

# IOT Based Smart Home Automation Using Raspberry Pi

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**Abstract-** With the advancement and dependency of people on technology along with increasing demands of easy and quick way of solving daily life task it has become an emerging need to propose a system which can control over the domestic and industrial applications using IOT. IOT based home automation is versatile and has popular applications. In home automation, all home appliances are networked together and able to operate without human involvement. Security of house is managed by sending notifications to the user using Internet in case of any trespasser and it can also ring an alarm if required. Home automation is utilized by using appropriate sensors installed around house (LM35, IR sensors, LDR module). Raspberry pi is used as a server and controller. Raspberry pi has task of controlling electrical appliances and providing authentication and security to user. Our solution also provides information about the energy consumed by the house owner regularly in the form of message.

**Keywords-** Internet of Things (IOT), Home Automation, Smart Security, Intrusion Detection, Raspberry Pi (pi).

## I. INTRODUCTION

Today, there is an increasing demand of automated systems so that human intervention is reduced. This paper focuses on a system that provides features of Home Automation relying on Internet of Things to operate easily, in addition to that it includes a camera module and provides home security. Security is achieved with motion sensors if movement is sensed at the entrance of the house; a notification is sent that contains a photo of house entrance in real time. This notification will be received by the owner of the house via SMS. So owner can raise an alarm in case of any intrusion. We have also incorporated a smoke sensor which, on detection of smoke will ring an alarm and alert the user on their phone by SMS alert.

The pi must always have Internet connectivity. Raspberry Pi is a small sized computer which acts as a server for the system. It functions like a computer with a small setup. It contains GPIO pins and USB ports and also supports port for camera module. These pins can be toggled on/off using simple programs.

The project mainly aims to overcome the shortcomings of home security systems by providing information of current situation when the owner is away from the house. The significant contributions of this paper are as follows:

- 1) Initially, we automate the functioning of some essential home appliances like fans, lights, air-conditioners and water heaters by the readings received by various sensors installed at different parts of the house.
- 2) All These sensors will be connected to the pi which will process the readings received by the sensors and control the relays connected to the appliances
- 3) A CT sensor is used to measure the energy consumed in the home regularly and updated in the database. Further, our solution uses database values and calculates power bill and it notifies through the SMS for every 15 days.
- 4) A load sensor has also been connected to the pi which keeps a track on the amount of LPG in the cylinder. If the weight of the cylinder reaches a certain threshold, then a SMS is directly sent to the gas booking agency and the user is notified about the booking along with the unique booking ID.

Further sections of this paper are organized as follows:

Section II represents the related work done in the field of Home Automation. Section III illustrates how the system has been implemented, while it also goes into greater detail about working of the individual components present in the system. The actual control flow of operations in the system has been demonstrated in section IV. Some further modifications which can be done to increase the fidelity and user friendliness of the current prototype have been discussed in section V.

## II. RELATED WORK

As per our survey, there exist many systems that can control home appliances using Android based phones/tablets. Each system has its unique features. Work on designing home automation system model is an ongoing process. The existing

systems have certain deficiencies namely: High base cost, lack of a good security system. We have tried to make improvements on the same. Some models that have been developed already are discussed below.

Andrea Zanella explained the model of comprehensive survey of enabling technologies, protocols and architecture for an urban IOT. They explained various technical solutions and Best - practice guidelines adopted in the Padova Smart City project, a proof of concept deployment of an IOT in the city of Padova, Italy, performed in collaboration with the city municipality.

Pavithra.D explained the model for efficient implementation of IOT in monitoring and controlling the home appliances via worldwide web (www). This model is economical and scalable. The model provided control of appliances via a web server as well as locally without internet access [5].

Ravi Kishore Kodali, Vishal Jain, Suvadeep Bose and Lakshmi Boppana explained the model for IOT project which focuses on building a smart wireless home security system which sends alerts to the owner by using Internet in case of any trespass and raises an alarm optionally. The microcontroller used in the current prototype is the TI-CC3200 Launchpad board. This system can send alerts and the status sent by the wifi connected microcontroller managed system can be received by the user on his phone from any distance irrespective of whether his mobile phone is connected to the internet [1].

Vamsikrishna Patchava, Hari Babu Kandala, P Ravi Babu proposed the system for Smart Home Automation technique with Raspberry Pi using IOT and it is done by integrating cameras and motion sensors into a web application. Raspberry Pi operates and controls motion sensors and video cameras for sensing and surveillance. For instance, it captures intruder's identity and detects its presence using simple Computer Vision Technique (CVT)[4].

The paper -"Internet of Things Business Models, Users, and Networks" describes various wireless IOT protocols used in smart home. It also describes the application protocols used for IOT. It is useful to recommend the best security features of different protocols and helps choose which protocol to use. [7]

.. A camera is attached at home for surveillance activity and for security purpose.

## II. IMPLEMENTATION

The architecture of Home Automation using Internet of Things is shown in [Figure-1]. Following are the main components of the system:

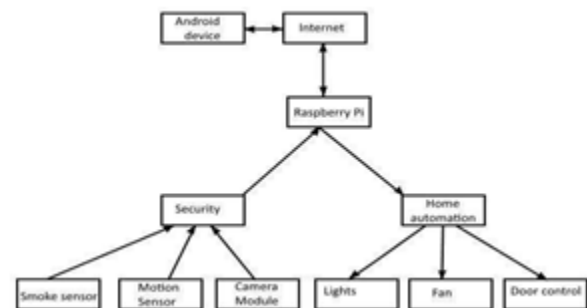


Fig. 1. System Architecture

### A. Raspberry Pi

A Raspberry Pi is a small -sized computer originally designed for portability, inspired by the 1981 BBC Micro. Eben Upton's created the device to make a small and affordable device to help improve programming skills and hardware understanding of students. Its small size and affordable price made it suitable for various applications. Hence it was quickly adopted by many customers [1]. The Raspberry Pi is a complete Linux computer and provides all its functionalities at a low-power consumption level.

### B. Sensors

The PIR motion detection sensor can be used to detect any intruders at the door. It uses infrared rays to detect any movement. On detecting motion, the user is alerted and a picture is captured. MQ-2 module is useful for gas leakage detection (in home and industry). It can detect various dangerous fumes of gases like H<sub>2</sub>, LPG, CH<sub>4</sub>, CO, Alcohol, Smoke or Propane. The sensors, namely, light sensor, IR sensor and temperature sensor are connected to the Raspberry pi. The CT sensor, HX711 ADC module and the load cell are connected to the pi coupled with Ethernet shield. The sensors acquire the data of the variables of the home environment and send the data to the pi. The pi then Triggers the relays connected to the lights, blinds, fan, air conditioner and the heater as and when the necessary conditions are met.

### C. Database Interface

The CT sensor (non-invasive current sensor) sends its data to the pi coupled with the Ethernet shield. The data received is processed by the pi and as a result, the energy consumed, and the price for the units consumed is sent to the database using the connected Ethernet shield. The load cell

and the ADC module sense the weight of the gas cylinder, and when the value reaches less than the set field, the weight is then sent to the database for further utilization. The sample Database structure is shown in Figure 3.

id	power	units_consumed	cost_agg	weight
12	1832.7635	152.3200	1066.2400	10.3674
13	1567.2115	153.8200	1076.7400	8.6300
14	1461.3773	155.0800	1085.5600	7.8200
15	1517.1139	156.5900	1096.1300	6.3300
16	1908.7989	158.5100	1109.5100	4.9800

Fig. 3. Sample Database Structure

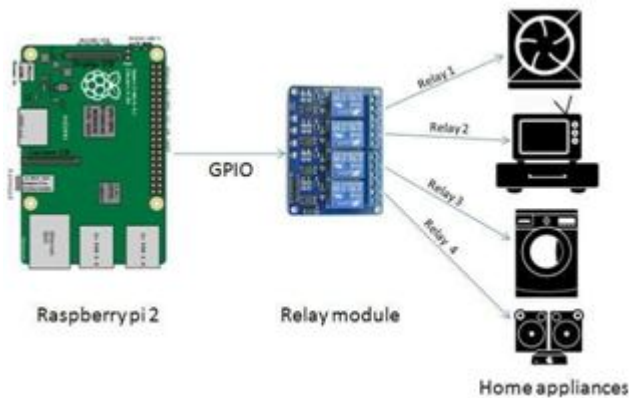


Fig. 4. Hardware Implementation

#### IV. CONTROL FLOW

The above mentioned data is received by the database in respective tables. At the start of the month, the user is notified about the weight of the gas cylinder and the cumulative units consumed by the automated appliances. The user is also notified about the new gas booking along with its ID if the weight of the gas reaches less than the threshold value. Sample notification messages about no units consumed, electricity charge and status of the Gas cylinder are shown in Figure 4.



Fig. 4: User notification messages about Electricity bill and Gas Booking reference

#### A. Objectives:

The pi assimilates the sensors data and then triggers the relays connected to the appliances, thus automating them without any user intervention. The energy of the automated appliances along with the units consumed, the total price and a reminder of booking a new gas cylinder beforehand is sent to the database. The PHP program then notifies the user about the price incurred for every 15 days and a reminder for booking a new gas cylinder day before completion of the existing one.

#### V. CONCLUSION

In this paper, the home automation is improved by considering a Raspberry pi integrated with various appliances through relay. A smart home integrates various electrical appliances in the home and automates them with no or minimum user intervention. The smart home keeps track of different environment variables present and guides the appliances to work according to the needs of the user. Not only automating the home appliances of daily usage but also notifying the user about the price of his electric bill in regular interval and automatically booking the gas cylinder, if the level of the gas reaches lower than the threshold. Security is achieved by automatically sending a notification to the house owner via SMS in case of intrusion (if movement is sensed at the entrance of the house). The alarm rings in case of smoke detection and alerts the owner via SMS.

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