

Smart Home Automation using Arduino and Wifi

Yash Mundra¹ Shivali Chaturvedi² Swadesh Jaiswal³ Shiv Shankar Rajput⁴ Kavita Namdev⁵

^{1,2,3}Student ⁴Assistant Professor ⁵Sr. Assistant Professor

^{1,2,3,4,5}Department of Computer Science and Engineering

^{1,2,3,4,5}Acropolis Institute of Technology and Research, Manglia, Indore, Madhya Pradesh, India

Abstract— This system is designed to assist and provide support in order to fulfill the needs of elderly and disabled in home. Automation of the surrounding environment of a modern human being allows increasing his work efficiency and comfort. There has been a significant development in the area of an individual& routine tasks and those can be automated. In the present times, we can find most of the people clinging to their mobile phones and smart devices throughout the day. Hence with the help of his companion-a mobile phone, some daily household tasks can be accomplished by personifying the use of the mobile phone.

Keywords: Internet of Things (IoT); Home Automation; Mobile phones

I. INTRODUCTION

As rapid change in technology always aims to serve the mankind, the expectation for living a simple yet advance life keeps on increasing .The Internet of things (IoT) devices not only controls but also monitors the electronic, electrical and various mechanical systems which are used in various types of infrastructures[1],[2]. These devices which are connected to the cloud server are controlled by a single user (also known as admin) which are again transmitted or notified to all the authorized user connected to that network. Various electronics and electrical devices are connected and controlled remotely through different network infrastructures. Web browser present in laptop or smart phone or any other smart technique through which we can operate switches, simply removes the hassle of manually operating a switch. Now a day's although smart switches are available they proves to be very costly, also for their working we required additional devices such as hub or switch .As there is rapid change in wireless technology several connectivity devices are available in the market which solves the purpose of communicating medium with the device and the micro-controller. Starting from Bluetooth to Wi-Fi, from ZigBee to Z-wave and NFC all solve the purpose of communicating medium. RF and ZigBee are used to used in most wireless networks . In this research paper we have taken ESP8266 Wi-Fi module which is programmed through Arduino UNO to control various devices. The rest of sections in this paper is organized as follows: Nowadays, we have remote controls for our television sets and other electronic systems, which have made our lives really easy. Have you ever wondered about home automation which would give the facility of controlling tube lights, fans and other electrical appliances at home using a remote control? Off-course, Yes! But, are the available options cost-effective? If the answer is No, we have found a solution to it. We have come up with a new system called Arduino based home automation using Wifi. This system is super-cost effective and can give the user, the ability to control any electronic device without even spending on the remote control. This research paper helps

the user to control all the electronic devices using his/her smartphone. Home automation systems have gained popularity in recent years, paralleling the advances in the concept of the Internet of Things. Although automation for commercial buildings is a mature technology, automation applications for residences are a relatively new development, which is gradually being adopted by consumers. Home automation involves the monitoring and control of activities such as lighting, heating, ventilation, air conditioning (HVAC), electrical appliances, sound systems, security cameras, door locks, and alarms. Home automation has various advantages, such as comfort, increased security, and energy efficiency. Figure 1 shows the general home automation system. The figure shows the various home appliances such as security sensors, thermostat etc[1][8]. which is controlled through the central control panel via the Internet. The widespread use of home automation can be seen in cold cities such as Milwaukee, where people set the heating of the house to go off when they leave and switch on the heater 15minutes before they return. The system is known as HVAC and is the best option for home automation. In an era with wireless technology such as Bluetooth, WiFi, Zigbee, and GSM, users want home appliances to be connected wirelessly. Each of these wireless technologies has its own significance and specifications. This research paper successfully uses Wifi with an available frequency of 2400 Hz, a range of 100 meters, and a speed of approximately 3 Mbps. There are a few concerns to be addressed when designing a home automation system. The system should be designed in a manner that integrates new devices, so that these devices should not be a problem at a later stage. On the host side, the system should be user-friendly, so that the devices can be monitored and controlled easily. In case of any problems in the future, the interface of the system should provide diagnostic services. Finally, the system should be cost-effective so that it can be widely used by anyone in the market.. Analyzing the current smart phone market,

II. LITERATURE SURVEY

Home automation was first introduced into the world market in the 1970s, but it failed to meet the expectations of people and was unsuccessful. There were various reasons associated with the failure of the home automation system. The system was neither user friendly nor cost efficient. Currently, the foremost point to be kept in mind when designing a home automation system is that it should be cost-efficient and easy to install. K. Y. Lee and J. W. Choi [1], in their research on the Housing Learning and Improvement Network in 2003, defined a Smart Home as a “unit where all the appliances of the house are connected together and controlled and monitored remotely.[1],[2]”

The following paragraphs will give a summary of the previous research works in the field of Smart Homes.T.

Tamura et. al. , in their research, constructed the welfare techno houses in Japan in 2003. The motive behind the report paper was to monitor the health of the disabled and older people living in the home, thereby improving their quality of life. D. J. Cook et. al. [3] successfully conducted the Mav Home report paper at the University of Texas, Arlington. The research paper used sensors to detect the state of the environment, and with the help of controllers, took the necessary action to maintain equilibrium. These sensors form an ad-hoc network to make the decisions. H. Kanma et. al. [4] conducted a medical research to monitor people who require medical help and present a wireless solution at the University of McGill in Canada. The report paper made use of cell phones and inexpensive sensors. It worked by making use of wireless protocols such as Bluetooth, ZIGBEE, as well as GSM and analyzing data through an adaptive architecture. The research had an architecture that consisted of three main parts. First, sensors collected the medical data and transmitted it via sensors to mobile devices. Second, an application called J2ME on mobile devices processed the collected data. Finally, all the data that was collected was combined to address the needs of the elderly. The major benefit of this report paper is that it could be implemented at an inexpensive price in a short span of time. In the past few years, significant research has been conducted in the field of Smart Homes to make the technology better for handicapped and elderly people. N. Liang et. al. [5] have described challenges related to Smart Homes and conducted research at the University of Erlangen, Germany, for the betterment of these populations and identified the benefits in-order to help them lead more independent lives. For the implementation of these report papers, there are various sub-networks used such as the Bluetooth module, Wireless LAN, RFIDs, and TCP/IP. A Wifi network transports the sensor data and interconnects the network. As per the location of the occupancy recorded, the RFID system transmits data from the RFID tags. The messages are transmitted via Wifi using Bluetooth modules. This reduces the cost, as no further hardware is required for the implementation. The idea presented in this report paper is the one similar to the report paper presented by the students at the University of Nigeria regarding the design of a home automation system using Arduino. The report paper focuses on the design of a home automation system using the Atmega 328 microcontroller. The report paper does, however, emphasize the advantages of using a wireless standard. To connect to a wide range of devices, Wifi is a global standard and is easily available in almost all devices, for it is easy to set up and use. It also encrypts data using a 128 bit long shared key, making it a secured connection as well [1][7]. With the advancements in RF Technology, such as Zigbee and Bluetooth, these systems have also become popular in the market. The previous infrared systems had numerous security issues and there were interferences between signals, making it unsecured and less popular in the market. Research is still occurring in this field; various systems have been proposed, but very few of them have been implemented in the market. Home automation is becoming popular due to its numerous benefits. Home automation refers to the control of home appliances and domestic features by local networking or by remote control.

Artificial Intelligence provides us the framework to go real-time decision and automation for Internet of Things (IoT). The work deals with discussion about different intelligent home automation systems and technologies from a various features standpoint. The work focuses on concept of home automation where the monitoring and control operations are facilitating through smart devices installed in residential buildings. Heterogeneous home automation systems and technologies considered in review with central controller based (Arduino), web based, email based, Bluetooth-based, mobile- based, SMS based, ZigBee based, Dual Tone Multi Frequency-based, cloud-based and the Internet with performance [6][7]

A. Bluetooth based home automation system using cell phones:

In Bluetooth based home automation system the home appliances are connected to the Arduino BT board at input output ports using relay. The program of Arduino BT board is based on high level interactive C language of microcontrollers; the connection is made via Bluetooth. The password protection is provided so only authorized user is allowed to access the appliances. The Bluetooth connection is established between Arduino BT board and phone for wireless communication. In this system the python script is used and it can install on any of the Symbian OS environment, it is portable. One circuit is designed and implemented for receiving the feedback from the phone, which indicate the status of the device. [7][8]

B. Zigbee based home automation system using cell phones:

To monitor and control the home appliances the system is designed and implemented using Zigbee. The device performance is record and store by network coordinators. For this the Wi-Fi network is used, which uses the four switch port standard wireless ADSL modern router. The network SSID and security Wi-Fi parameter are preconfigured. The message for security purpose first process by the virtual home algorithm and when it is declared safe it is re-encrypted and forward to the real network device of the home. Over Zigbee network, Zigbee controller sent messages to the end. The safety and security of all messages that are received by the virtual home algorithm. To reduce the expense of the system and the intrusiveness of respective installation of the system Zigbee communication is helpful.

C. GSM based home automation system using cell phones:

Because of the mobile phone and GSM technology, the GSM based home automation is lure to research. The SMS based home automation, GPRS based home automation and dual tone multi frequency (DTMF) based home automation, these options we considered mainly for communication in GSM. In figure shows the logical diagram the work of A. Alheraish, it shows how the home sensors and devices interact with the home network and communicates through GSM and SIM (subscriber identity module). The system use transducer which convert machine function into electrical signals which goes into microcontroller. The sensors of system convert the physical qualities like sound,

temperature and humidity into some other quantity like voltage. The microcontroller analysis all signal and convert them into command to understand by GSM module. Select appropriate communication method among SMS, GPRS and DTFC based on the command which received GSM module.

D. Home automation using RF module:

The important goal of Home Automation System is to build a home automation system using a RF controlled remote. Now technology is accelerating so homes are also getting smarter. Modern homes are deliberately relocating from current I switches to centralized control system, containing RF controlled switches. Today traditional wall switches situated in various parts of the home makes it laborious t for the end user to go near them to control and operate. Even further it turns into more problematic for the old persons or physically handicapped people to do so. Home Automation using remote implements an easier solution with RF technology. In order to accomplish this, a RF remote is combined to the microcontroller on transmitter side that sends ON/OFF signals to the receiver where devices are connected. By operating the stated remote switch on the transmitter, the loads can be turned ON/OFF globally using wireless technology[8][12].

E. Raspberry pie home automation with wireless sensors using smart phone Home:

Automation System has been developed with Raspberry Pi by reading the algorithm and subject of Email. Raspberry Pi guarantees to be an efficient platform for implementation powerful, and economic smart home automation. home automation using Raspberry pi is better than any other home automation methods in several ways. For example, DTMF (dual tone multi-frequency) using home automation, the call tariff is a big demerit, which is not the problem in their proposed method. In Home Automation using web server, the design of web server and the memory space required is dismiss by this method, because it just uses the already established web server service given by G-mail. LEDs were used to identify the switching action. This System is efficient and flexible interactive.[1][6]

III. RESEARCH METHODOLOGY AND PROCESS DIAGRAM

Nowadays people use mobile phones every time so this product is useful for them, as they can control appliances through their mobile phones. As the product will be cost effective, it will be economical for large sums of people.

A. Innovativeness

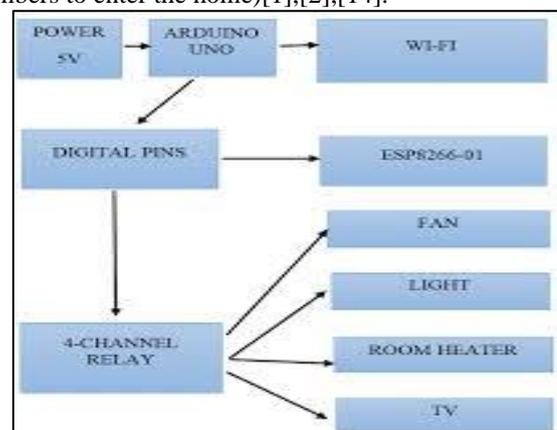
We are shifting from conventional switches to central processing unit system controlled by a smart phone. Smart home concept are taking an important role in innovation trends. Artificial Intelligence, Internet of Things and Clouds of Things will contribute to the smart city/home services developments. An important attribute characterizing a great part of smart home innovation is its growing complexity. Some innovations in a smart home are seemingly incremental, involving new combinations of existing technologies. Some innovations represent a new approach to service development and are based on the new technologies. The terms radical and incremental innovation are often used

to describe the degree of innovativeness of a service, product, process or business model. Incremental innovation is often describes as an improvement and exploitation of the existing technologies, services and business models. Radical innovation aims to create a new product, service or technology which solves a need that the market had not previously expressed, or which had not yet been seen as solvable, which results in transformation of existing markets or creations of new ones. New products or solutions are based on an invention or an insight that is ahead of its time and of the market. Often, radical innovation is technology driven, starting from a new technology, looking for an application. In the context of smart home services and infrastructures, radical innovations will be often aimed at driving the performance frontier rather than serving under-served or unserved markets like in the case of disruptive innovation. The fast development of ICT technologies is enabling the emergence of many new applications and the redesign of traditional systems towards smarter solutions. In practice, many innovations in smart home are a mix of different types of innovations. Even though incremental and radical innovations generally result from different processes and require quite different strategies, both activities need to be executed within smart home concept[1],[8][14].

B. Usefulness

It will be useful for the physically challenged people as well as aged people. The Wifi technology and Aurdino in the system will allow to connect multiple systems at the same time. The inefficiency of operation of conventional wall switches can be overwhelmed using various home automation systems (without using conventional switching methods).

The loss of power can be reduced and manpower required for home automation is very less compared to conventional methods. The IR, RF, android application, Arduino, Wifi, DTMF, etc., based home automation systems can be more efficient, provides ease of operation. Provides safety from electrical power short circuits while using conventional wall switches to operate loads. Home automation system with automated door locking and security cameras facilitates more security. By using a home automation system, we can save a lot of time to operate home appliances from anywhere (without wasting time to move from office to home for just unlocking door for family members to enter the home)[1],[2],[14].



IV. RESULT

All appliances are controlled and everything is working properly. By using NodeMcu esp8266 we can control home appliances with smart phones.

V. CONCLUSION

Throughout the report paper many problem arose that could not be solved during the designation time period. 2 major issues relate to the ability to detect voice sensor and LED on/off. This issues arise when voice was not recognized properly such an action is independent of the application therefore the system is unable to recognize the voice and LED turning on/off simultaneously. This issue can be solve with the use of adding an option of on/off in an existing application. But as mentioned earlier voice recognition system was a difficult task to add on with more time it is possible to solve the problem encountered throughout this report paper turning the prototype into actual product. The final conclusion would be that the prototype is functional, yet requires more work to complete all the functionalities that would be required for a commercial product. The team truly believes that home automation is the next big step in the lives of consumers. The technology is available , most houses have a wifi service , most consumers have smartphones. What is left is creating a unified home automation system where the home appliances are all connected allowing the home owner to control every aspect of their functions[1],[2],[3].

REFERENCES

- [1] www.wikipedia.org
- [2] www.arduino.org
- [3] www.electgo.com
- [4] www.javatpoint.com
- [5] www.circuitdigest.com
- [6] <https://developer.android.com/studio>
- [7] <https://cityos-air.readme.io/docs/esp8266-nodemcu>
- [8] <https://lastminuteengineers.com/esp8266-nodemcu-arduino-tutorial/>
- [9] <https://www.hiotron.com/home-automation-system/>
- [10] <https://www.control4.com/blog/345/78-home-automation-ideas/>
- [11] https://developer.mozilla.org/en-US/docs/Web/API/WebSockets_API
- [12] <https://www.circuito.io/blog/arduino-code/>
- [13] <https://www.arduino.cc/en/Guide/HomePage>
- [14] <https://www.circuito.io/blog/arduino-uno-pinout/>