JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Smart Home Automation and Security System using IOT Application

Arun Dwivedi[1], Nishi Pandey[2], Prof. Abhishek Agwekar[3]
M. Tech. Scholar, Department of Electronics and Communication, TRUBA, Bhopal, India[1]
Assistant Professor, Department of Electronics and Communication, TRUBA, Bhopal, India[2]
Head of Dept., Department of Electronics and Communication, TRUBA, Bhopal, India[3]

Abstract: The Internet of Things (IoT) is the network of devices such as vehicles, and home devices that contain electronics, software, actuators, connectivity which allows these things to connect, interact and exchange data. Automation is the technology by which a process is performed with minimum human efforts. Automation or automatic control is the use of discrete control systems for operating equipment. This paper is focused on five different techniques such as home automation system by using symmetric encryption scheme, Eet-based Smart Home intelligent system, by using set of sensors, low-cost Wi-Fi based automation system for Smart Home, monitoring and controlling the home appliances via World Wide Web. Even though, some issues arise in every method which is analyzed in analysis and discussion section. To improve these issues, this paper has proposed a new home automation technique with the use of IOT, so as to reduce the existing problems and make home automation more smart and secure.

Index Terms – IOT, Arduino, Node MCU, WI-FI, Smart phone, Home automation system, Sensor

I. INTRODUCTION

Home automation and the Internet of Things (IoT) are getting popular day by day. In present days automated systems are most liked over the manual system. Smart Home is an IoT domain. It is a concept of creating a pervasive environment that comprises network of devices including wireless sensors, connected devices and related technology to provide in house network access. This setup provides home residents an ability to obtain knowledge, monitor and automate various parts of home. This enhances the efficiency of day-to-day household activities; maybe from anyplace, anything, anywhere and anytime, using internet via a smart phone application. With advancement in smart home technology, smart devices become networked to form digital mesh of intelligent home ecosystems. These ecosystems have connected devices to combine efforts and offer benefits beyond convenience including enhancing the security and safety, culture, health and fitness of the residents and their overall quality and efficiency of the lives. The advancement of IoT and smart connections in present days home, has gained popularity owing to maturity in the use of data analytics, wireless sensor protocols, wireless sensors, advanced processor, edge computing, and widespread availability of mobile network. Smart home is a major component in Smart City. As every other IoT, the aim of IoT enabled home is to make the life of home owner simpler and more comfortable. Home IoT devices can be categorised into following Types

- Communication devices - Personal Computer, Tablets, Smart phones
- Entertainment devices – Smart TVs, Projectors, Sound bars , Speakers streaming devices
- Home gadgets – Smart Oven, Refrigerator, Dishwasher, Robotic vacuum cleaner etc.
- Smart lighting – Bulbs , Plugs
- Security devices – Smart locks, Surveillance CCTV camera, Video Door phones,
- Wearables – Fitness trackers, Most of the IoT devices commonly used by smart home users are included in the above list.

However, since this market is very dynamic new products are being developed and launched almost on a daily basis. Therefore, this list is expected to expand exponentially. Given the ease and convenience of these devices, home IoT devices pose a major danger to home owners. Risks of inadequate protection may have a very significant effect on home owners.

II. ADVANTAGES OF SMART HOME INNOVATIONS

Fortunately, we are living in the golden age of technological evolution. Smart home technology typically refers to any group of devices, appliances or systems connected to a common network that can be managed independently and remotely. Whenever home technology works together in one unit, it can also be more loosely pointed to as "connected home" or "intelligent home." For example, TVs, thermostats, smart lights, audio speakers (like Alexa), security surveillance cameras, door locks, other home gadgets are all connected to a common computer that can be controlled from your smartphone or tablet. Smart Home Automation gives us the ability to indulge ourselves in high-tech technology and convenience that was not possible before. As technological developments continue to grow, consumer home automation adoptions can make life easier and more enjoyable. There are several practical benefits of using Smart Home Technology

1. Remote control feature - Don't underrate the ability to remotely control your house. User can give a command to home on an extremely hot day to get cooler just before you get home.

2. The comfort and convenience – This is a very big factor. Smart home technology helps users to monitor all home devices from a single place. Being able to maintain all devices connected with a single application at home is a big step forward for devices and home management. For this, all you need to do is learn how to use a single control system on your smartphone or tablet, and you can get into a multitude of functions of smart home.

3. Adaptability & versatility - New devices and appliances are designed to provide adaptability. When it comes to incorporating modern devices, appliances and other technologies, smart home systems appear to be remarkably flexible. No matter how state-of-the-art your appliances appear today, as time goes on, newer, more amazing models will be developed. In addition, it is possible that one will add to the machine suite as older ones are replaced.

4. Better safety & security - When users incorporate protection and monitoring features into the smart home network, it strengthen your home security. There are hundreds of options available. Home control devices, such as Security alarms system, door locks, motion detectors, surveillance cameras, and other security appliances in your home. Biometric system, retina scanners and facial recognition technologies help in providing highly validated and authorized high-security systems.

5. Improved quality of the Gadgets - Smart homes functions will allow user to properly operate home appliances. Opening and closing doors and windows by means of voice assistance, music systems to soothe the atmosphere, automatic heating and lighting systems, refrigerators to order grocery stores, equipment to feed pets and equipment to relay warning alarms in the event of potential accidents.

6. Greatly improved energy efficiency – Smart devices in smart homes allow users to monitor energy usage over time. It's possible to make your home more energy efficient, with the use of smart-home technology. For example, with a programmable smart thermostat that learns your schedule and temperature preferences, you can have more control over your home's heating and cooling system, and then recommend the best energy-efficient settings during the day. Lights and motorised shades can be programmed to switch to an evening mode when the sun sets, or when you enter or exit the room, the lights will turn on and off automatically, so you never have to worry about waste of energy.

III. PROPOSED METHODOLOGY

Home automation is the procedure to control home appliances automatically using various control system techniques. The electrical and electronic appliances arises in the home such as fan, lights, outdoor lights, fire alarm, kitchen timer, etc., can be controlled using various control techniques. There are various methods arises to control home appliances like IOT based home automation over the cloud, home automation under Wi-Fi through android apps from any smart phone and Arduino based home automation. Arduino is an open-source hardware and software, project and user community which designs and manufactures single- board microcontrollers and microcontroller kits for building digitaldevices and interactive board microcontrollers and microcontroller kits for building digital devices and interactive board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the actual and digital world.

In figure 1, the above flowchart is showing how a controlling system would work here. The system is connected to the Wi-Fi. Then the user will log in to the web page and send a command to the server.This command is processed in the ESP module. The command is then read by the microcontroller. BothESP module and microcontroller runs on DC. The relays are turned on and off accordingly by the microcontroller. Since the output devices run on AC, the relays act like channels which provides AC power when the command is ON and turns OFF supply when it is OFF. The coding and simulation has been done based on the flowchart shown in figure 1.

The android OS provides the flexibility of using the open source. The inbuilt sensors can be accessedeasily. The application used to control the system has the following features. Android Phone acts as a client and data are sent via sockets programming. The application takes command from user in two different modes.

- **Switch mode:** Switch mode uses the radio buttons that are used to control the home appliances.The radio button sends the status of the switch.
- **Voice mode:** Voice Mode is used to control the home appliances using voice command. Usingthe inbuilt microphone of Smartphone, the application creates an intent that fetches the speechdata to the Google server which responds with a string data. The string data are further analysedand then processed.

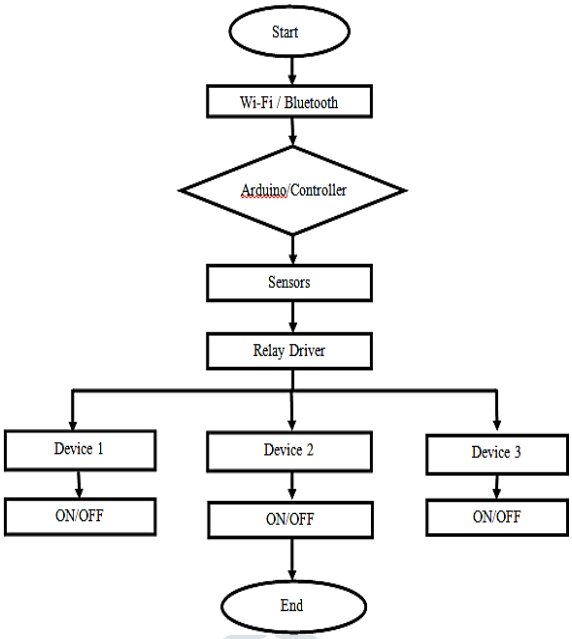

Figure 1: Flowchart of Proposed Methodology

Working Principal:-

The working procedure of the project can be described from the following figure. In the following figure power supply adapter is used in order to step down the voltage from 220V to 12V. This 12V dc is directly connected to reduce the voltage from 12V to 2.5V. Becausethe Node MCU module is operated in 3.5V. This Node MCU module is connected with 6 channel relay modules. An inverter has been used to invert the voltage from 3.5V to 5V. Then, log into the web page and to give command to turn off or on to the corresponding load. By logging in the web page, the current status of the load can be observed. With the 5loads (2 fan, 2 light and solenoid door lock). An LM2596 dc adjustable buck converter wasused.

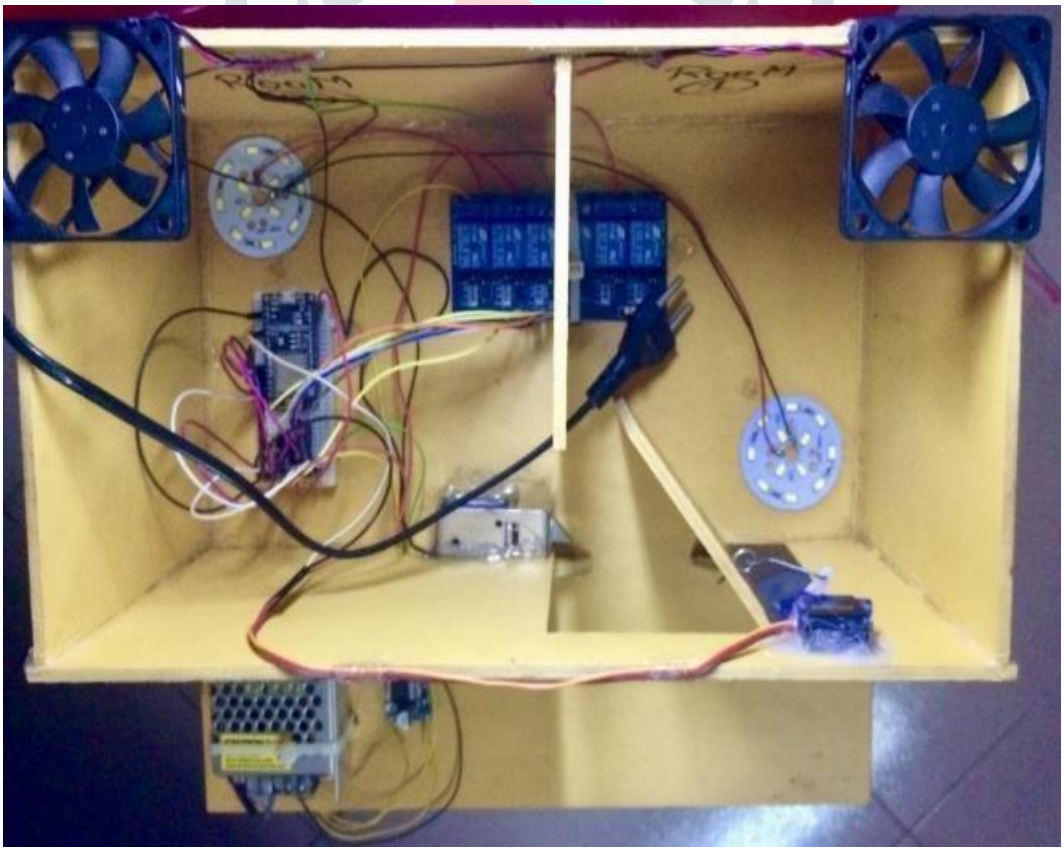

Figure 2: Full hardware project picture

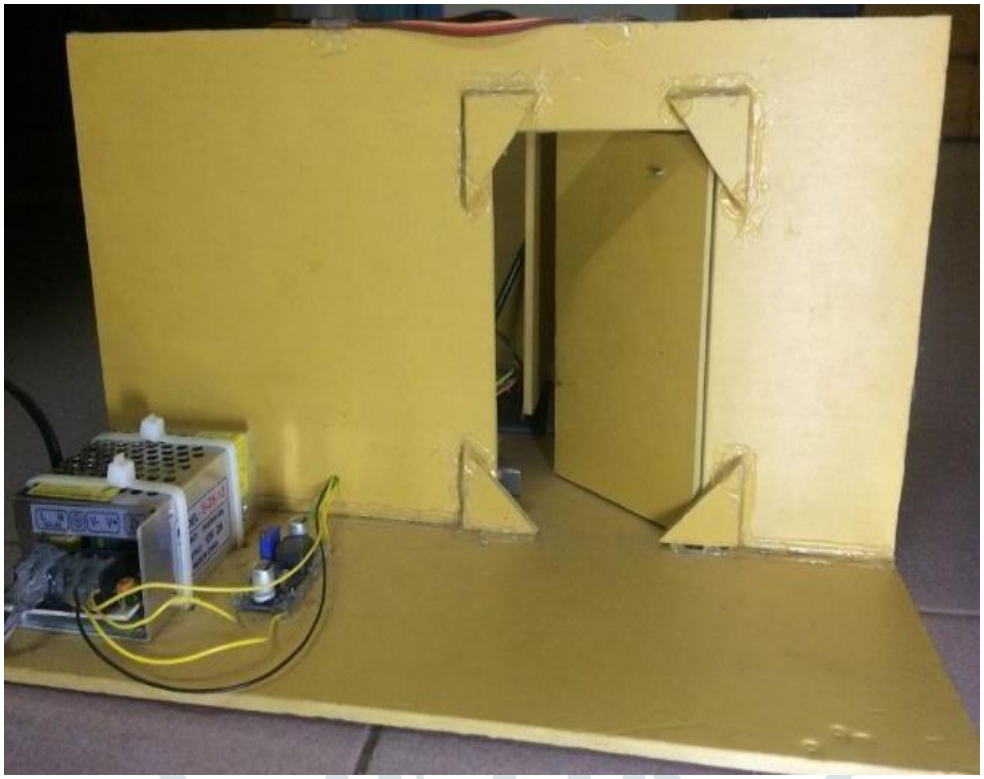

Figure 3: Front view of project

IV. SIMULATION RESULTS

Bluetooth is generally used for point to point networks and Bluetooth operates at a much slowerrate of around 720 Kbps which is very small for video transfer or moving large amount of datalike theimage captured from a camera, whereas the bandwidth of Wi-Fi can be up to 150Mbps and very ideal for video transmission. Wi-Fi is very much secure means of communication than Bluetooth. Wi-Fi connection to send video, audio, and telemetry operation, while accepting remote controlcommands from an operator who can be located virtually anywhere in the world. Robots are already being eyed for obvious tasks like conducting search-and rescue missions during emergencies or hauling gear for soldiers in the jungle or woods. The mechanics of the robot uses the concept that has been developed to ensure robust navigation, search and transportation in rough terrain.

Table 1: Comparison chart of Wi-Fi with other wireless communication protocols

STANDARD	BLUETOOTH	UBW	ZIGBEE	WI-FI
IEEE specification	802.15.1	802.15.3a	802.15.4	802.11a/g/b
Frequency band	2.4 GHz	3.1-10.6 GHz	868/915 MHz; 2.4 GHz	2.4 GHz; 5 GHz
Maximumsignal rate	1 Mb/s	110 Mb/s	250 Kb/s	54 Mb/s
Nominal range	10 m	10 m	10-100 m	100 m
NominalTX power	0-10 dBm	-41.3 dBm/MHz	(-25) -0 dBm	10-20 dBm
RF channels	79	1-15	1/10; 16	14 (2.4 GHz)
Channel bandwidth	1 MHz	500 MHz-7.5 GHz	0.3/0.6 GHz; 2 MHz	22 MHz
Modulation type	GFSK	BPSK, QPSK	BPSK (+ASK), O-QPSK	BPSK, QPSK, COFDM, CCK,M-QAM
Spreading	FHSS	DS-UBW,MB-OFDM	DSSS	DSSS, CCK, OFDM
Co-existencemechanism	Adaptive frequency hopping	Adaptive frequency hopping	Dynamicfrequency selection	Dynamic frequency selection, transmit power

				control
Basic cell	Piconet	Picomet	Star	BSS
Extension ofbasic cell	Scattemet	Peer-to-peer	Cluster tree,Mesh	ESS
Maximum cellnodes	8	8	>65000	2007
Encryption	E0 Stream chipper	AES block cipher (CTR, counter mode)	AES block cipher (CTR, counter mode)	RC4 stream cipher (WEP),AES block cipher
Authentication	Shared secret	CBC- MAC (CCM)	CBC-MAC (extention ofCCM)	WPA2 (802.11i)

VOICE MODE CONTROL

The prototype works in both switch mode and voice command mode. Switching modes is simply accessing the radio buttons in the Blynk app, and the controls were discussed earlier in this chapter in the previous section. Here we will discuss the prototype's voice mode control. We use the IFTTT app and the Google Assistant on our smartphones for voice commands. IFTTT stands for "If This Then That", which is an interface that provides web services in which devices are connected to a mobile application. We can't connect Google Assistant directly to Node MCU and that's the only reason we use the Blynk app. The Blynk application can connect directly to the Node MCU and send data to it. So if we can send voice commands interpreted by Google Assistant directly to Blynk app, then Blynk app can pass those commands to NodeMCU. But the problem is that Google Assistant can't directly understand unrelated commands like "turn on fan" or "turn on relay" etc. by himself. So, to solve this problem, we use another intermediary application/website called “IFTTT”. Simply, to control our home appliances over the internet we use Node MCU and to connect Node MCU to home appliances we use relay board. Now, to send or deactivate signal to Node MCU we use our smartphone and we do this using Blynk app. But we want to send an on or off signal by voice command.

Figure 4: Voice and switch mode control

To do this we use the Google Assistant in our smartphones and an app called IFTTT. So in the end what will happen is when we say a voice command like "ok google turn on the lights" to google assistant, google assistant will send that unrelated command to IFTTT. IFTTT interprets this command and sends an on or off signal to the Blynk application through the Blynk server. Blynk will then send this signal to the Node MCU and then to our electrical devices.

Table II: Costing of Project

Equipment Name	Cost in Taka (৳)	Cost in Dollar ($)
Node MCU	550	6.63
Power supply	849.97	10.15
Resistors	2	0.024
Breadboard	240	2.89
Relay module	600	7.17
Not gate 7404	22.10	0.26
Wires	35	0.42
Buck converter	335.28	4.01
Servo motor	315.81	3.77
Solenoid lock	965.32	11.53
Adapter	170	2.05
Total	4085	48.804

V. CONCLUSION

From the work of this company, it is clear that the IoT-based smart home security and mechanization framework can be economically manufactured using locally accessible parts and can be used to control various household appliances, from lights to security, from TVs to cooling frames and surprisingly the lighting of the whole house. Even better, the parts needed are so few that they can be grouped together in a small, imperceptible compartment. Planned home motorized chassis has been tried many times and confirmed to control various home devices used in lighting frames, cooling frames, home theater setups and more. The framework can then adapt and adapt.

According to the results from the simulation and hardware implementation and based on the study about this project, a new automation system with an online feature is done for home automation. The IOT based home automation as stated can provide solution to the difficulties of traditional home automation. With the execution of the IOT network system which is as of now accessible it is route to eventually achieving the advantages of remote automationand control of an electrical system.

REFERENCES

[1] P. P. B. A. Uma Pujaria "Internet of Things based Integrated Smart Home Automation" International Conference on Communication and Information Processing (ICCIP-2020).

[2] El-Hajj, M.; Fadlallah, A.; Chamoun, M.; Serhrouchni, A. A Survey of Internet of Things (IoT) Authentication Schemes. Sensors 2019, 19, 1141.

[3] Froiz-Míguez, I.; Fernández-Caramés, T.M.; Fraga-Lamas, P.; Castedo, L. Design, Implementation and Practical Evaluation of an IoT Home Automation System for Fog Computing Applications Based on MQTT and ZigBee-WiFi Sensor Nodes. Sensors 2018, 18, 2660.

[4] Jabbar, W.A.; Kian, T.K.; Ramli, R.M.; Zubir, S.N.; Zamrizaman, N.S.M.; Balfaqih, M.; Shepelev, V.; Alharbi, S. Design and Fabrication of Smart Home with Internet of Things Enabled Automation System. IEEE Access 2019, 7, 144059–144074.

[5] Ozeer, U.; Letondeur, L.; Ottogalli, F.-G.; Salaun, G.; Vincent, J.-M. Designing and Implementing Resilient IoT Applications in the Fog: A Smart Home Use Case. In Proceedings of the 2019 22nd Conference on Innovation in Clouds, Internet and Networks and Workshops (ICIN), Paris, France, 19–21 February 2019; pp. 230–232

[6] Syafa'Ah, L.; Minarno, A.E.; Sumadi, F.D.S.; Rahayu, D.A.P. ESP 8266 for Control and Monitoring in Smart Home Application. In Proceedings of the 2019 International Conference on Computer Science, Information Technology, and Electrical Engineering (ICOMITEE), Jember, Indonesia, 16–17 October 2019; pp. 123–128.

[7] Jabbar, W.A.; Alsibai, M.H.; Amran, N.S.S.; Mahayadin, S.K. Design and Implementation of IoT-Based Automation System for Smart Home. In Proceedings of the International Symposium on Networks, Computers and Communications (ISNCC), Rome, Italy, 19–21 June 2018; pp. 1–6.

[8] Byun, J.; Park, S.; Cho, K.; Park, S. Zone-aware service platform: A new concept of context-aware networking and communications for smart-home sustainability. Sustainability 2018, 10, 266.

[9] Gupta, P.; Chhabra, J. IoT based Smart Home design using power and security management. In Proceedings of the 2016 International Conference on Innovation and Challenges in Cyber Security (ICICCS-INBUSH), Noida, India, 3–5 February 2016; pp. 6–10.

[10] Debnath, B.; Dey, R.; Roy, S. Smart switching system using bluetooth technology. In Proceedings of the 2019 Amity International Conference on Artificial Intelligence (AICAI), Dubai, United Arab Emirates, 4–6 February 2019.

[11] Ganesh, E. Implementation of IOT Architecture for SMART HOME using GSM Technology. Int. J. Comput. Tech. 2017, 4, 42–48. 34. Kaur, S.; Singh, R.; Khairwal, N.; Jain, P. Home Automation and Security System. ACII 2016, 3, 17–23.