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Smart Home Energy Management Using IOT and Big Data

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ABSTRACT: Increasing cost and demand of home energy has led to find the smart way for managing the use of energy. The leading technologies of Internet of Things and Big Data can be utilized to better manage energy consumption in residential, commercial, and industrial areas.This paper presents an Energy Management System for smart home which analyzes the usages and history of each household equipments.In this system,each device is interfaced with control block. The devices can be controlled and monitored through mobile device. Data from each device is collected and transformed to the server for further analysis.

I. INTRODUCTION

The current energy demand has required significant en-ergy reduction in all areas. The energy consumption in home areas has increased as more home appliances are installed. Energy saving is considered as method of solv-ing home energy problem. The energy consumption and saving should be simultaneously considered to save the home energy cost.A smart home automation system is a means that enable individuals to control electric appliances smartly and automatically within a home environment to make life easy by providing convenience, comfort, security and energy efciency to it. Many existing home automation frameworks depend on wired correspondence. In this paper, we focus on data collection and analysis for the purpose of the existing home automation (HA) system.Devices within the HA system can be divided in two categories: actuators and sensors. Actuators are the devices that can be controlled by the system users, such as lights, dimmers, plugs, etc. On the other hand, properties of sensor devices can only be monitored by the user: temperature, humidity, motion, smoke and more. The sensor devices within HA system generate immense amount of data, as they are constantly gathering new information. Actuators give us more information about the user daily habits and routines, since they do not only monitor environmental parameters, but are directly controlled by the user. Therefore, distinguishing between relevant and insignificant information is essential.

II. RELATED WORK

Existing Technologies for Smart Homes Home-based Sys-tem automations range from simple systems to more as complex systems around the house, to more complicated systems such as security and robotics for home care or home environment [4]. Current Smart Home gadgets are typically a redone mixture of at least one of these applications for more extensive applications[4]. Access to these applications can be by and large gathered into 4 access types that are hardwired sort utilizing bus line or power line based technology[4]. As well as the wireless type utilizing radio, infrared, Wi-Fi, RFID, Bluetooth or cellular networks that can support some form of remote data transfer, sensing and control various levels of intelligence in the home[4]. The other smart home system use Web services, Simple Object Access Protocol (SOAP) and Representational State Transfer (REST) as an inter operable application layer to access home automation systems remotely[4]. However, future smart home appliances are moving towards the remote condition and thus the Bluetooth and radio range will be generally utilized by demonstrating stability and security. Current Scenario of Cloud Storage Cloud computing is the act of utilizing remote servers on the web to oversee, store and process data as opposed to utilizing an individual computer [6]

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[7]. Cloud computing is a general term that is better partitioned into three classications: Infrastructure-as-a-Service, Platform-as-a-Service, and Software-as-a-Service. IaaS (or utility computing) takes after a customary utilities model, giving servers and storage on request with the consumer paying IoT in Home Automation accordingly. PaaS takes into consideration the development of utilizations inside a providers framework, similar to Googles App Engine[4]. SaaS empowers clients to utilize an application on request via a browser. A typical case of cloud computing is Gmail, where you can access your stored data from any computer with internet access[4]. Problems with Current Systems First, there are too many remote controls or monitoring terminal for home automation and they are specically oriented towards the design and development of home automation systems. [7] Also, the access range to remotely control these gadgets are restricted by either length of cables or wireless network coverage in a personal area network. Second, many of the solutions do not provide a user friendly mobile interface to monitor and control electrical appliances at home. Third, most of the existing systems are not affordable and cannot be integrated with an already built home without re-wiring. Fourth, Bluetooth based home automation systems using Android Smart phones (without the Internet controllability) also has several drawbacks [9]. Finally, the existing works were mainly focused on switching and controlling home appliances.

III. SYSTEM ARCHITECTURE

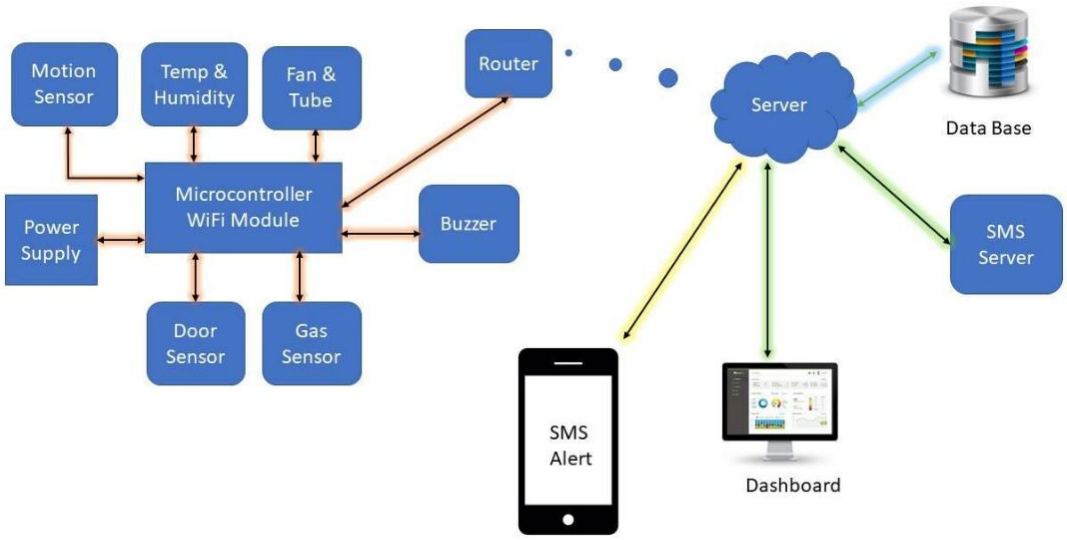

fig1.System Architecture

System architecture is the conceptual model that defines the structure,behaviour and more use of system.In this section, we first describe the architecture of the existing system. Then, we identify the points within the system, where the interface towards data collection service can be implemented. The architecture of the existing system is showed in Fig. 1. The system contains devices can be sensors or actuators. We refer to all of the devices within the system as nodes. All of the nodes in the system are connected to the ESP-8266 wifi module. Communication between the devices and the microcontroller is mostly accomplished by IP, protocols. The HA gateway controls all of the devices within the local network, and communicates with the HA cloud [1]. Home Automaton cloud enables remote control of the system, through the web interface and mobile applications.

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IV. HARDWARE AND SOFTWARE

Sensors and Actuators:- The system is used to control and monitor the home system therefore different sensors are used like Gas sensor,Temperature and Humidity sensors,Door sensor,etc.The data is collected through these sensors and transformed to server.

Server:- The server is used to store the collected data from the sensors used in the home system.The server is helpful in monitoring and controlling the status of each devices used in the system.

User Web Interface:- The user interface is used to interact with system.It gives easy access from anywhere through internet.
Hardware Board:- ESP-8266 WiFi Module.

V. WORKING OF THE SYSTEM

On turning on the system, the Base station through the Wi-Fi module gets connected to the specified Wi-Fi access point and establishes a TCP connection with server and the Android Application. It receives the commands from the application running on Android Smartphone which is connected to the same access point or to a different point by Port Forwarding. It also establishes an RF connection with the satellite stations through the RF modules using their respective addresses. The Base station fetches the sensor data and room conditions from the satellite stations one by one through the RF link whenever a command is sent by user and this data is sent to the Cloud Platform at a frequency of 15 seconds by the Wi-Fi module using the given API
key. The readings of all these sensors can be retrieved from the ThingSpeak account and seen on the app and as well as website. There are two modes through which we can control the electrical appliances, by Manual Mode and also by Automatic Mode/ Sensor Based Mode. At the Satellite station, on receiving a Manual control command from the base station it turns ON or OFF the appropriate appliance manually. On receiving an AUTO control command for light, it turns on the light if the light detector indicates absence of light in the room otherwise, the light is turned OFF. On receiving an AUTO command for fan, it turns ON the fan if the temperature sensor detects a temperature of more than the threshold set; otherwise the fan is turned OFF. Satellite station continuously reads the analog or digital value that is output from the sensors and data such as temperature is converted from raw analog output to degree Celsius. This sensor data is sent to the Base Station upon request.

A. Security and Monitoring System:

At the Satellite station, the PIR Motion sensor, Gas sensor and Capacitive Touch Sensor provide a monitoring and security feature to the system. The room is continuously monitored for movement and LPG leakage using PIR and Gas sensor. The capacitive touch sensor is able to detect even the slightest touch and can be used for intrusion detection. The present status of these sensors is sent to the base station through which it reaches the cloud and an indication (for example, a tweet) is sent to the user in case of an IoT in Home Automation emergency or an alarm is triggered at the satellite station. The indication of these alarms is seen on the android app as either 1 or 0, where 1 indicates that an alarm is triggered and 0 otherwise. The sensor data from PIR, LPG Sensor and Touch sensor is pushed onto the cloud via base station.

VI. CONCLUSION

The proposed system is to replace home automation system with internet of things where devices at home are connected to internet can be accessed from anywhere by using android smart phone.The system design uses data analytics and scalable storage for building a smart EMS to aid different stakeholders with their respective privileges. The system empowers users to remotely monitor and control devices, and online bill generation via a friendly user interface mobile application.

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