variety of devices, link layer technologies, and services that may be involved in such a system .To make life more easy and to avoid using batteries in the daily life, I propose a IoT system which eases the human life .In this paper I proposed smart devices which operate on speech rather on remote controlling system and also controlling the devices which are at home from remote locations[4][5][6] The devices which humans see in their regular life if they are automated through speech rather than with a remote control base which had to be operated through hand. So through this one can free their hands from this work, which can be used for another work parallel. With this idea the current generation can stop reducing the batteries which had to be charged for a longer time which in turn reduces the power consumption at every home. Also when residents are away from home, they can control the devices at home through remote access through the concept of IoT enabling security feature as well.

INTRODUCTION

In today's current life style everyone is always thinking of efficient planning of a day. So in order to meet up the requirements the technology of managing the devices at home through speech is introduced wherein which the user need not use the effort of hand and a remote control to control the devices at home like air conditioner, fan, tube lights, bulb ,refrigerator, oven. Through this the user instead of spending the time to operate a device manually can do some other task, thus managing time effectively and efficiently. At the same time when the user is away from home and need to operate any devices at home can just simple send messages by using the latest technologies like Io T. Generraly when one needs to switch on / switch off a air conditioner, fan, oven, refrigerator either we operate manually or through remote. But by doing so one needs to spend some time. At the same time for remote access, one needs to maintain charged batteries, but charging batteries again results in the consumption of power. By controlling the devices through speech, the user can reduce consumption of power at the same is managing the time effectively and efficiently. Also imagine a case where in which the refrigerator has exceeded certain limit of temperature beyond which certain items in refrigerator may spoil.

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In case the user is at home and busy in some other household works may miss this job, also if the user is away from home may not be able to track this and may leave the items in refrigerator get cooled intensively. In order to avoid the same, by using the latest IoT methods one can switch off refrigerator from remote place just by sending message from the android phone via Wi-Fi to the device. Thus the device can be switched off immediately after receiving the message. Like this many similar cases are discussed in the below sections in detail.

CONCEPTS AND SERVICES

In this section, the concepts and services of the smart devices which are operated through speech and IoT are discussed. This method would enable today's generation to ease their work life style by avoiding some works to be done by hand. These works can be just handled through speech which controls certain devices. At the same time I have proposed the system of controlling certain devices at home [5][6] which can be handled or controlled from remote locations i.e away from home. Especially the working professionals when at home feel tough to manage certain works at home simultaneously, in order to ease their lifestyle this application would definitely help them. Fan controlled through Speech: In certain countries like India where fan is essential during summers but may/may not be essential during winters.

When the user goes into deep sleep and feels tough to operate the fan through remote can just control the fan through a speech command "FAN OFF". When fan receives this command it will turn off, also when the user is busy doing work and when both the hands are occupied with work, then the user can simply control the fan to turn it on by a speech command "FAN ON". The sensor deployed on the fan will be able to automatically turn the fan off and on depending on the objects it's able to sense. Air conditioner controlled through Speech and IoT: Instead of controlling the device through a remote, the device can be controlled via speech. When user feels the device to turn it on the user needs to give a speech command "AC ON", and when the user feels to turn it off, the command to control through speech is "AC OFF". Let us take the scenario of some countries which are very hot during summers. The users who are away from home and have planned to reach home in another 15 to 20 minutes can control the air conditioners at home though IoT by turning them on, so that by the time the user reaches home the room will get cooled. In this way of controlling the devices through IoT, the human being is managing the life style in a very simplified way. Let us take the case of countries which are very cool having temperatures of less than 10 degree Celsius. In such a case when the user plans to reach home in another 20 to 30 minutes can turn the heaters at home which would keep the room warm by the time the user reaches home. This is achieved by accessing the air conditioners at home from remote locations through Wi-Fi, cloud and IoT.

Refrigerators controlled through speech and IoT: Usually users operate refrigerators either manually or through remote, for both the ways user needs to spend some time but with the latest technologies emerging in market we enable the refrigerator to respond to the speech commands. Some scenarios like opening the refrigerator, closing the refrigerator, stop cooling, start cooling, setting temperature, and enabling the freezing. Incase when the user is away from home, but due to some items that are kept in refrigerator the user wants to shift from freezing point to normal low temperature, this can be achieved by accessing the refrigerator remotely through IoT via Wi-Fi (Bressan et al., 2010) using MQTT (Castellani et al., 2010; Bonetto et al., ?). So through this remote access facility users are able to change the temperatures of the refrigerator. Along with this a proposed idea is that, the user should also be able to know the items that are deficit in refrigerator which are used in the daily life. So the refrigerator should be able to send a reminder message on to our android phones with the items list. For example if the refrigerator daily holds milk, curd, some vegetables, beverages and some fruits.

With this daily data the refrigerator if incase there are any one of the items that it is holding daily is under deficit, then it should be able to do this analysis and send a message to the users phone, so that if incase the user is away from home will be able to purchase the items on the way to the home instead of rechecking after going home and again travelling back to the provisions store. This is an excellent feature which will plan the day of a user effectively and efficiently. Oven controlled through speech and IoT: This is a device that is used in regular life for baking etc. If the user is busy in kitchen with some other works and if the item in the oven is getting over baked but the user is not in a position to switch off the oven manually (by hand) or by remote, then the user can just give a speech command to the oven to turn it OFF.

Also in case if the user is away from home , but wants to recheck if the oven is turned off or not , the user can just send a message to the oven through IoT using Wi-Fi and can turn it off. With this the user is able to save power at the same time be able to take safety precautions on the items at home even though the user is away from home. Television controlled through speech: This is a device that is used in regular basis for knowing news, entertaining oneself and for gaining knowledge. When the user is busy with household work but was simultaneously watching some entertainment channel and would like to switch on to a news channel then the user can give a command through speech to which the TV responds and changes the channel to the one requested by the user. Some of the functionalities like turning off and turning on the television through speech commands. So with this facility the application reduces the usage of batteries if accessed by remote which in turn reduces the power consumption per home.

Doors and windows controlled through speech and IoT: At any point of time security is the main concern which has to be handled with utmost care. Theft can be from any form or from any direction. Since in today's generation working professionals have increased tremendously so the time the working professional being away from home is more. So in order to ensure the safety of home from remote location IoT is very helpful. The user when away from home can check whether the doors and windows are locked by deploying a sensor on to the door near the lock which can sense whether its locked or not. Now the message is sent through cloud using Wi-Fi and this application works as per the logic present in the python scripts. In the same way windows too work using the same methodology as that of doors. Also the doors and windows can be locked through speech. This will be useful to the residents who are paralyzed / bed ridden and alone at home. With this remote security check of lock through IoT the user can confirm that the doors and windows are locked. Similarly the doors and windows can be opened and closed through speech by user. But the locking system should be handled with a secure password or passcode and safety precautions should be taken that, it is not known to the outsiders. At times this kind of application is useful when one looses key. When the user is away from home if anyone is trying to access the door or window, immediately the resident of the home i.e. the user will be receiving an alert message. This feature will increase the safety and security factor.

The below fig1 depicts the concept that is being discussed in this paper.

From the figure 1 it is very evident that in addition to humans even the non living beings are being connected to internet. This advancement in technology is making the human being to plan the tasks much more efficiently and effectively.

Architecture

Controlling smart devices through speech and IoT can be handled with the following architecture depicted in figure 2.In the below figure, the devices fan, air conditioner, refrigerator, oven, doors and television are deployed with speech sensor which would capture the commands that are communicated through speech. The sensor should send data to the cloud using MQTT (Castellani et al., 2010; Bonetto et al., ?) over Wi-Fi through Raspberry Pi by using the logic present in the python script through Ethernet medium.
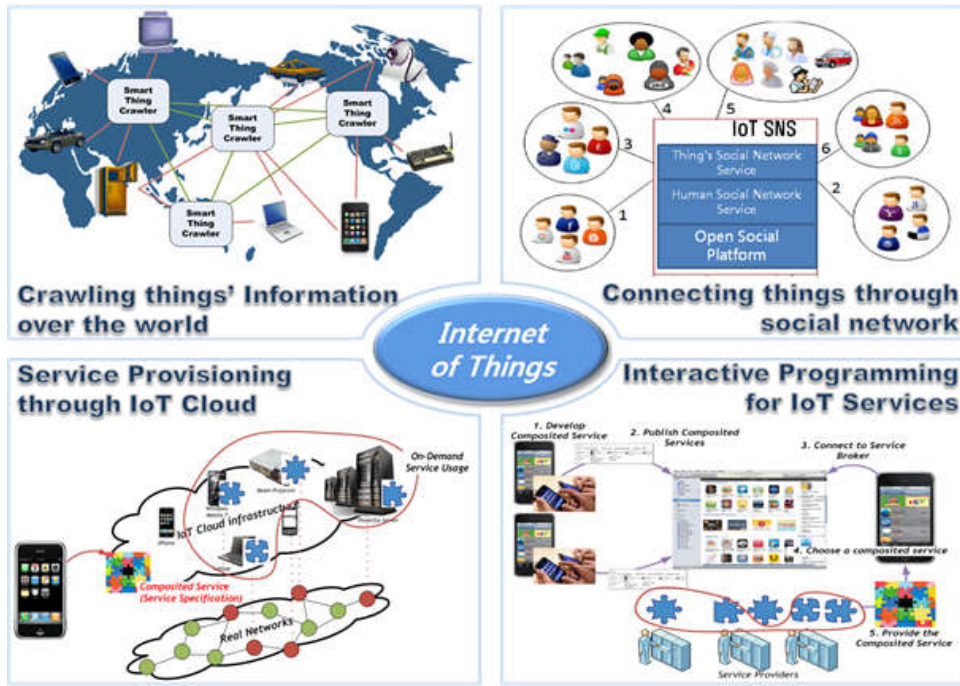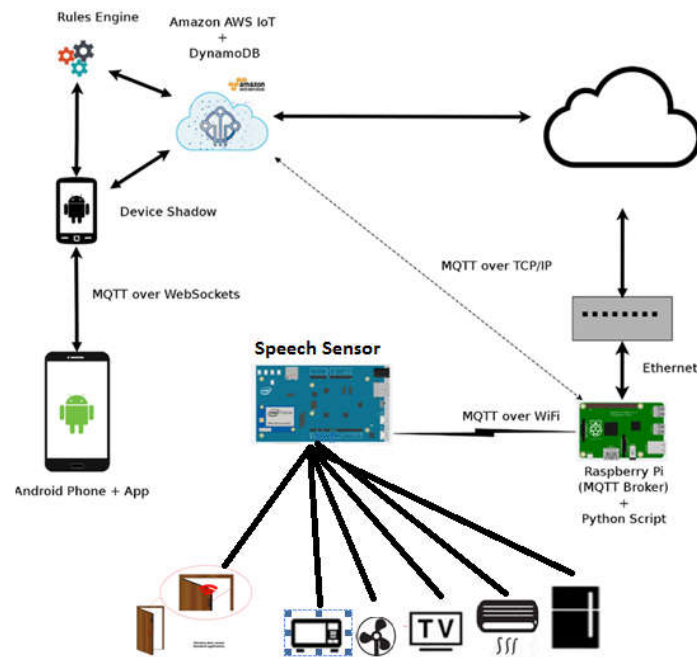
Fig 1. Internet of Things (IoT)

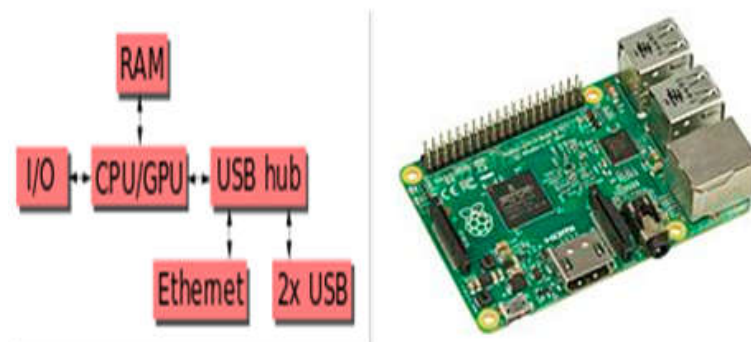**Fig 2. Architecture of Controlling Smart devices through Speech and IoT**

Fig. 3. Raspberry Pi Block diagram and hardware

Fig 4. Speech Sensor

The data present in the cloud can be shared through Amazon AWS IoT using Dynamo DB .This data is further sent to various devices using Android. So the users using the Android phone or devices would get alert message from sensor. This proposed application would definitely ease the life of the user. Each device behaves according to the logic written in the python script.

Advantages

The following are the advantages of the system being built in the smart devices:

- By making the fan respond to speech, the user can work simultaneously without being interrupted to operate the fan manually or through remote. The battery usage comes down drastically, consumption of less power and high throughput.
- Air conditioner which has become one more common appliance at every home can be operated through from remote. Due to these users belonging to city / country suffering from high temperature can get the room or house become cool before the user reaches home. At the same time users belonging to city/country suffering from low temperatures can turn on the heaters, so that the room/home will be maintained at required room temperature before the user reaches home.
- Able to know the deficit items that are kept in refrigerator regularly by sending a reminder message to the user helps to plan the day of the user efficiently and effectively, as the user need not travel to the provisions store multiple times.
- Over cooking or over baking at times leads to spoil the dish, since the user might be busy in some other house hold work. With this the user will be able to control the oven through speech commands. Also in case if the user forgot to turn off the oven, then the user can send a message from a remote location by which the oven gets turned off. This helps the user in taking safety precautions from remote place and also to reduce power consumption.
- While taking dinner or busy in kitchen if the user wants to know the current affairs or happening in the society, the user by giving command through speech can turn off ,turn on ,change the channels and settings of the television. Also due to the busy life style the user forgot to turn off the television, the same can be performed from remote location with this proposed feature.
- Safety will be increased tremendously since the security check of cross checking whether the doors and windows are locked or not can be monitored from remote location and by speech.

Highly advantageous to the paralyzed users as the doors and windows can be controlled through speech. At the same time when the user is away from home will be alerted with message if in case anyone is trying to access the door or window of the house.

Through this IoT application the comfort levels of the human being are being increased drastically.

Terminology

MQTT: MQTT (MQ Telemetry Transport) is an ISO standard (ISO/IEC PRF 20922) publish-subscribe-based "lightweight" messaging protocol for use on top of the TCP/IP protocol. It is designed for connections with remote locations where a "small code footprint" is required or the network bandwidth is limited. MQTT (Castellani et al., 2010; Bonetto et al., ?) defines methods (sometimes referred to as verbs) to indicate the desired action to be performed on the identified resource. What this resource represents, whether pre-existing data or data that is generated dynamically, depends on the implementation of the server. Often, the resource corresponds to a file or the output of an executable residing on the server. Connect : Waits for a connection to be established with the server. Disconnect: Waits for the MQTT (Castellani et al., 2010; Bonetto et al., ?) client to finish any work it must do, and for the TCP/IP session to disconnect. Subscribe: Waits for completion of the Subscribe or Unsubscribe method.

Unsubscribe: Requests the server unsubscribe the client from one or more topics.

Publish: Returns immediately to the application thread after passing the request to the MQTT client.

Raspberry Pi: The Raspberry Pi is a series of credit card-sized single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and developing countries. The Raspberry Pi hardware has evolved through several versions that feature variations in memory capacity and peripheral-device support.

The Raspberry Pi needs to be integrated with the fan, air conditioner, refrigerator, oven and door sensors at a low cost with easy installation. The Raspberry Pi is a credit card sized single board computer developed in the UK by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science in schools. The Raspberry Pi is manufactured in two board configurations. The Raspberry Pi has a Broadcom BCM2835 system on a chip (SoC), which includes an ARM1176JZFS 700 MHz processor, Video Core IV GPU, and was originally shipped with 256 megabytes of RAM, later upgraded to 512 MB.

It does not include a builtin hard disk or solid state drive, but it uses an SDcard for booting and persistent storage. The Foundation provides Debian and Arch Linux ARM distributions for download. Tools are available for Python as the main programming language. Speech sensor: Voice activity detection (VAD) (Bressan et al., 2010), also known as speech activity detection or speech detection, is a technique used in speech processing in which the presence or absence of human speech is detected. The main uses of VAD are in speech coding and speech recognition. It can facilitate speech processing, and can also be used to deactivate some processes during non-speech section of an audio session: it can avoid unnecessary coding/transmission of silence packets in Voice over Internet Protocol applications, saving on computation and on network bandwidth. VAD is an important enabling technology for a variety of speech-based applications. Therefore various VAD algorithms have been developed that provide varying features and compromises between latency, sensitivity, accuracy and computational cost. Some VAD algorithms also provide further analysis, for example whether the speech is voiced, unvoiced or sustained. Voice activity detection is usually language independent.

Conclusion

This application would definitely lend a helping hand to the society by managing things properly by reducing time, cost and effort at the same time safety is also taken care of.
The Internet of Things which emerged in this latest advanced technology is definitely making surroundings manage in a smart way. In present scenario of managing both work and life one will always opt for leading a smart life with smart devices which are making the surrounding smarter. The idea present in the paper which was drafted needs to be implemented which would be the future scope of this paper.

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