



INTERNET OF THINGS: HOME AUTOMATION AND SURVEILLANCE SYSTEM

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ABSTRACT

The technological advancements in the field of Automation has aided our everyday life with comfort and ease. The exponential increase in the number of internet users over the past decade has made the Internet an integral part of life, IoT being the latest emerging technology. Internet of Things can be regarded as a network of everyday objects, from industrial machine to consumer goods that can share information and complete tasks while a person is busy in other activities. Home Automation and Surveillance System using IoT uses computer, mobile devices and dedicated android applications to control basic home functions and features using internet. An automated home is also called a Smart Home. It is meant to save electric power and human energy. By means of an internet connection, home automation system allows the user to operate it from anywhere around the world, this makes it different from the other existing systems. In this paper we present a Home Automation and Surveillance System using Arduino board that employs the integration of Server Centralized Database, wireless communication that provides remote control over various domestic appliances and storage of the data in the server. Use of different sensors contributes in improvement of security. This system is designed to be cost efficient and is also expandable since it allows a large variety of devices to be controlled.

KEYWORDS: Internet of Things (IoT), Arduino Mega 2560 Microcontroller, Wi-Fi network

I. INTRODUCTION

A. Overview

In our day to day life, people use internet very often. Also people prefer automatic system over the manual system therefore concept of IoT for home automation is highly preferred by the public since it gives more comfort and more self-controlled to people.

Many existing and well establish home automation systems are wired. This system does not give any problem if it is implemented according to plan and build during the construction but if the plan is not well executed then it may give problem in future and it may increase the cost of the system.

To reduce the cost and complication of the system, we are going to introduce IoT for the home automation system which is implemented using different sensors for the input of each movement and changes in environment and through the internet the system is managed by android application or website.

B. Advantages of Home automation systems

In recent years, wireless systems like Wi-Fi have become more and more common in home networking. Also in home and building automation systems, the use of wireless technologies gives several advantages that could not be achieved using a wired network only.

- 1) Adds safety through appliance and lighting control:** One of the home automation advantage is added safety for both your family and home. You have the ability to control the small appliances and lighting, again with the simple tap of your finger on your favourite technological device. You can always check to make sure your daughter turned off her curling iron or ensure that your oven has been flipped off from the morning family breakfast. Your home and family also enjoy an added measure of safety through your ability to control the lights in your home. Not only does this allow you to make sure lights are off when you are gone to save electricity, it also allows you to turn them on at specific times if you would like it to look like you are home. This also helps increase the safety and security of your home.
- 2) Increases awareness through security cameras:** Unfortunately, we just cannot be everywhere at once. This means that we often miss things that happen, perhaps even in our own home or yard. With a home automation system, you can easily see what is happening. Now you can make sure no unwelcome guests arrive unbeknownst to you or your family. Security cameras increase family safety by recording clips when detecting movement or at specific times of the day or night.
- 3) Saves money and increases convenience:** As mentioned earlier, a home automation system saves money. The most beneficial impact the system will have is on your monthly utility bill. No longer will you be spending money for household appliances left on in your family's absence. You will also save on gas costs, as you will never need to stop by the house in order to turn something off or on. This is certainly convenient. You will have complete control to make sure costs are low without exerting any additional effort.

- 4) Increases peace of mind:** Perhaps this benefit will not apply to everyone, but for those who habitually worry about whether or not they have taken care of everything at home before leaving for the day, a home automation system is a perfect investment. In short, it offers peace of mind. This is quite beneficial for those individuals who leave each day, obsessively worrying if everything is in order. With so many stresses in daily life, it is nice to take at least one off the list by being able to see what is going on at home without physically being there.
- 5) Resale:** When it comes time to sell a smart home, sellers will have an abundance of effective selling points. Whichever advantage of a smart home appeals to a given buyer, the seller can explain the system and discuss how it makes life easier. Homes with automated systems have the potential to sell for much more than comparable homes with conventional technologies. Automating a home can be a worthwhile investment in increasing its market value and attracting possible buyers in the future.

II. EXISTING SYSTEM

Home automation or Smart Homes (otherwise called domotic) can be depicted as presentation of innovation inside of the home environment to give accommodation, solace, security and vitality productivity to its inhabitants. Adding knowledge to home environment can give expanded personal satisfaction to the elderly and impaired individuals who may somehow or another require guardians or institutional consideration. There has been a noteworthy increment in home automation because of higher reasonableness and headway in Smartphones and tablets which permits incomprehensible availability. With the presentation of the Internet of Things, the exploration and usage of home automation are getting better known. A significant part of the exploration consideration has been given in the educated community. Different remote advances that can bolster some type of remote information exchange, detecting and control, for example, Bluetooth, Wi-Fi, RFID, and cell systems have been used to insert different levels of knowledge in the home. The studies in [1] have exhibited Bluetooth based home automation frameworks utilizing Android Smartphones without the Internet controllability. The gadgets are physically associated with a Bluetooth sub-controller which is then accessed and controlled by the Smart phone using Bluetooth connectivity. But, because of restricted scope of operation (greatest up to 100 m) the framework can't adapt to portability and must be controlled inside of the region. Analysts have likewise endeavoured to give system interoperability and remote access to control gadgets and apparatuses at home utilizing home gateways. [2] presented a Wi-Fi based home control framework utilizing PC based web server which deals with the associated home gadgets. The weaknesses of these frameworks are twofold. Firstly, a top of the line PC has been used which builds the expense of establishment as well as expansions the vitality utilization. A GSM based correspondence and control for home apparatuses has additionally been exhibited by [3] where diverse AT commands are sent to the Home Mobile for controlling distinctive machines. The disadvantage of this framework is that clients are not given a graphical client interface and clients need to recollect diverse AT commands to control the associated devices. [4] proposed portable IP based engineering and its potential applications in Smart homes security and automation with no real organization and testing. Of late couple of analysts have additionally exhibited utilization of Web administrations,

Simple Object Access Protocol (SOAP) and Representational State Transfer (REST) as an interoperable application layer to remotely get to home automation systems. [5] presented a smart home administration plan over the Ethernet system in view of XML SOAP models. The disadvantage of utilizing SOAP based Web an administration is that it is intricate and adds overhead to the customer and server while parsing the message, bringing about slower operation and higher Bandwidth. REST [6] has been introduced as a Web-based communication for controlling family machines utilizing Web strategies, for example, HTTP storing and push notification. Likewise a Web-based graphical client interface has been produced to deal with the home gadgets. Home automation utilizing Cloud processing has additionally been proposed by [7, 8] where clients could control different lights and machines inside of their home.

The aforementioned frameworks have made critical commitments to the outline and improvement of home computerization frameworks. Be that as it may, the current works were fundamentally entered around exchanging and controlling home apparatuses or associated gadgets as opposed to remotely checking of home environment.

III. PROPOSED SYSTEM

A. Features of the Proposed System

In order to address the mentioned issues of flexibility and functionality in the literature survey, we designed and implemented a novel, flexible and low cost home controlling and monitoring system using PHP, JSON and MySQL based Web services as an interoperable application layer. The system consists of a Web – client based on Arduino Ethernet, hardware interface modules viz. Gas Sensor, Motion Sensor, Fire Sensor, Sound Sensor, Light Sensor and Relays in addition to the Android compatible Smart phone app. The architecture presented in this work can be customized in different ways in order to accommodate different application scenarios with minimum recoding and design i.e. each time a new device is replaced in the relay, the device is automatically inherits the switch state of the old device in the Smart phone app and the online database. Hence, the aim of the proposed work is not to incorporate expensive components such as high end personal computers. This system allows authorized home owners to remotely control and monitor connected devices at home using a high speed Wi-Fi or 3G/4G enabled Smart phone which supports Java. The android smart phone app provides a graphical user interface (GUI) for accessing and controlling the devices at home.

B. Description of Proposed Architecture

This section describes the proposed architecture and design of flexible and low cost home controlling and using the Internet of Things. The architecture is divided into three layers: Home Environment, Home Gateway and Remote Environment (see Figure 1). Remote Environment represents authorized users who can access the system on their Smart phone app or the website using the Internet via high speed Wi-Fi or 3G/4G network. Home Environment consists of Home Gateway and a hardware interface module i.e. sensors and relays connected to the Arduino Mega 2560 micro-controller. The primary function of the Home Gateway for the proposed architecture is to upload sensor data to the dedicated server and download the

Relay data from the same using the Internet. The main component of the Home Gateway is a Web – client based on

Arduino Ethernet. The main task of the Arduino is to manage, control and monitor system components, that enables hardware interface modules to successfully execute their assigned task using actuators and to report server with triggered events via sensors. Hardware interface modules are directly interfaced with sensors and actuators through wires. It has the capabilities to control energy management systems like lightings, power plugs, TV, etc. systems and security systems such as door locks, and gate.

For monitoring Home Environment the system supports sensors such as temperature, humidity and current. It also makes use of another android smart phone which is used as a convenient CCTV that will capture an image when the motion sensor is triggered and upload the same to the server. The user who is running the android app will get the notification of motion detected and will be able to see the image in the app. Other users can see the same image in the web browser by going to the website.

Push notifications are also incorporated in the android application for smart phones. Whenever a sensor is triggered, a notification will be sent to all the devices running the app within reasonable time. The user can acknowledge the notification by clicking on it and can choose to disable the triggered sensor back to normal state. For eg, if the motion sensor detects some motion, it will communicate with the Arduino saying that it has detected a motion. The Arduino then uploads the motion flag to the database. The android app is continuously running in background to check for any changes in database. As soon as the app detects change in the database, in our case motion is detected, it will generate a notification saying that Motion is detected.

IV. SYSTEM IMPLEMENTATION

The system has 3 modules which are mentioned below:

1. Arduino Mega 2560 micro-controller with the following sensors: Motion, Fire, LPG, Sound and Light sensors along with a 4-relay switch all connected to the Ethernet shield which is connected to internet providing router using a RJ45 cable
2. A web server hosting PHP files and a MySQL database and CCTV image folder
3. A client. It can be an Android application or a simple web browser pointing to the web server

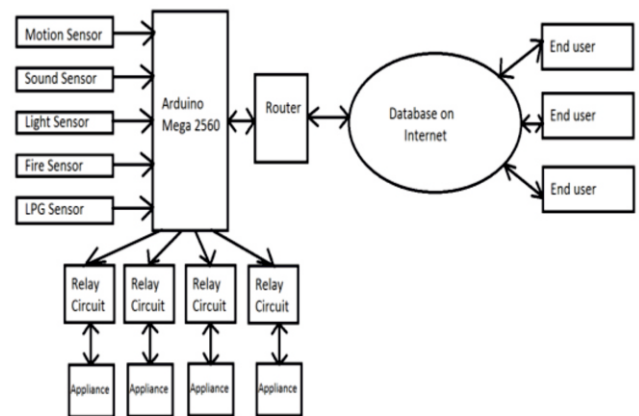


Figure 2: Proposed model of Home automation system

The above diagram shows the overall connectivity of the system. The Arduino repeatedly uploads the sensor data to the web server and downloads the relay data from the web server at an interval of 5 seconds. The MySQL database is updated accordingly to the sensor values from the Arduino. When motion sensor detects change a image is clicked by a android mobile and is sent to the database. Arduino downloads an XML file consisting of the relay device and state. The Arduino on the other hand, changes the state of the relays according to the parsed XML downloaded from the server. If any movement or change is occurred then sensor ends acknowledgement to the microcontroller which notifies the end user through application using internet.

V. RESULT



Figure 3: Experimental setup of HAS

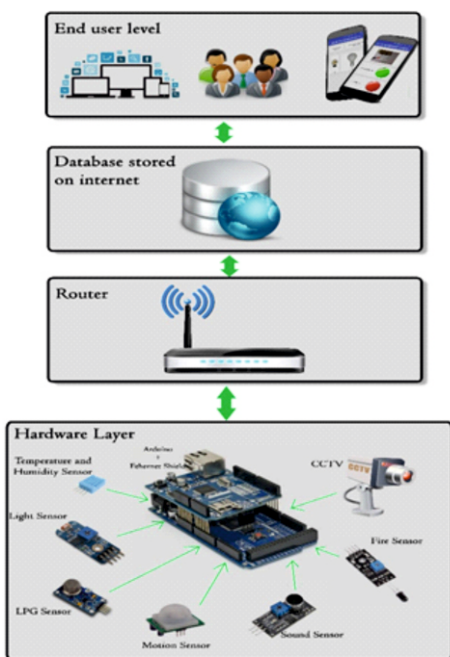


Figure 1: A Overview of Conceptual architecture.

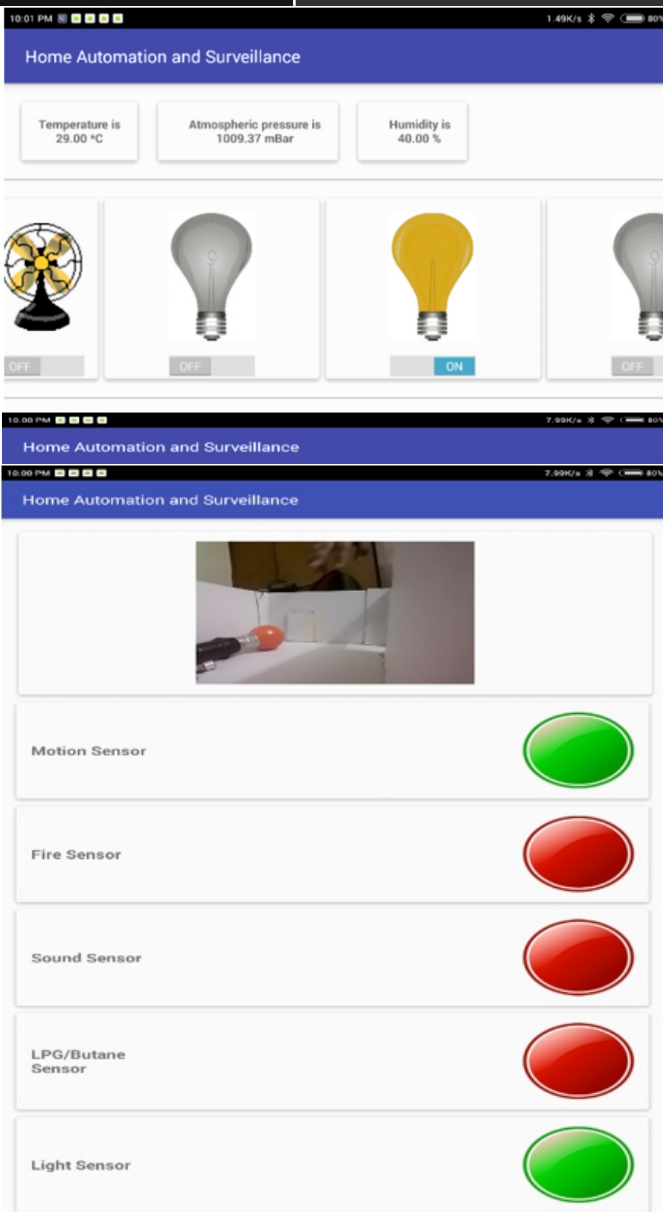


Figure 4: Screenshots of graphical user interface.

After the successful connection to the server, the data of sensor are sent to the web server for monitoring of the system. The figure 4 shows the user interface which will allow us to monitor and control the system. The stored database gives the information about the temperature in different places of the house and motion state in the house. It also gives the status of the various electrical appliances like light, fan etc. which we can control remotely.

VI. CONCLUSION AND FUTURE WORK

A. Conclusion

From this home automation experiment using IoT, it is proved that fetching data from sensors like temperature sensor, barometer, gas, light and motion sensor and controlling that data using small mobile phone is successfully implemented. It also switch on when the room gets dark. It also shows weather condition using the barometer, temperature and humidity sensor. This will help the user to analyse the condition of various parameters in the home anytime anywhere rapidly.

B. Future work

This system can be expanded by just adding different home security appliances. For that camera which is install in the house can capture picture of the house periodically and connecting that camera to the system's database to store for user to access it later or we can provide CCTV camera footage to user so that he/she can monitor the home using the small application on cell phone. This system including the changes can be used in the hospitals with disable people or in different chemical industries where the temperature and pressure has to maintain without human being since it may be hazardous to them, and it can also be implemented for environmental monitoring.

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