



INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X

Impact factor: 4.295

(Volume 5, Issue 3)

Available online at: www.ijariit.com

Home automation and security systems using IoT and open source platforms

Somraj Chowdhury

somrajchow26@gmail.com

Vidyavardhaka College of
Engineering, Mysore, Karnataka

Rajkumar Jain

rkjmb123@gmail.com

Vidyavardhaka College of
Engineering, Mysore, Karnataka

Thimmaiah M. B.

mbthimmaiah8@gmail.com

Vidyavardhaka College of
Engineering, Mysore, Karnataka

Prajwal R.

prajwalprags5@gmail.com

Vidyavardhaka College of
Engineering, Mysore, Karnataka

Rakesh K. R.

rakeshkr@vvc.ac.in

Vidyavardhaka College of
Engineering, Mysore, Karnataka

ABSTRACT

This paper discusses the design and implementation details of home automation, monitoring, and security system using the Internet of Things (IoT) and some open source technologies. The IoT is the network of physical objects or “Things” embedded with electronics, software, sensors and network connectivity which enable these objects to collect and exchange data. The user here can interact directly with the system through a web-based interface over the Internet, while monitoring and control of domestic home appliances such as lights are remotely controlled through a user-friendly web page. Monitoring is carried out by sending the sensor data to an open source platform called Thingier which shows the status of the device and also the location of the device with values of the sensor.

Keywords— Automation, Sensor, Monitoring, Things, Security

1. INTRODUCTION

The home automation industry is gaining popularity and great demand day by day because of large advantages. The reason for this surge demand of network-enabled home automation systems is reaching the zenith in recent days for its simplicity and comparable affordability. One can achieve home automation by simply connecting the home appliance and electrical devices to the internet or cloud storage. Platforms based on cloud computing help to connect to the things so that one can find it easy to access anything and everything at one place at any time. The home automation system that we have designed is a wireless system that can be controlled using an IP enabled web application. Therefore any device that supports any kind of web browser can be used to control the smart home appliances. The basic idea of home automation is implemented by employing sensors and creating a control system to monitor

and adjust the various mechanisms of our system. IoT allows objects to be sensed and controlled remotely across existing network infrastructure, creating an opportunity for more direct integration between the physical world and computer-based systems, and resulting in improved efficiency, accuracy. [1]

2. RELATED WORK

A number of related studies and projects were found in the area of home automation systems that used various existing network architectures and various IoT technologies. They are given as follows:

“**Design & Implementation of a Wi-Fi Based Home Automation System**”: The goal of this study was to control the home automation system remotely using Wi-Fi technology. One of the main objectives was to implement an inexpensive and open source home automation system. [2]

“**Cloud-based low-cost Home Monitoring and Automation System**”: The purpose of this paper was to provide a home automation system on the cloud at a low cost and use the least cost resources possible. One of the reasons that led to this work was due to the fact that home automation systems were currently expensive in terms of maintenance and installation.[3]

“**Front-End Development for Home Automation Systems using JavaScript Frameworks**”: A proposed system checks for various problems related to the development of a home automation interface as well as using existing system solutions to solve problems. [4]

“**Home Automation & Security System using Android**”: This paper describes implementation and design of a smart home control system. The smart home system and subsystems are controlled remotely using the Internet with LABVIEW software.[5]

“Design & Implementation of Advanced Home Automation Systems using Android and GSM”: In this paper, an electrical monitoring device and remote home and office control system redesigned using GSM modem. Users can monitor and control devices by sending SMS messages. [6]

3. SYSTEM PRELIMINARIES

The study is concerned with developing a multi-function system prototype that includes security and data monitoring modules. The modules are listed as:

- (a) Face detection and recognition using the OpenCV library and Python.
- (b) IP enabled web application that operates over an existing Wi-Fi network.
- (c) Smart Light Control system enabling turning ON and OFF of lights and adjusting light intensity via a web application.
- (d) Display sensor data on the web application.
- (e) Sending sensor data to a cloud platform called Thingier.
- (f) Motion Detection using a PIR sensor and a buzzer alarm to enhance home security.
- (g) Password-based Door Lock using 4x4 keypad and a servo motor.

4. DESIGN AND IMPLEMENTATION

This section deals with the design and implementation of the various modules in the system. In each of the three system modules, a micro-controller is used to acquire values of physical conditions through sensors connected to it. Arduino IDE, an open source software was used for programming for each module except the image processing module.

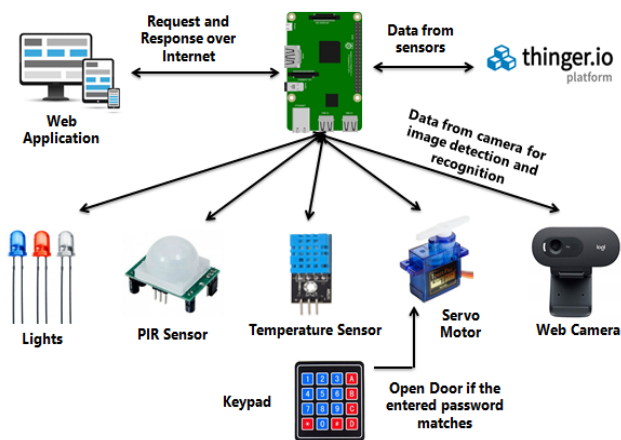


Fig. 1: System architecture

4.1 Motion detection module

Motion detection is performed using a passive infrared (PIR) sensor. PIR sensor is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. PIR detects motion within approximately 10m from the sensor.



Fig. 2: PIR sensor

A buzzer is used as an alarm which is raised whenever motion is detected. The motion detection module is implemented on an Arduino UNO which is a microcontroller.

4.2 Web application for controlling the smart home

The web application interface is actually an IP enabled web-server that is programmed using HTML, CSS, JavaScript and AJAX. Our application is run over an existing Wi-Fi network and therefore we have used a NodeMCU (ESP8266) board that is used as the Wi-Fi module for our system. We flash the code onto the NodeMCU and then it returns an IP address. That IP address can be typed in on any browser on any device like Mobile phone, desktop or laptop and then the user interface is loaded and ready to use.

4.3 Smart light control system

The lights of any room can be turned ON / OFF via the web application from anywhere within your house over an existing Wi-Fi network. Also, the intensity of lights can be set according to the users need. In this way, you can save wastage of electricity and also have better control of all the lights inside your house. The NodeMCU is also used to connect a temperature sensor called DHT11 to keep track of the temperature and humidity values inside the house. These sensor values are displayed on the application screen and are also sent to the Thingier cloud of data monitoring and analytics.

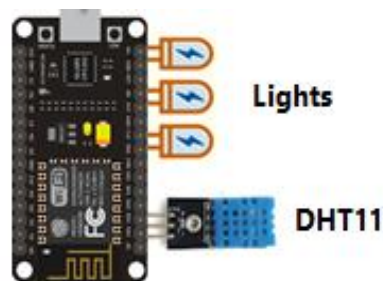


Fig. 3: NodeMCU with Lights and Sensors

4.4 Face detection and recognition

To enhance the security of the smart house, this image processing module is implemented which detects a face and then recognizes whether he/she is a registered visitor to the house. The OpenCV library is used to perform this function of face detection and recognition.

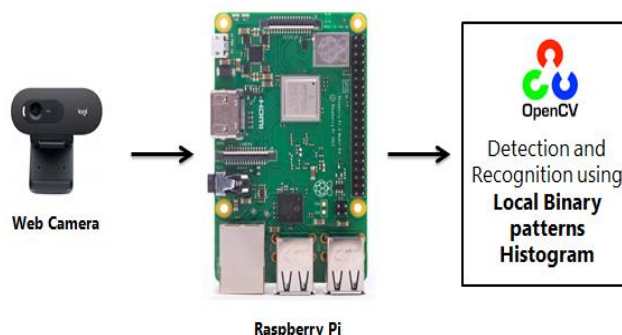


Fig. 4: Facial detection and recognition

The hardware requirements of this module are a web camera used to capture images in real time and a microprocessor board called the Raspberry Pi which is used to perform image processing on the captured images.

4.5 Password based door lock

To enhance the security of the smart house, a passkey based door lock has been implemented. For this module, a 4x4 keypad is used which is interfaced with a servo motor in a way that whenever the user enters the right password, the servo unlocks the door latch and otherwise doesn't. To implement this module, we have used a micro-controller called Arduino UNO to control the keypad and servo motor.



Fig. 5: Door lock

4.6 Open source platform – Thingier.io

Thingier.io is an open source platform for the Internet of Things (IoT). It provides a ready to use scalable cloud infrastructure for connecting things. It also shows the location of your device in the world. [7]

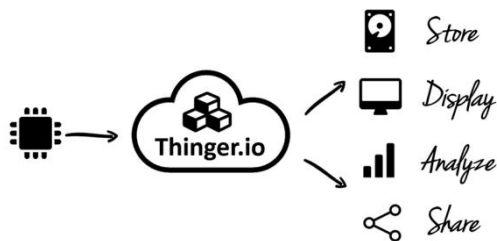


Fig. 6: Thingier.io

5. RESULTS AND OUTCOMES

After integrating all the modules into one set system, the system is successfully able to:

- Detect motion and raise the alarm
- Able to detect and recognize registered faces
- The door opens on the entry of a correct password
- Web app loads and allows to control the lights
- Temperature sensor data is sent to Thingier cloud

6. FUTURE ENHANCEMENTS

This smart home automation system could be updated with:

- Text message notifications for any alarm raised or any other action
- Adding safety features to detect gas leakage etc.
- Opening the garage door on the detection and matching of the owner's car number plate using image processing and machine learning algorithms

- Ability to control the system from anywhere around the world

7. CONCLUSION

Almost everyone in today's world is connected to the internet and hence learning to use such systems will not take long periods of time. The objective of this home automation system is to make life easier by making your home smarter. Installing such a system could keep you safe from burglary and also enable you to save electricity by continuous access to the state of the lights in all of your rooms. As technology is moving at a faster rate, people should also accept to move from conventional switches to remotely controlled switches. Also, the main aim was to reach out to users with such systems at an affordable cost. The system is programmed and monitored using open source software and platforms which makes the system more public reachable. Controlling the home appliances from anywhere inside your house when you are busy with other activities saves a lot of your time.

8. REFERENCES

- [1] Design and Implementation of a Multi-Function Home Automation System Based on Internet of Things (IoT) - Omar Tayan, International Journal of Computer Science and Information Security, 2019
- [2] Ahmed ElShafee , Karim Alaa Hamed, Design and Implementation of a Wi-Fi Based Home Automation System, International Journal of Computer and Information Engineering, World Academy of Science, Engineering and Technology, Vol:6, No:8, 2017
- [3] Shruthi Raghavan, Girma S. Tewolde, Cloud-based low-cost Home Monitoring and Automation System, Proceedings of the 2015 ASEE North Central Section Conference, 2015
- [4] Olaf Droegehorn, Marie Leslie Melanie Pittumbur, Jari Porras, Front End Development for Home Automation Systems using JavaScript Framework, Proceedings of the International Conference on Internet Computing and Internet of Things, (ICOMP'17), 2017
- [5] Deepali Javale, Home automation and Security System using Android ADK, International Journal of Electronics Communication and Computer Technology (IJECCCT), Volume 3 Issue 2 (March 2013)
- [6] Geetha Mrunalini.Kadiyam, K.Rajasekhar, A.Pravin, Design and Implementation of an Advanced Home Automation System using Android and GSM Technologies, International Journal & Magazine of Engineering, Technology, Management and Research, Vol 2, Issue 5, May 2015
- [7] Thingier.io – Open Source IoT Platform, <https://thingier.io/>