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Smart Home Using Internet of Things

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Abstract: Home automation or smart home is the residential extension of building automation. There are various types of automation based on the application they can be categorized as home automation, industrial automation, autonomous automation, building automation, etc. This system uses Wi-Fi for remote monitoring and are a part of the Internet of things. Modern systems generally consist of switches and sensors connected to a central hub sometimes called a "gateway" from which the system is controlled with a user interface that is interacted either with a wall-mounted terminal, mobile phone software, tablet computer or a web interface, often but not always via internet cloud services. In this work, CC3200MCU is used which has in built Wi-Fi module and temperature sensor. The sensed temperature data is send to MCU and then it is posted to the server, status of the fan and light is viewed in the android application and then it is controlled with the same.

Keywords: Automation; Wi-Fi; web interface; heating ventilation; air-conditioning (HVAC); Gateway; IoT; Microcontroller unit (MCU).

I. INTRODUCTION

The process of controlling or operating various equipment, machinery, industrial processes, and other applications using various control systems and also with less or no human intervention is termed as automation. Types of automation: Industrial automation, Factory automation system, Building automation system, Tank automation system, Library automation system, Microscope automation system, welding and cutting automation system, Assembly automation system.

Home automation or smart home is the residential extension of building automation. It involves the control and automation of lighting, heating (such as smart thermostats), ventilation, air conditioning (HVAC), and security, as well as home appliances such as washer/dryers, ovens or refrigerators/freezers. Earlier technologies which were used to implement home automation were: Bluetooth, GSM, and ZigBee etc.Home automation is a step toward what is referred to as the "Internet of Things," in which everything has an assigned IP address, and can be monitored and accessed remotely. The Internet of things (stylized Internet of Things or IoT) is the internetworking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings, and other items—embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. Homes of the 21st century will become more and more self-controlled and automated due to the comfort it provides, especially when employed in a private home. A home automation system is a means that allow users to control electric appliances of varying kind. The first and most obvious beneficiaries of this approach are "smart" devices and appliances that can be connected to a local area network, via Ethernet or Wi-Fi.

However, electrical systems and even individual points, like light switches and electrical outlets, were also integrated into home automation networks, and businesses have even explored the potential of IP-based inventory tracking. Although the day is still far off when you'll be able to use your mobile browser to track down a lost sock, home networks are capable of including an increasing number of devices and system. In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT as "the infrastructure of the information society." The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention.

When IOT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart homes, intelligent transportation and smart cities. Home automation refers to control the home appliances by using computer technology. Computer Systems enables from remote control of lighting through to complex micro-controller or computer based networks with various degrees of intelligence and automation. Home automation provides security, energy efficiency and ease of use hence, it is adopted more. It also provides remote interface to home appliances to provide control and monitoring on a web browser.

Home automation systems face four main challenges; these are high cost of ownership, inflexibility, poor manageability, and difficulty in achieving security. The main objectives of this research are to design and implement a home automation system using IoT that is

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capable of controlling and automating most of the house appliances through an easy manageable web interface. The proposed system has a great flexibility by using Wi-Fi technology to interconnect its distributed sensors to home automation server. This will decrease the deployment cost and will increase the ability of upgrading, and system reconfiguration.

In this paper, section I describes the previously available technologies which could have been used to implement the project. How the project has been designed with the help of block diagram and the circuit diagram for working of the project is explained in section II. The results of the project are mentioned in section III. It concludes the project in section IV and Section V includes about the extension of the project according to the upcoming technologies.

II. RELATED WORK

Many Authors designed home automation systems using different technologies. Some of the design and proposals that are considered to implement our project are described below.

Pooja Patel, Mitesh Patel, Vishwa Panchal & Vinit Nirmal [1], main aim of the project is to develop a system that will provide remote control of home appliances and also provide security against the mishaps when the home host is not at home. This paper is mainly concerned with the automatic control of light or any other home appliances using internet. It is meant to save the electric power and human energy. This project is made with the help of controller and raspberry pi. The various appliances connected to the micro controller and sensor is connected using wireless network.

Nisha Sangle, Shilpa Sanap, Manjiree Salunke, Sachin Patil [2], home automation system uses portable device as user interface, monitoring and controlling home appliances will be the demand of new era. main objective to developed proposed system is to provide remote level control and monitoring by means of few communication protocols like this Wi-Fi, Zigbee. This system uses wireless technology to avoid wired connection between appliances and the gateway. It helps to do complete monitoring and control functionalities of the home environment using wireless sensors and actuators modules than just the switching ON/OFF functionality provided by similar systems. Multiple appliances can be control and monitor using IoT in propose system web portal will play an interface between appliances and android app to be develop.

Kaushik Ghosh, Rushikesh Kalbhor, Disha Tejpal, Sayali Haral [3] IoT (Internet of Things) is fast emerging technology which involves interaction among things through internet without human interference. It has made human life easier and comfortable. Now-a-days digital devices in home are increasing rapidly due to which there is a need of accessing and controlling the devices remotely. This paper represents an affordable and flexible home control system using an Arduino, web server with IP connectivity for interacting with devices and appliances remotely using Android based Smart phone app. It demonstrates the usefulness of the system using devices such as light switches, temperature sensors, and water-level sensors.

Vinay sagar K N,Kusuma S M [4]Internet of things is a growing network of everyday object-from industrial machine to consumer goods that can share information and complete tasks while you are busy with other activities. Wireless Home Automation system(WHAS) using IoT is a system that uses computers or mobile devices to control basic home functions and features automatically through internet from anywhere around the world, an automated home is sometimes called a smart home. It is meant to save the electric power and human energy.

Mamata Khatu, Neethu Kaimal, Pratik Jadhav, Syedali Adnan Rizvi [5] IoT coverage is very wide and includes variety of objects like smart phones, tablets, digital cameras and sensors. Once all these devices are connected to each other, they enable more and more smart processes and services that support our basic needs, environment and health. Such enormous number of devices connected to internet provides many kinds of services. They also produce huge amount of data and information.

YAN Wenbo, WANG Quanyu, GAO Zhenwei[6] It aims at helping people manage the home appliance freely and build an autonomous environment in home or work area. This paper introduces a wireless solution based on Internet protocol. Based on this approach, we design a smart home system with the implementation of related software and hardware. People can use smart phones or tablets to control or monitor the home appliances both locally and remotely. We come up with the concept of Smart Units and Home Proxy. Low cost WiFi module is used to build Smart Units.

Swati Tiwari, Rahul Gedam[7]The paper proposes an implementation of IoT (Internet of Things) based smart home automated system to remotely control the home appliances using Wi-Fi. A low-cost Wi-Fi module ESP8266 along with ATmega 328 MCU is used to build Smart Units. The user can remotely operate home appliances like lights, fan, door lock etc. through Telnet. The lights in any room can be controlled from any place in the house, within the wifi range, through telnet by using a single keyword.

Rajeev Piyare [8] This paper presents a low cost and flexible home control and monitoring system using an embedded micro-web server, with IP connectivity for accessing and controlling devices and appliances remotely using Android based Smart phone app. The proposed system does not require a dedicated server PC with respect to similar systems and offers a novel communication protocol to monitor and control the home environment with more than just the switching functionality.

Dhakad Kunal, Dhake Tushar, Undegaonkar Pooja, Zope Vaibhav, Vinay Lodha [9] Smart Building not only

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refers to reduce human efforts but also energy efficiency and time saving. In this ASP.NET is used in which appliances are connected to sensors and sensors give status of appliances to the web. Here electric appliances are operated by the website. The main objective of home automation and security is to help handicapped and aged people that will enable them to control home appliances and alert them in critical situation.

Rutuja Ekatpure, Devendra Ingale [10] Home automation is the automatic control and monitoring of household appliances and residential house features like TV, fans, lights, doors, gate and even the windows. Events can be programmed to be triggered under specific conditions (such as depending on the sensors data), and this can be used in reducing the total energy consumed by some appliances. On the other hand, the system can suggest smart task scheduling. In simple installations, domestics may be as straightforward as turning on the lights when a person enters the room.

III. PROPOSED WORK

This project aims to control the home appliances remotely for physically disable people using internet. The controlling of the devices is achieved by using CC3200 microcontroller. The Simple Link CC3200 device is a wireless MCU that integrates a high-performance ARM Cortex-M4 MCU, allowing customers to develop an entire application with a single IC. The CC3200 device is a complete platform solution including software, sample applications, tools, user and programming guides, reference designs, and the TI E2E™ support community.

The applications MCU subsystem contains an industry-standard ARM Cortex-M4 core running at 80 MHz the device includes a wide variety of peripherals, including a fast-parallel camera interface, I2S, SD/MMC, UART, SPI, I2C, and four-channel ADC. The CC3200 family includes flexible embedded RAM for code and data and ROM with external serial flash boot loader and peripheral drivers.

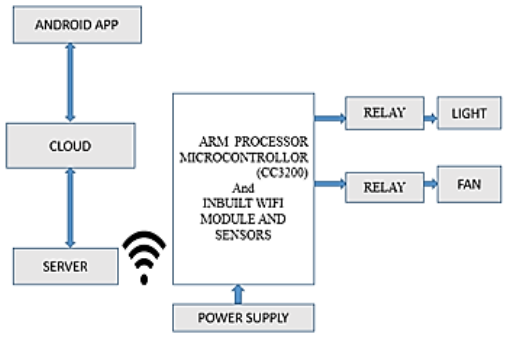
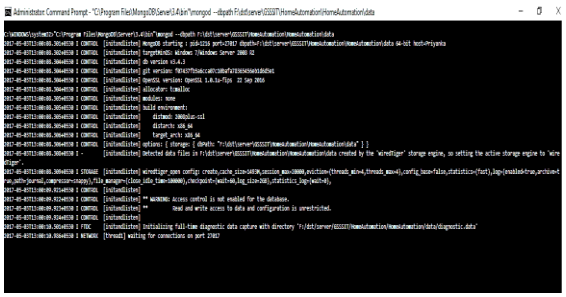


Fig 1. Block diagram of Smart Home Monitoring and Controlling using IoT

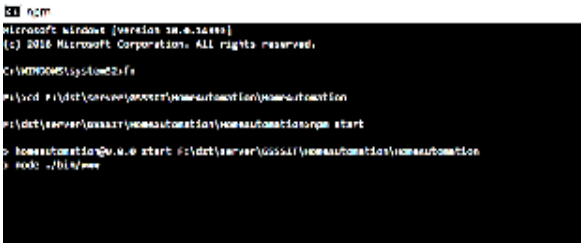
Smart home monitoring system shown in fig:1 uses android application to control the home appliances like fan and light. The status of the devices is given to the cloud using http post method and is sent in the form of json format. This data in the cloud is sent to the local mongo dB server wirelessly and this information is carried to the microcontroller. The relay is connected and change in the state of the fan and light is based on the instruction given from the application.

IV. RESULT

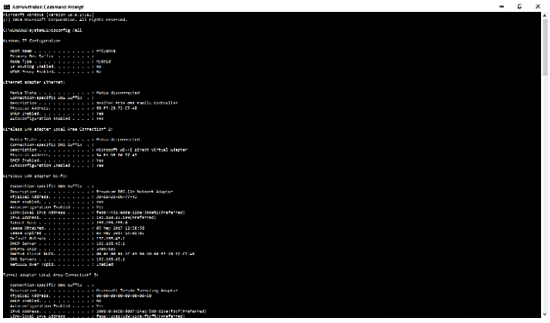
The data which is being sensed and posted to the server can be controlled using android application based on that temperature the fan and light is monitored and controlled and that status of output can have viewed in the laptop browser as well as in the smart phone android application dashboard. Web server and database server initialization steps are shown in fig2.



(a)



(b)



(c)

Fig 2. Snap shot of setup procedure to Start a) database server b) Web server c) IP address

Once after initializing the server the input is given to the android application to change the status of the light. Through server input of user is given to microcontroller using wifi. Microcontroller changes the status of the light

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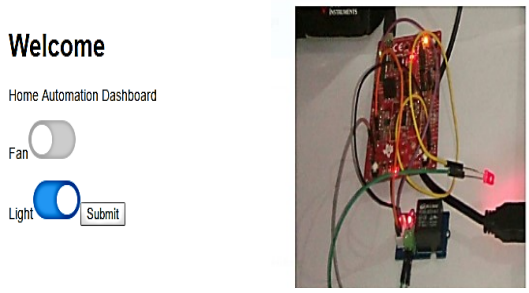
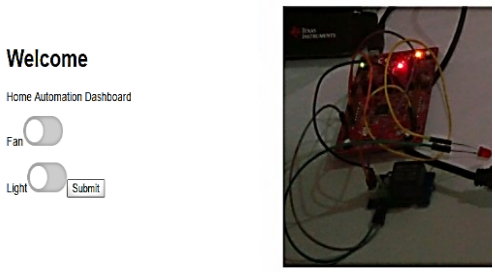
using relay based on user instruction as shown in fig:3 and 4.



(a) (b)

Fig 3. Snap shot of a) android application to turn on light. b) Output when light is turned on.



(a) (b)

Fig 4. Snap shot of a) android application to turn off light. b) Output when light is turned off.

V. CONCLUSION

The internet of things involves an increasing number of smart interconnected devices and sensors (such as cameras, biometric, and medical sensors) that are often transparent and invisible. The home automation using Internet of Things has been successfully implemented using low power microcontroller CC3200 Launch pad and wifi to control light. The designed system not only monitors the home appliances but can also be controlled using the android phone or laptop.

VI. FUTURE WORK

Using this system as framework, the system can be expanded to include various other options which could include home security feature like capturing the photo of a person moving around the house and storing it onto the cloud. This will reduce the data storage than using the CCTV camera which will record all the time and stores it. The system can be expanded for energy monitoring, or weather stations. This kind of a system with respective changes can be implemented in the hospitals for disable people or in industries where human invasion is impossible or dangerous, and it can also be implemented for environmental monitoring.

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