

Design and Development of Smart Home Automation Using Internet of Things

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Abstract - Recent technology in home automation provides security, safety and comfortable life at home. The proposed home automation technology provides smart monitoring and controlling of home appliances. Control and monitoring status of appliances have been implemented using Internet of things and Cloud Computing. The system is made affordable and it is user-friendly and has easy installation in home or multi-purpose buildings. Using this technology, the consumer can reduce the wastage of electrical power by regular monitoring of home appliances or proper ON/OFF scheduling of the devices. The home automation system is developed based on the techniques from intelligent sensor systems, and integrated with cloud or mobile application.

Keywords—Domestic Safety, Internet of Things, Smart Home, Remote Monitoring

I. INTRODUCTION

Home is one of the greatest investments in life. It is an essential part of people's lives and an improvement in this area means more comfort for any individual. This includes ideas for making daily tasks easier or even eliminating some of the duties. Today, people can install smart appliances inside their homes in order to control some of the house tasks. This type of intelligent devices can be remotely controlled. Besides daily home tasks like changing light color or room temperature, house security is also considered. Classic mechanical door locks have been used starting from Ancient Egypt. The appliances of the house can be monitored and controlled by different methods such as Graphical user interface (GUI) and World Wide Web (WWW). This automation system can send and receive data from the remote user via the internet. The user can monitor the status concerning ON/OFF and control the appliances of the home by online or offline. He can watch his family members, security guard etc. from anywhere and anytime by using smartphone or Desktop/laptop. The door permission system gives the flexible choice to both the visitor and the homeowner for easy and secure interaction [1].

The new methods for controlling the appliances in the house need to be easy to use. These devices must also be easy to integrate in the home environment. In order to design a modern

home automation system the concepts of IOT and cloud computing can be used. This helps in the storage of sensor data and access to it using a microcontroller [2].

Internet of Things (IoT) concept envisions the interaction and cooperation among smart objects surrounding us (such as home appliances, mobile devices, portable medical devices) to reach common goals. In IoT, it comprises of interconnected smart objects with access to internet, provided by networking technologies traditionally, the pervasive presence of these devices and their connectivity requirements consume large amounts of data transmissions, and thus conduct the research on communication technique. Currently the commercial standards have been well constructed such as Bluetooth, ZigBee, and Wi-Fi. This alleviates the techniques on communication. As one of the fastest growing fields of the IOT technology, smart homes comprises of a network of smart devices which belong to different applications. Any device at home that uses electricity can be put on the home network and at one's command. The home can be controlled by voice, remote control, tablet or smart phone. Most applications relate to lighting and heating, home security, home theatre and entertainment, and energy conservation [3].

The technology enables the company to better develop and manufacture its solution that is hence

able to support connectivity and collaboration along the whole value chain: the collection, analysis, and sharing of data generates value from providers to customers, inside (tangible part) and outside (intangible part) to the product. In literature this kind of technology basis is commonly called Internet of Things (IOT). The RFID group defines the Internet of Things as the worldwide network of interconnected objects uniquely addressable based on standard communication protocols [4] [5].

Sensors are used to sense the surrounding environment like temperature, smoke level, light intensity, etc. The sensor data is sent to the microcontroller that processes the data. The data is then sent to a cloud server where the data is stored and converted to graphs in order to facilitate easy understanding for the user. The IOT concept is used to control the appliances using smart devices such as smart phone, tablet, etc., through mobile application [6]. Since the devices and the home automation system are connected to the same internet, the appliances can be remotely controlled using smart devices. The mobile application also shows the readings of each sensor and virtual buttons to control the system appliances [7].

II. EXISTING SYSTEM

The existing home automation systems use either the IOT or cloud computing, i.e. either the system is remotely controlled or the data is sent to the cloud. But the functionalities of both the above concepts have not been combined. In this system the combination of IOT and cloud allows the user to remotely control the system as well as store the huge amount of real time data in cloud. A home automation system can be designed to work on ZigBee, Bluetooth, gsm and Wi-Fi. However with the introduction of internet into our daily lives Wi-Fi and internet have connected people for over a decade but the same Wi-Fi and internet can be used to connect a person with his/her house. This is possible by placing sensors all over the house for sensing various parameters. The data is then sent to the microcontroller where it is processed and sent to a mobile application where a user can access it and control the devices the same data is then sent to the cloud server.

III. PROPOSED SYSTEM

A typical home automation system uses IOT concept to interconnect various sensors and their functionalities. IOT is also used to remotely control the system by controlling the functioning of the microcontroller which in turn controls the sensors. The concept of cloud is used to store the data in a remote open source cloud server.

However by combining the concepts of cloud and IOT we can remotely control the appliances as well as save memory space on our devices by storing the massive amount of real time data in a remote server. The data in the remote server can be accessed through proper authentication.

Smart devices are used to control the appliances by downloading a simple mobile application and the same smart device can be used to access data from cloud usually two different boards are used for IOT and cloud applications. However the using two different microcontrollers in a system causes confusion and complications. Thus by using a single microcontroller for both the applications makes the system simple and easy to use.

Smart, connected products are composed of three core elements:

- a. Physical components,
- b. "Smart" components, and
- c. Connectivity components

Physical components comprises of the product's mechanical and electrical parts.

Smart components comprises of sensors, microprocessors, data storage, software, and an embedded operating system and enhanced user interface.

Connectivity components amplify the capabilities and value of the smart components, which can also become a separate external part of the physical product itself.

A smart, connected product can potentially incorporate all of them. This kind of technology basis is called Internet of Things. 'Things' are active devices which are enabled to interact and communicate among themselves and with the environment by exchanging data and information sensed about the environment.

WORKING PRINCIPLE

To realize smart home automation of Internet of things (IOT), transmission devices with Wi-Fi protocol are used. As a result, the signals on mobile device applications are received. This implementation integrates the functionalities of different home automation devices into a single application. All the data from the sensors and IOT applications is transmitted to a cloud server. The data in the cloud server can be accessed from any smart device through suitable authentication. The data in cloud can be converted into simple graphs, pie charts etc. Thus by adopting the concepts of IOT and cloud computing and using the functionalities of sensors and a microcontroller, a home automation system can be designed and implemented.

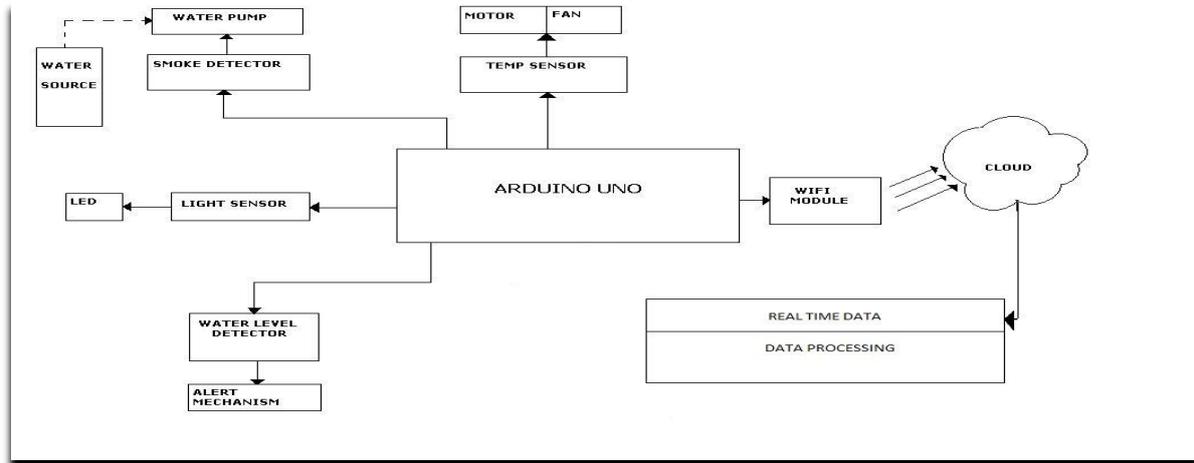


Fig 1.1 Block diagram of Smart Home Automated System

A block diagram of Smart home Automation System is presented in figure 1.1. It consists of the following blocks:

A. Temperature and Humidity Sensor

DHT11 features a temperature and humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature and humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and a temperature measurement component, and connects to a high-performance 8-bit microcontroller. This gives excellent quality, fast response, anti-interference ability and cost-effectiveness. The Circuit is constructed using ESP Node MCU 12e and DHT11 temperature sensor and other components. DHT11 gives analog output proportional to the temperature which is given to ESP NodeMCU input D2. It is then compared with set points. If it is more than set point, then the fan is turned on, which is connected to relay output. If temperature is less than the threshold value then the fan is automatically turned off.

B. Smoke detector

It is a device that senses smoke, typically as an indicator of fire. Commercial security devices issue a signal to a fire alarm control panel as part of a fire alarm system. In household smoke detectors, a local audible or visual alarm from the detector itself is issued.

C. MQ-2 gas sensor

It has high sensitivity to LPG, Carbon-monoxide and Gas, also could be used to detect Methane and other combustible steam. It is of low cost and suitable for different applications. When a gas interacts with this sensor, it is first ionized into

its constituents and is then adsorbed by the sensing element. This adsorption creates a potential difference on the element which is conveyed to the processor unit through output pins in the form of current. Whenever the output pins are HIGH, the LED glows. Now, whenever the water is in contact with both the wires immersed in the container, the circuit gets completed, and the INPUT pin in the setup reads HIGH and this controls the water supply. IOT or internet of things allows us to access and control devices remotely using a smart device such as smart phones, tablets, etc. In home automation, the appliances such as light source, fan, water pump and fire extinguisher mechanism can be controlled remotely by using an android mobile application. The android/ iOS mobile application can be developed using IOT software such as things speak, etc.

IV. TODAY'S CONCERN TO SOCIETY

In today's world, a typical home consists of appliances that need to be controlled using switches and remotes. But this can be changed by automating the home environment by using sensors and microcontroller. Automation enables the user to live in a comfortable environment without any hassles. HVAC is one of the important applications of home automation that deals with heating, ventilation and air conditioning. By using IOT we can remotely control the home environment that allows the user to be more productive to the society and also makes any household efficient and smart. Home automation also reduces the energy consumption of any household which in turn helps in saving the environment. This also helps us in saving resources for the future generations.

V. RESULTS OBTAINED

1. Home automation system based on IOT and cloud computing was designed.
2. Realized IOT applications by remotely controlling the home appliances.
3. The sensor data (smoke sensor, temperature sensor and water level indicator), was remotely monitored using a mobile
4. The user could notify with alert messages in case of any critical conditions in the home environment.
5. Realized cloud applications using Wi-Fi protocol and THINGSPEAK server by sending all the data from the sensors to the cloud.
6. Graphical representation of data of different gases sensed by smoke sensor is available in the cloud.

VI. CONCLUSION

The home automation using Internet of Things has been experimentally proven to work satisfactorily by connecting simple appliances to it and the appliances were successfully controlled remotely through internet. The designed system not only monitors the sensor data, like temperature, gas, light but also actuates a process according to the requirement. Any Android based Smart phone with built in support for Wi-Fi can be used to access and control the devices at home. When a Wi-Fi connection is not available, mobile cellular networks such as 3G or 4G can be used to access the system. It also stores the sensor parameters in the cloud (Gmail) in real time. This will help the user to analyze the condition of various parameters in the home anytime anywhere.

VII. SCOPE FOR FUTURE WORK

There are endless possibilities for improvising a home automation system. The home automation system can be designed to be more energy efficient. This can be achieved by designing a circuit to switch off the appliances when not required automatically. The electronic devices such as TV, home theatre, exhaust fan, etc. can also be automated using various sensors such as pressure sensor, motion sensor, etc. Security and authenticated entry can also be adapted into a home automation to make the home environment more secure. Biometric authentication technique can also be used for home safety. However the implementation of these ideas requires some research and adaption of the latest technologies.

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