

Smart Security System & Home Automation Using IOT

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ABSTRACT: “IOT (Internet of Things)” is a fast-growing technology with a lot of business opportunities in various fields. There has been an increase in demand for home security to have an anti-theft and anti-accident environment of our homes, offices and workplace. Our system aims at controlling home appliances and also building a smart wireless home security system wherein Wi-Fi is used as a communication protocol. There are other researches relevant to our research but our system is too human friendly that a common man of this era can easily understand how to operate it and also our system is very cost-effective. The project focuses on controlling lights and fans referred as Home Automation and providing Smart security using internet when an object is detected and uses fingerprint. By using “Node MCU” Module we are going to implement this project.

Keywords – IOT, Wi-Fi, Node MCU, fingerprint, cost-effective.

1. INTRODUCTION

Home Automation refers to controlling home appliances and maintaining security using micro-controller and internet. Automation is a preferred choice nowadays because of the following reasons:

- It makes repetitive tasks more convenient
- Cost effective in the long run
- More efficient, accurate and consistent in operations
- It provides increased home safety

IOT based smart security system and home automation is a system in which user can control every object of his home from any part of the world by using internet through mobile phone or

personal computer. The main focus is to achieve comfort combined with simplicity. It is a system in which the user will login to his personal account relative to his own house and he will control the appliances of his home like fans, lights etc. and the locks of doors through that website by using internet. Any person accessing the doors or appliances will have to put his fingerprint to open the door locks or switch on the appliances. If the fingerprints match with the database only then the person will be able to open the door or switch on the appliances. The person will have three fingerprint attempts and two for the password used in case there is any injury on fingers or any other issue. This way there is a security provided from any theft or unknown intruder. This is how wireless home security and automation are the dual aspects covered in this project.

2. LITERATURE SURVEY

2.1 Bluetooth based Smart Security System and Home Automation

The system includes three main components: an Arduino microcontroller for connecting the appliances, a Bluetooth module for signal transfer, and a PC or smartphone with the Android application to control home appliances. Each home device is physically connected to a local Bluetooth sub-controller. The home devices communicate with their respective sub-controller using wired communications. From the sub-controller all communications are sent to the primary controller using wireless communications.^[1]

Limitations of Bluetooth based system are: Less secure, not suitable as a receiver, on battery based applications, data Rate is low, not a swift way to communicate, not in the trend, not robust at all, slow and limited communication possible, a limited number of devices can be connected.^[2]

2.2 GSM based Smart Security System and Home Automation

Diptanil Chaudhuri’s project consists of three basic modules along with a GSM modem. The GSM modem is used to send the message to the respected authorities in case of emergency. The first module consists of lock keypad which can be used to lock the doors. If more than three attempts are made emergency signal will be sounded. The second module consist of intruder checkers which consists of an array of PIR sensors to detect the presence of a person in the house. Lastly the third module is the fire detection module which consists of LPG gas sensors and temperature sensors. [3]

Disadvantages of this project are: Many of the GSM technologies are patented by Qualcomm and hence licenses need to be obtained from them, In order to increase coverage repeaters are required to be installed, GSM provides limited data rate capability, GSM uses pulse based burst transmission technology and hence it interferes with certain electronics. [4]

2.3 ZigBee based Smart Security System and Home Automation

Khusvinder Gill and his teammates proposed a ZigBee based home automation system and Wi-Fi network integrated through a common home gateway. The home gateway provides network interoperability, a simple and flexible user interface, and remote access to the system. A dedicated virtual home is implemented to cater for the system’s security and safety needs. To demonstrate the feasibility and effectiveness of the proposed system, four devices, a light switch, radiator valve, safety sensor and ZigBee remote control have been developed and evaluated with the home automation system. [5]

Disadvantages of this project are: It requires knowledge of the system for the owner to operate ZigBee compliant devices, it is not secure like Wi-Fi based secured system, replacement cost will be high when any problem occurs in ZigBee compliant home appliances, the coverage is limited and hence cannot be used as outdoor wireless communication system. [6]

2.4 Voice Controlled Smart Security System and Home Automation

Aqeel-ur-Rehman and his teammates proposed a voice-controlled home automation system in which certain tasks can be performed using voice commands. The system also has a hand-held device (remote) so that the user do not have to walk over to the microphone to speak. The project uses an RF module and AVR Microcontroller. The speech recognition board utilizing HM2007 speech recognition chip is used. It uses an idea of paired-word for issuing a command to the system, so that if words similar to the voice commands are spoken within the vicinity of the voice recognition kit, they are not accidentally detected. The system is speaker dependent and also an isolated speech system, to avoid further accidental voice detections. [7]

Limitations of this system are: Continuous spoken words could not be accepted by system due to overlapping, system is speaker dependent hence too many speakers speaking simultaneously would result in overlapping of signals and interruptions and there is a limitation on vocabulary size as well.

3. PROBLEM STATEMENT AND SOLUTION APPROACH

Home automation systems face four main challenges; these are high cost of ownership, inflexibility, poor manageability, and difficulty achieving security. The main objectives of our work are to design and to implement a cheap and open source home automation system that is capable of controlling and automating most of the house appliance through an easy manageable web interface to run and maintain the home automation system.

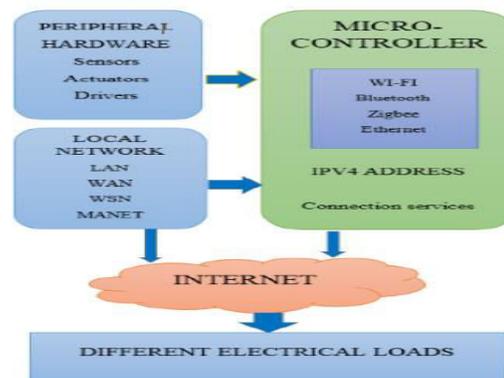


Figure 1. Network architecture of IOT devices

The proposed system has a great flexibility by using Wi-Fi technology to interconnect its distributed modules to home automation server. That will decrease deployment cost and will increase the ability of upgrading, and system reconfiguration. System will make use of secure wireless LAN connections between distributed hardware modules and server, and secure communication protocols between users and server.

4. PROPOSED WORK

The proposed system is a simple distributed home security and automation system, consists of server (laptop), hardware interface modules. Server controls hardware one interface module, and can be easily configured to handle more hardware interface module which adds flexibility to our system. The hardware interface module in turn controls its alarms and actuators (light, fan). Server is a normal PC with built in Wi-Fi card and thus acts as web server. System can be accessed from the web browser of any local PC in the same LAN using server IP, or remotely from any PC or mobile handheld device connected to the internet with appropriate web browser supports asp.net technology through server real IP (internet IP). Wi-Fi technology is selected to be the network infrastructure that connects server and hardware interface modules. Wi-Fi is chosen to improve system security (by using secure Wi-Fi connection), and to increase system mobility and scalability. Even if, user intends to add new hardware interface modules out of the coverage of central access point, repeaters or managed wireless LAN will perfectly solve that problem. The main functions of the server is to manage, control, and monitor distrusted system components, that enables hardware interface modules to execute their assigned tasks (through actuators), and to report server with triggered events (from sensors). Hardware interface modules are directly connected to sensors and actuator through direct wires connections.



Figure 2. The proposed home automation system layout

4.1 Hardware Description

The hardware consists of various parts such as:

- Fingerprint: A fingerprint is a biometric device that is used to authenticate the user based on the user fingerprint stored in the software.

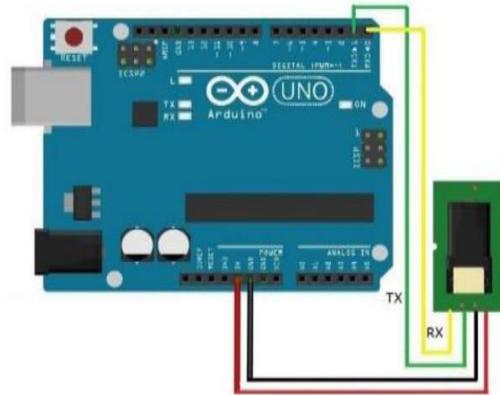


Figure 3. Arduino Fingerprint

- Arduino UNO: Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino consists of both a physical programmable circuit board and a piece of software, or IDE runs on your computer, used to write and upload computer code to the physical board.

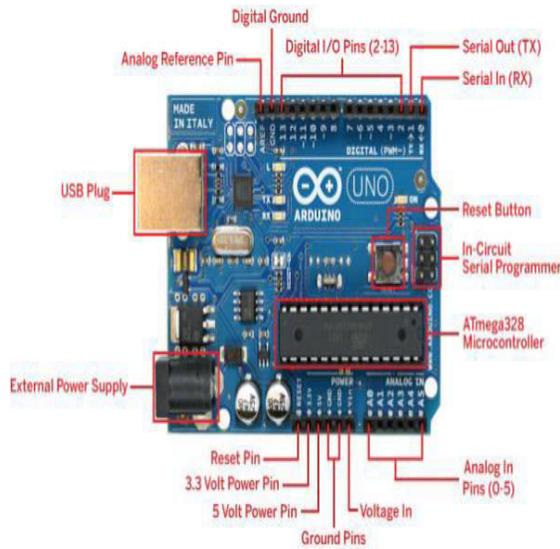


Figure 4. Arduino UNO

- **LCD Display:** The LCD display is used to see whether the entered password is correct or not. It is also used to interface with the project to output lock status.

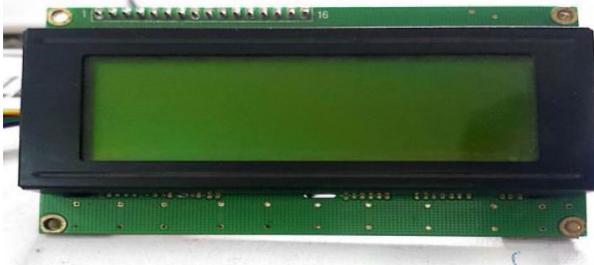


Figure 5. LCD display

- **NODE MCU:** Node MCU is an open source IOT platform. It includes firmware which runs on the ESP8266 Wi-Fi SOC from Espressif Systems, and hardware which is based on the ESP-12 module. It's having 128KBytes of memory and its storage space is 4MBytes and power is supplied through an USB and it is a single board microcontroller and also it is having 16 GPIO (General Purpose Input/Output) pins.

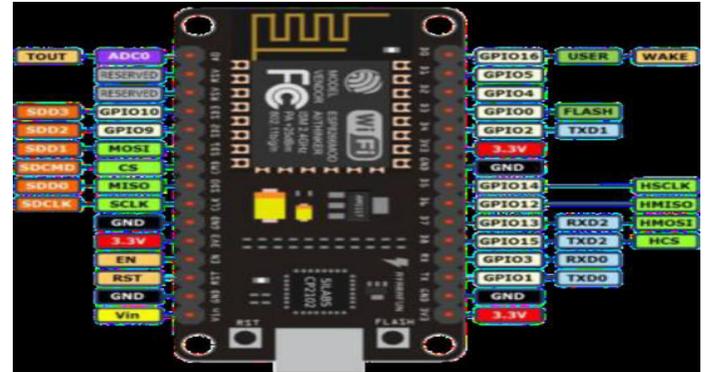


Figure 6. Node MCU

- **Relay Board:** A relay is an electromagnetic switching device consisting of an armature which is moved by an electromagnet to operate one or more switch contacts. Some advantages of relays are that they provide amplification and isolation and are straight forward. It has a standard interface that can be controlled directly by microcontroller.



Figure 7. Relay Board

- **AWS (Amazon web services):** Amazon Web Services (AWS) is a subsidiary of Amazon.com that provides on-demand cloud computing platforms. The technology allows subscribers to have at their disposal a full-fledged virtual cluster of computers, available all the time, through the Internet.

5. WORKING OF PROTOTYPE

The prototype can be used in following two ways:

5.1 Smart security system:

We place a fingerprint sensor at the entrance of a building. This signal which detects the presence of a person becomes the input trigger for the micro-controller. The owner, who may or may not be present in that building, will receive a message through an E-mail on his mobile phone

(whose Mail will be predefined in the program) stating that "There is an Intruder in the House". If the person's fingerprint matches to that stored in the database then the door will open otherwise it will remain closed. Also, we have buzzer attached to our system which will snooze in case the fingerprints or password does not match. Moreover, if the owner finds that his building is not safe, he can send an SMS to the concerned authority to police department explaining his situation.

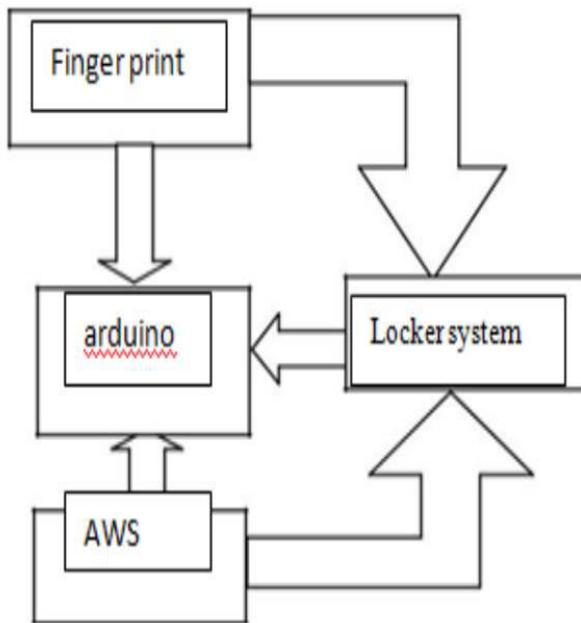


Figure 8. Block diagram of project as a security system

5.2 Smart home automation system:

Under the Home Automation we can control all electrical appliances from long distance through our PC or mobile phone. In this project we are controlling basically lights and fans through Internet but we can easily add other home appliances in the system using repeaters or managed wireless LAN. This will be helpful for the aged people as well as handicapped to control their home appliances easily.



Figure 9. Arrangements in a home automation system

6. CONCLUSION

The IOTs based home security and automation is incredibly useful for remote users. Any home are often monitored and controlled by using the prototype implemented during this paper. This IOTs based system is that the building block of all internet based diverse applications. It has many application like we will use this project in door for home and office security, lockers, ATM, and anywhere where security is required. The system developed during this paper is cost effective solution of IOT applications. The modules utilized in its formation are light, easy to use, secure and value effective. It also enables easy operation and quick access of knowledge. Finally, the proposed system is best from the scalability and adaptability point of view than the commercially available home automation systems.

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