

# Secured Home Automation using OTP Authentication with Iot and Cloud Integration.

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**Abstract**—Every task in today's fast developing world is becoming automated. The main reason for this automation is the advent of Internet. Each and every object we interact within our everyday life is being connected onto the internet. This is part of the Internet of Things revolution. A home automation system is a set of hardware and software elements that are involved in controlling appliances at home. But as these systems are being connected to the internet, they are more and more vulnerable to be hacked into. The proposed system not only allows users to access their appliances from everywhere but also involves a secure method to enter into the system.

In this paper, we present a Secure Home Automation System running on a Raspberry Pi connected to a Web Server running on the most reliable cloud service provider Google. This allows remote control of all appliances at one's home. But before we do all this, there is an important security step involved. Which is to login to the system with a 2 factor authentication method using a One Time Password sent to their registered mobile number.

**Keywords**—Home automation system; Internet of things; OTP; Cloud as Infrastructure; Raspberry Pi; Zigbee;

## I. INTRODUCTION

### A. Overview

In the present day world, technology is everything. The technology boom exists because of the ease of use it provides. This ease of use can be brought to one's home using Internet Of Things (IoT). Using this we can control all kinds of appliances. Most established systems are a wireless system upto the main control board. But then the installation from the board to the appliances they have a wired system to control the appliances. This leads to high installation prices and difficulty in installing the system. Now with the advent of the new specification called Zigbee, there is an easy method for wireless transmission.

### B. Advantages of our Home Automation System

- **Security:** The main advantage of our system is the security it provides. The Home Automation System (HAS) access to all the appliances at home. This system getting into wrong hands would spell disaster. So in an attempt to improve security, the user has to pass through 2 factor authentication before getting access to the system.

- **Easy access:** Any device that is connected to the internet can get access to the system. Be it a laptop, a desktop, a mobile phone or a tablet.
- **Truly Wireless:** Since we use Zigbee to communicate for the main board to the appliances, there is no visibility of any kind of wiring. This improves the aesthetic appeal of the home.
- **Low cost HAS:** Since the board used here is a Raspberry pi which costs very less, the system is very cost efficient and feature rich

For these reasons, we propose a secure truly wireless system.

## II. RELATED WORK

[1] Vinay sagar K N, Kusuma S M

This paper proposes a Home Automation system(HAS)using Intel Galileo that employs the integration of cloud networking, wireless communication, to provide the user with remote control of various lights, fans, and appliances within their home and storing the data in the cloud. The system will automatically change on the basis of sensors' data. This system is designed to be low cost and expandable allowing a variety of devices to be controlled.

[2] Sirsath N. S, Dhole P. S, Mohire N. P, Naik S. C & Ratnaparkhi.N.S

This paper proposes a Home Automation system that employs the integration of multi-touch mobile devices, cloudnetworking, wireless communication, and power-line communication to provide the user with remote control ofvarious lights and appliances within their home. This systemuses a mobile phone application, handheldwireless remote, and PC based program to provide a meansof user interface to the consumer.

[3] Basil Ahmed

The main objective of this Paper is to design and implement a control and monitor system for smart house using LabVIEW software. Smart housesystem consists of many systems that controlled by LabVIEWsoftware as the main controlling system in this paper. Also,the smart house system was supported by remote controlsystem as a sub controlling system.

[4] Deepali Javale, Mohd. Mohsin, Shreerang Nandanwar

It gives basic idea of how to control various home appliances and provide a security using Android phone/tab. The design consists of Android phone with home automation application, Arduino Mega ADK. User can interact with the android phone and send control signal to the Arduino ADK which in turn will control other embedded devices/sensors.

### III. SYSTEM ANALYSIS

#### A. Problem definition

Home automation systems faces many challenges, they would be a high risk in terms of security, low portability, poor or complicated user interface. Our main objectives in this research is to design and implement a home automation system using IoT that is capable of controlling and automating most of the house appliances through an easily manageable interface. The proposed system has a great flexibility by using ZigBee technology to interconnect its distributed sensors to home automation server and also include cloud services to help with user authentication and OTP authentication.

#### B. Proposed System

Our home automation project consists of a secure, portable wireless system. We will be using Raspberry Pi running Raspbian OS along with a ZigBee trans-receiver connected to the Pi board. The appliances we intend to control will have a ZigBee trans-receiver which is serially connected to a relay which will convert the signals received from the Pi board to the actual input signals the electrical appliances take. These appliances can also be scheduled to work on required times. The home security is maintained by PIR sensor which will detect any motion. This can be used to automatically light rooms and also sound the hooter when an intruder intrudes the house during safe mode. Remote access is done by a secured authenticated cloud connection. Remote access to this system is controlled by a secured OTP authenticated connection.

### IV. SYSTEM DESIGN AND IMPLEMENTATION

#### A. Proposed home automation system

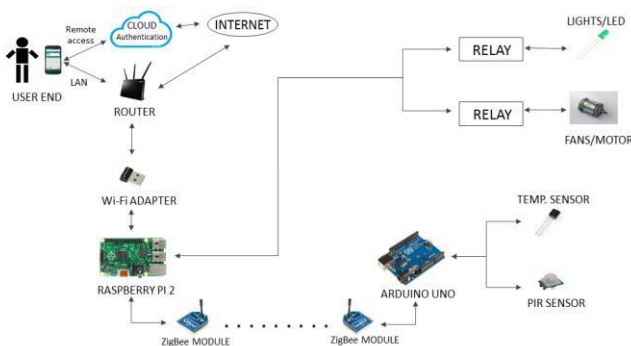


Figure 1: Proposed model of the Home Automation System

The proposed system consists of few sensors and a relay driven circuit to run the appliances. The raspberry pi controls

all these appliances. And so to connect to pi, it is first connected to the Internet using a Wi-Fi adapter. Pi is connected to the Arduino that works as an Analog to Digital Converter via the Zigbee Module.

On the cloud server side, the user initiates a connection to the Pi by registering on the web portal. If they are already registered, they can directly login using their login credentials. On entry of the right username and password, they get a OTP to their registered mobile number. The user then has to enter that OTP on the portal and once it's verified, he gets access to the Home Automation System. Now he has an easy to use GUI made solely for him on the portal. Any changes made on the site get reflected at their home.

#### B. Proposed Functionality the System Provides

The proposed system provides the following functionalities:

- A secure entry to the system using OTP without which no unwanted user can get access to the system.
- An easy to use GUI on the web portal which reflects the design of their own house which means that the user need not remember which appliance is which.
- The hardware functionalities it provides are:
  - A temperature sensor which logs the temperature in an easy to understand graphical logging.
  - A safe mode that turns the motion sensor on which triggers when there is any motion detected and starts an alarm and sends text messages to the user.
  - A mode to turn lights ON/OFF
  - It can turn any kind of appliances ON/OFF

#### C. Software Design

- Cloud Infrastructure:
  - We are using cloud as an infrastructure in this system. This means that we get our own VM on which we can run the software of our choice.
  - The cloud service provider we are relying on is Google Cloud Services.
  - We are using Google's Compute Engine service for our requirements.
- Web Server:
  - We have set up a LAMP server on the cloud engine.
  - The server runs all php scripts that are connected to the raspberry pi and change anything necessary.
  - The front end design has been done using HTML and CSS.
- Message Portal Integration:
  - We need to send a lot of text messages. Text messages are used to send OTP, intruder alert, temperature alert etc.
  - So we have integrated with a message portal called as 2factor.in

■ A php script is used to send messages to the user.

D. Implementation

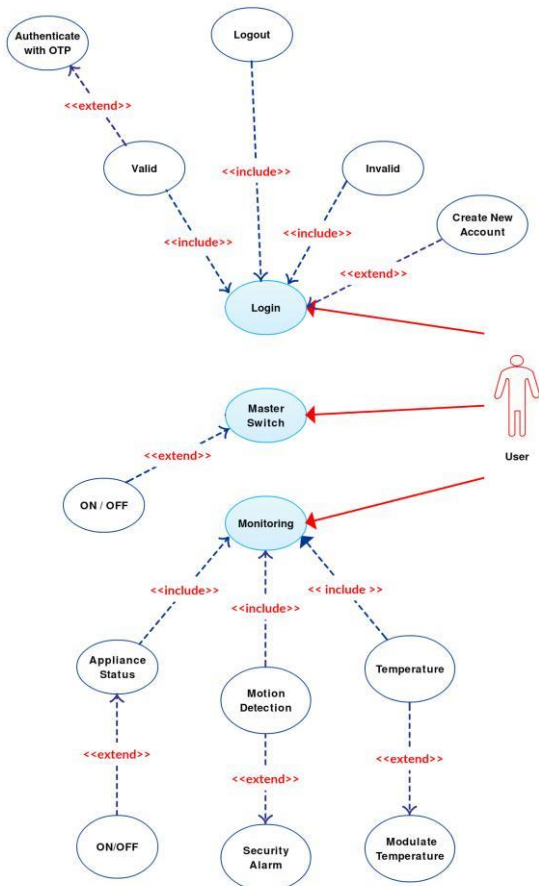


Figure2: Use case diagram of the proposed system

The user can perform 3 tasks i.e login, control the master switch, and monitor the home automation system. Figure 2 shows the use cases for the proposed system.

- Login: User has to first get registered to use the system by creating an account by entering the user credentials, once registration is done he can login to the system by providing the credentials and he'll get the OTP as shown in figure 3 if he is the authorized user, this way we can provide more security and he can logout after performing necessary operations. If he is not an authorized user then he can't login to the system.
- Master Switch: This is the main control switch to completely turn on or turn off the proposed system with one click.
- Monitoring: Once the authorized user logs in to the system he can monitor the system, he can control the appliances by the user interface given, like turn

on/off the appliances and will also be able to see the current status of appliances.

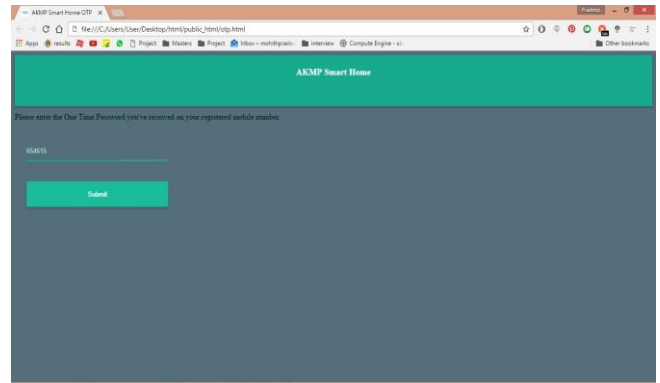


Figure 3: Shows the page to enter the received OTP

User can activate "Secure mode". Once this mode is turned on the motion sensor will be activated. If any motion is detected by the sensor the alarm turns on and a message will be sent to the authorized person. This happens only when secure mode is on otherwise sensor will be inactive.

Temperature of the house is also regularly sensed and logged onto a live graph on a thingspeak.com channel. Where the user can see the temperature of the house and modulate it.

V. RESULTS

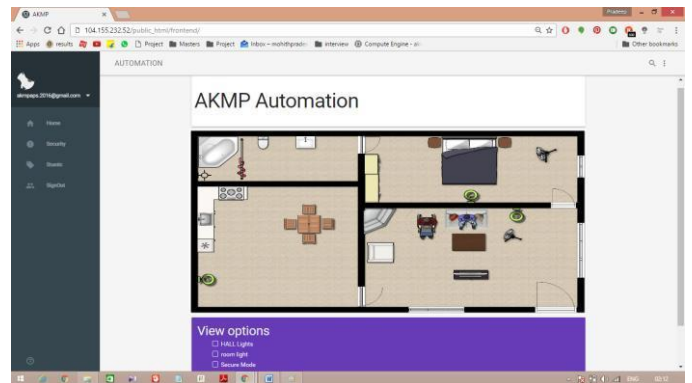


Figure 4: Home page on the cloud server

On connecting to the server, the data of sensor are sent to the web server for monitoring of the system. The figure 4 shows the web server page which will allow us to monitor and control the system. The web server gives the information about the temperature in different places of the house. It also gives the status of the various electrical appliances like light, fan etc. which we can control using the GUI.

Temperature sensor data from the raspberry pi is uploaded to a graph on thingspeak.com which is embedded into the GUI. Figure 5 shows and the temperature values being plotted onto the graph live.

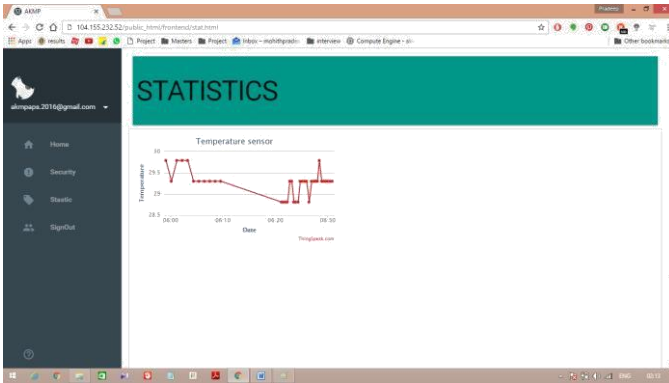


Figure 5: Temperature log from thingspeak

## VI. CONCLUSION AND FUTURE WORK

### A. Conclusion

The proposed home automation system has been proven to satisfy all the stated objectives and has been successful in improving security for these home automation systems. It also proved to be easy to use with the simple GUI helping old aged and for people not that comfortable with the present day technology. The automation is simple enough to use by physically challenged people without any struggle to move. It also has proved to reduce the installation cost involved in home automation systems as it is a truly wireless system.

### B. Future Work

Using this system as framework, the system can be improvised by adding facial recognition as an entry to the house. When the motion sensor is triggered we can implement basic image processing to detect human entities so as to avoid the unnecessary alert messages that are sent to the user because of any random motion of inanimate objects. We can extend the working of the system into farming industry by working with an AEH relay to control farming equipment's.

## ACKNOWLEDGEMENT

We acknowledge the efforts and hard work by the experts who have contributed towards development of Internet of Things and Home Automation Systems. We would also like to thank Professor C. P. Sameerana, HOD, department of CSE, APSCE and Mr. Somasekhar T, assistant professor, department of CSE, APSCE for their constant encouragement, support and their invaluable suggestions in preparing this paper.

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