

IOT BASED SMART HOME AUTOMATION SYSTEM

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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 arises in every method which are 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 - Internet of Things (IOT), Home automation system.

I. INTRODUCTION

An IoT involves extending Internet connectivity beyond standard devices, such as desktops, laptops, smart phones which is Embedded with technology, these devices make communication over the Internet, and user can be remotely monitored and controlled. This proposed system focused on five different techniques and systems such as Low cost Wi-Fi based home automation system, it facilitates global connectivity over world-wide physical objects to serve people in a collaborative manner automatically and intelligently [1]. Home automation using symmetric encryption scheme uses the chaos-based cryptography and message authentication code for data transmission to ensure the security [2]. Home automation using set of sensors, which focuses on building a smart wireless home security system which sends alerts using internet [3]. Ethernet based system works on real time monitoring and voice control, so that the devices and switches can be remotely controlled with or without android based app [4]. Home automation system via WWW, which provides an interface to home appliances using telephone line or internet to supply management and observance through smart phone [5].

This paper presents, Home automation by IOT in which a method is defined that uses arduino controller to control and manage different electrical appliances of the home. This system performs its task with the help of the sensors which help in controlling the state of the devices

II. BACKGROUND

Home automation is constructing automation for a home, called a smart home or smart house. In which the system can control lighting, climate, entertainment systems, and appliances. It may also involve home security such as access control and alarm systems. When connected with the Internet, home devices are an important constituent of the Internet of Things.

In low-cost Wi-Fi based automation system for Smart Home (SH) in order to monitor and control home appliances remotely using Android based application. An Arduino Mega microcontroller provided with Wi-Fi module is utilized to build the automation system [1].

The proposed symmetric encryption scheme is secured by the secret keys being generated by chaotic systems. So, the incorporate message authentication codes in the scheme to guarantee data integrity and authenticity [2].

The microcontroller used in existing prototype is the TI-CC3200 Launch pad board which comes with an embedded micro-controller and an onboard Wi-Fi shield making use of which all the electrical appliances inside the home can be controlled and managed [3].

WWW based Home automation system uses the portable devices as a user interface. Communication can be done with the help of home automation network through an Internet gateway, by means of low power communication protocols like Zigbee, Wi-Fi etc [4]. Ethernet based upon the real time tracking of the devices at home an INTEL GALILEO 2nd generation development board, system works on real time monitoring and voice control, so that the electrical devices and switches can be remotely controlled and monitored with or without an android based app [5].

The paper is arranged as follows:

Section I Introduction. **Section II** discusses Background. **Section III** discusses previous work. **Section IV** discusses existing methodologies. **Section V** discusses attributes and parameters and how these are affected on mobility models. **Section VI** proposed method and outcome of result. Finally **Section VII** Conclude this analytical paper.

PREVIOUS WORK DONE

Waheb A. Jabbar et al. (2018) [1] proposed a low-cost Wi-Fi based automation system for Smart Home (SH) in order to remotely monitor and control home appliances by using Android based application. An Arduino Mega microcontroller is bringing with Wi-Fi module is utilized to build the automation system.

Tianyi Song et al. (2017) [2] proposed a data transmissions within the SHS are secured by a symmetric encryption scheme with secret keys being generated by chaotic systems. The incorporate message authentication codes to the scheme guarantees data integrity and authenticity.

Ravi Kishore Kodali et al. (2016) [3] proposed the system consisting of microcontroller used in the existing prototype is the TI-CC3200 Launch pad board comes with an embedded micro-controller and an on board Wi-Fi shield make use of all the electrical appliances inside the home can be controlled and managed.

Jasmeet Chhabra et al. (2016) [4] The proposed system works on real time monitoring and voice control, so that the electrical devices and switches can be remotely controlled and monitored with or without an android based app. Various sensors are used to not only observe the real time device tracking but also maintaining the security of the house.

Pavithra.D et al. (2015) [5] proposed the communication with home automation network through an Internet gateway, by means of low power communication protocols like Zigbee, Wi-Fi etc. The system aims at controlling home appliances via Smartphone using Wi-Fi as communication protocol and raspberry pi as server system.

IV. EXISTING METHODOLOGIES

A. low-cost Wi-Fi based automation system:

Arduino Mega microcontroller along with WI-FI module ESP8266 in HAS is specially used for controlling the home appliances. A local control system over Wi-Fi and a remote control is established based on IoT. A suitable Wi-Fi-based android application which is Virtuino is utilized because it has a user-friendly interface and it can work efficiently with Arduino Mega to control and monitor via smart phone. The Wi-Fi module, buzzer, temperature and humidity sensor is connected directly to Arduino Mega microcontroller. The relay board receive its input signals from Arduino Mega, while the bulbs and fan which are only samples for real home appliances are connected to the relay outputs.

$$1. X_{t+1} = r x_t (1 - x_t)$$

$$2. C = (A||T) + k_j^{(i)}$$

B. By symmetric encryption scheme

The proposed architecture of the SHS consists of four groups of entities: 1) appliance group 2) monitor group 3) central controller 4) user interfaces

Appliance group contains the home appliances including TV set, stove, oven, thermostat, etc. Each member of the group has individual ID so that it can be uniquely identified by the central controller. The entities in appliance group can perform particular operations, such as switching on/off, turning up/down, reporting status, etc.

Monitor group is formed by sensors and detectors, such as smoke sensor, motion sensor, electricity meter, and home security monitoring sensor. The sensors always sense the data and periodically send the data to the central controller.

$$1. G_k + C_E + G_M$$

$$2. G_k + V_M + C_D + R_w$$

C. Home automation using set of sensors:

The TI CC3200 Launchpad consists of Applications Microcontroller, Wi-Fi Network Processor, and Power-Management subsystems. It performs with the ARM Cortex M4 Core Processor at 80 MHz. It has embedded memory including RAM (256 KB). The dedicated ARM micro-controller also has a network processing subsystem in it.

$$V_o = V_s \left(R \frac{R}{R_{LDR} + R} \right)$$

D. Ethernet based system:

The Ethernet based system connected to the app is android based which is connected to the internet through either Wi-Fi or mobile data. It makes connection to the Intel Galileo based server over the internet and lets the users to monitor with the help of an internal mobile timer and toggles the switching by tap-to-touch or voice using Google API speech recognition tool.

$$S = \{S, E, U, I, O, \text{send}(), \text{receive}()\}$$

E. Via World Wide Web:

The Raspberry Pi is a lower cost credit card sized single board computer which is developed by raspberry pi foundation. Raspberry pi is controlled by a revised version of Debian Linux optimized for the ARM architecture. The setting up of raspberry pi consists of selecting raspbian OS from prebuilt SD card.

$$V_{out} = (0.0062 * Humidity_{relative} + 0.16) V_{in}$$

ANALYSIS AND DISCUSSION

Low-cost Wi-Fi based automation system is the prototype of smart home which is built using plywood. After that, the wiring and hardware implementation is carried out. Then the programming phase of Arduino Software is accomplished. For design enhancement and optimization, any problem that occurs during building the project, is identified and solved during testing phase. Some improvement is also done to avoid the same error. A local control system over Wi-Fi and a remote control is established based on IoT. A suitable Wi-Fi-based android application which is Virtuino is utilized because it has a user-friendly interface and it can work efficiently with Arduino Mega to control and monitor via smart phone [1].

In symmetric encryption scheme, there are four steps included

- Key Generation: In this case, the server generates the secret keys for each agent.
- Encryption: The agents encrypt the data using the generated secret key.
- MAC Generation and Verification: Both the server and the agents generate the message authentication code (MAC) using generated secret keys and by receiving a message from the server/agents it check the authenticity of the message using the same key.
- Decryption: The server and the agents decrypt the message after the authentication is verified. To reduce the energy consumption on the agents, the symmetric encryption algorithm is used [2].

The motion sensor has been connected to a digital in-out pin of Texas board. The board is powered up by external 12V battery or 12V adapter. The home appliances are connected to main supply through relay which in turn is connected to another digital pin of the board. The programming can be done on to have an access to the local Wi-Fi. The voice call feature of the mobile phone should be enabled [3].

An Ethernet based system in which users can monitor real time switching information of the electrical devices and controlling them through an android app as well as monitoring the security of their homes in case of unwanted entry or fire. This model uses temperature sensor and smoke sensors to check for fire at the users home, PIR motion sensors to check for the unwanted presence at their homes and also monitor and control the real time tracking and switching of all their electrical devices through an android based mobile app [4].

The Infrared sensor (IR) is a low cost infrared object detection unit that user can be applied at home using IR LED's. It gets triggered when light is detected. When the sensor is sensed the data it sends a signal to raspberry pi. From the raspberry pi, through Wi-Fi configuration and IoT concept user can turn ON/OFF the light. Similar to IR, the PIR motion sensor is used to detect the human being presence and accordingly the fans are turned ON/OFF. The lights and fans can be controlled by creating web server in personal computer, tablet or can create an app in mobile [5].

TABLE1: Comparison of different schemes

Proposed techniques	Advantages	Disadvantages
Low-cost Wi-Fi based automation system	Electric bill can be reduced because the user can control the electrical appliances anytime without using human energy.	Remote control of the system is not yet supported.
Symmetric encryption scheme	It manages all the home devices from one place.	The cost of equipment and installation is more.
By using set of sensors	To operate home security system the user need not have data connection enabled in his phone. The system runs fine with the launch pad connected to Wi-Fi.	The cost associated with the implementation of this system is higher.
Ethernet based system	Lots of smart gadgets are compatible with one another, and user can set different triggers between devices to automate the processes.	This system is difficult to implement.
World Wide Web	The devices can be controlled and monitored in any of the operating system in mobiles i.e. in both windows and android.	Its low processing power will not be capable of performing any complex multitasking or run any demanding programs.

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 digital devices and interactive objects that can sense and control objects in the actual and digital world. The proposed method also uses relay drivers. A relay permits you to turn ON or turn OFF a circuit using voltage and/or current much higher than what Arduino could handle. The proposed system consists of Arduino or controller, sensors, relay drivers and various devices connected to the relay drivers. Wi-Fi or Bluetooth is to be enabled in the mobile phone to handle the system. The Arduino Controller is used to control the system. The System can be handled using the Android device over the Internet. Various sensors are used to change the system state. The proposed system can be used to handle the household devices such as lights, fans and others to turn them on or off via remote distances.

Diagrammatic representation of proposed method is shown as follows:

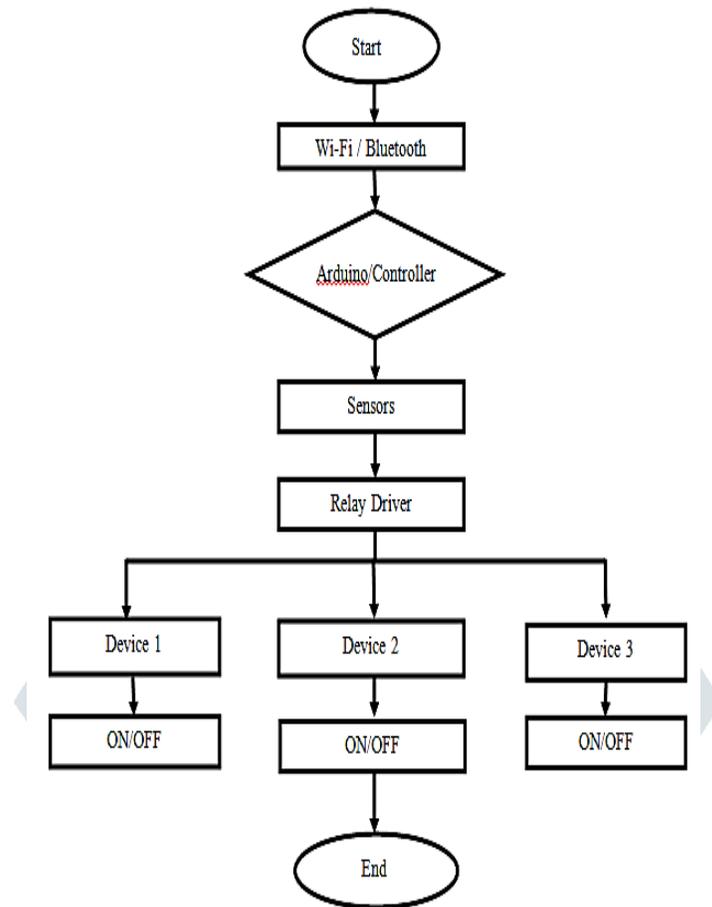


FIGURE 1: Flowchart of Proposed Methodology

VII. OUTCOMES AND POSSIBLE RESULT

Home automation is Automation technology which makes the work easier in all aspects related to home. This method proposes a low cost solution and Home automation done using IOT system which uses mobile devices to control and analyse the basic home functions and features automatically through internet from any corner within short span of time.

VIII. CONCLUSION

The paper is focused on five different techniques such as home automation system by using symmetric encryption scheme, Ethernet-based Smart Home intelligent system, home automation 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. But there are some issues arise in each method. So, this proposed method will help to solve the problems related to home automation and at a lower cost and an arduino controller kit increases the performance of the proposed methodology significantly.

IX. FUTURE SCOPE

From observations of the proposed method the future work will include the implementation of the home automation system using IOT. The system will result in controlling the devices using mobile phone and Internet.

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