

SMART HOME WITH SMART SECURITY USING DEEP LEARNING AND IoT

¹Kundan Kumar Dubey, ²Ajitanshu Jha, ³Akshay Tiwari, ⁴Caroline El-Fiorenza

^{1,2,3}Student, ⁴Assistant Professor

Department of Computer Science and Engineering,
SRM Institute of Science and Technology, Chennai

Abstract: The main aim of this paper is to present a smart and secure home automation system using IoT and deep learning. Integration of deep learning and machine learning are the latest emerging technologies that can change the world to make it smart and automated. This method enables the user to control appliances like fan, television, bulb and other electronic or electrical equipment through an application installed in the mobile or can be controlled over voice. Moreover it can accommodate hardware for Motion detection, temperature control, image recognition and image description. This system uses passive infrared sensor to detect the presence and absence of human body or any type of object which also detects the motion change.

Keywords: IOT, Deep learning, Image Recognition and image description

1. INTRODUCTION

The home automation system is the main aspect of the paper using deep learning and internet of things. Internet of things uses the concept of connecting the real world objects to internet so that it can be control via mobile application and the deep learning concept is used for image recognition and image description .This embedded system or electronics devices contains various components like Raspberry-pi ,microprocessor ,breadboard and relay etc .Raspberry-pi is a small size computer that provides us to control the real world object through mobile application or voice control .Voice control uses voice recognition system using deep learning and machine learning .IoT and deep learning are the emerging technologies which are growing rapidly and changing the lives Currently built system send alert to the owner over messages or emails using internet, if any movement is near or inside the house and it also provides the option of alarm if user wants.

Using Automation the user can schedule events for the device connected to Local Network or internet through time related or stimulus triggered program from large industry to small industry everywhere. The concept of automation is being used to reduce human burden and to improve the efficiency of work and the productivity of the job. Home automation is the process of alternating the various appliances inside our house that can be controlled by mobile application as well as voice. The automation consists of heating lighting ventilation climate control and the home appliances like television fan bulb, fridge etc. With the evolution of phones and technologies like Wi-Fi, Bluetooth and zigbee, it gives the ability to connect to the home network while the person is away from home.

The advantages of using Home Automation systems are as follows [6]

- Home appliances can be controlled i.e. It can be switched off and on, as well as the magnitude of power also can be controlled.
- Image recognition system give the access to recognise the person and the image description tells about the images.
- All the services are activated and gives valid information which are very useful for living.
- Energy consumption can be tracked and the productivity and efficiency can be increased.
- The gas cylinder can be measured and if it is important than auto booking is done and the unique booking ID is send to the SMS.

2. RELATED WORKS

Home Automation is growing gradually now a days, it is being used everywhere i.e. from agriculture to the cities having that the building are using the automation Technology.

Also the home appliances can directly controlled by using 433 MHz radio frequency control module [1]. By using wifi interface the smartphones and tablets can connect to the central controller but some of the problems may cause by using radio signals.

For establishing communication between the smart home appliances and the user Blue tooth 4.0 protocol is used. The user can use smartphones or tablets to control these appliances. But the disadvantage of using Blue tooth technology is that the devices can only be controlled from very short range.

Also the IoT based home automation are using android phones is proposed .So the two types of home automation are used and they are as follows, 1.Bluetooth and 2.Ethernet-based. The customized Android based mobile application were used to control home

appliances like Fan, TV, AC, BULB etc. The data sources in the prototype is not clear and it leads deadlock situation when multiple android phones try to access the same web portal.

In this [2] the author used sensors for energy consumption like lm35 IR sensor, LDR module and Raspberry-pi Uno etc.. The paper proposes the system to control the home appliances as well as the level of gas cylinder and energy consumption, they also used motion sensor that detects the presence of human body. The only disadvantage is that the camera cannot recognise the image type or the things which human is carrying.

Smart system and energy Management [3] has been created which displays the necessary data on a webpage using the help of SMS GPRS email alert and other messaging systems. For controlling the devices and for the wireless communication microcontroller has been used in the system. This is not very security System because it is easily hackable.

The low cost flexible and smart home system[4] has been presented. In the paper Raspberry-pi Ethernet is used to communicate over the internet with customised application installed on the Android platform or any other platform. The sensor like humidity sensor, temperature sensor smoke or gas sensor all are integrated in the audio device. All these can be controlled through the mobile application used by user.

The conceptual view[5] of smart home has been presented. This paper shows the concept of Home Automation as well as basic architecture of smarthome. It also contains the recent projects which are being implemented in the society few projects are like Georgia Tech aware home and MIT intelligent room etc.

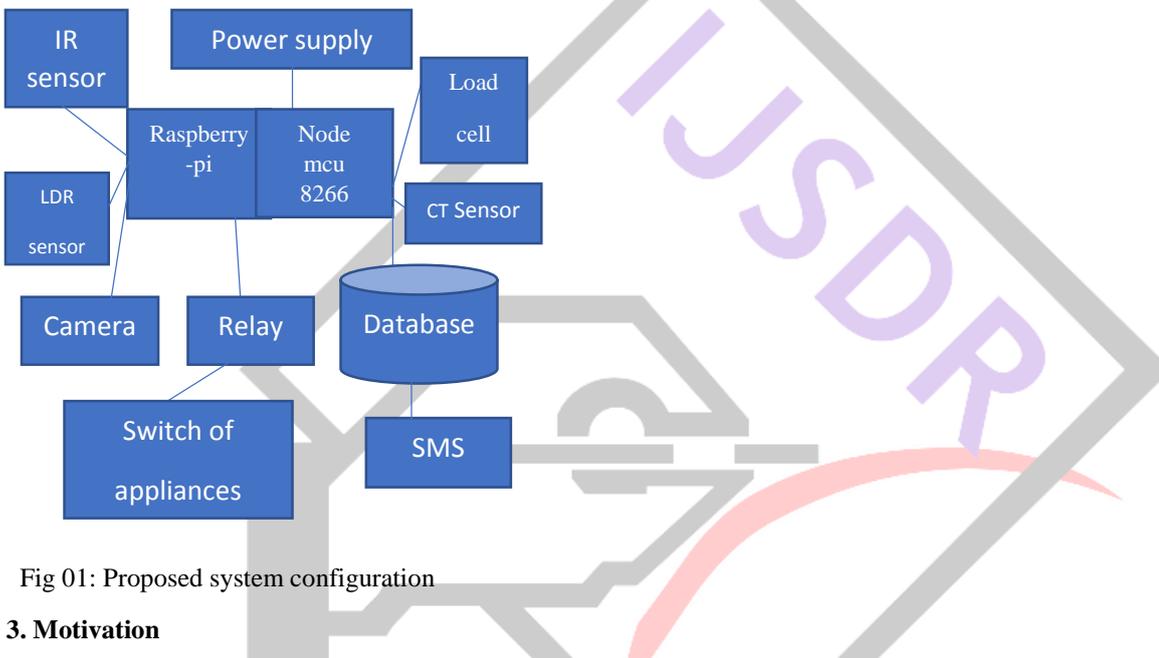


Fig 01: Proposed system configuration

3. Motivation

Home Automation is among the Technologies which are growing rapidly now a days .with the use of technology there has been smart and more advanced solutions can be derived from Internet of things in domain of automation. To standardized the living of humans the appliances need to be fully automatic so that user can use the appliances by the mobile application or the voice, this enables the end user a free interaction with appliances through the mobile or the voice control and thus the clients learn and react as for the users instructions without any physical activity and only through the mobile application or the voice control. Wired sensor are more difficult to handle and also required so much amount of wiring. The sensor at different location are very efficient for the implementation of Home Automation. Home Automation can be very useful for the energy saving as well user must be aware of energy consumption of automatic appliances for the users who has busy life schedule. Home Automation provides energy saving and comfort as well as efficiency in their work without any physical activity.

4. PROPOSED SYSTEM

Proposed system consists of the facilities to access the home appliances and control their regulation paper presents highly secured and smart home automation system. The proposed system configuration and the prototype is soon in the figure number 01, it consists of Raspberry-pi load cell various sensors cameras database and relay[7].

A. Design of system

The proposed system in the paper consist of mainly three layer of implementation namely :-

1. Sensor node layer
2. Sensor data and database interface layer

3. Server and notification layer

1. Sensor node layer

The paper contains sensor like light sensor, IR sensor and temperature sensors which are connected to the node Mcu ESP 8266 CT sensors object 711 ADC module and load cells are connected to the Raspberry-pi which is coupled with the wifi module. The sensors acquire the data of the variable home surrounding and send the data to node MCU triggers ,the relay which is connected to the home appliances light fan air condition fridge etc .The remote controlling and automation of appliances are made possible by the Raspberry-pi which contains the microprocessor and the data storage .Raspberry-pi can program the sensors to do their tasks and thus to trigger the alliances according to the automation architecture.

Raspberry-pi: It is a small size computer which consists of microprocessor and data storage and the Pins in which we can connect the sensor as well as camera etc. First in the Raspberry-pi a operating system is installed but now a days Windows 10 with iot and many other operating systems can be installed in Raspberry-pi Raspberry-pi is the main reason for the automation of systems the sensors are connected to the Raspberry-pi pins and program for their tasks, the programming can be done in any hardware language like in Python etc and does have all the sensors which can do their work accordingly.

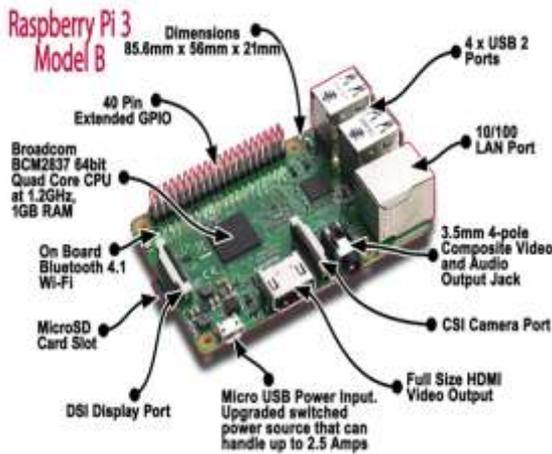


Fig. 2:Raspberry-pi and it's component

Node MCU ESP 8266 Wi-Fi module is a very low cost Wi-Fi chip with full tcp and IP stack and a microcontroller unit .Low cost, compact size and presence of an inbuilt Wi-Fi module are the reasons for the selection of the component node MCU ESP 8266 Wi-Fi module.

2. sensor data and Database Interface layer :-

CT sensor send its data to the Raspberry-pi and the data sent by the sensor is collected by Raspberry-pi OS and thus the result of energy consume and the price of the unit consumed is set to the database using the connected Wi-Fi module. Load cell and ADC module sensors send the weight of gas cylinder and when the values reaches less than the set field then this will be automatically booked and the unique ID is sent to the user mobile number .

3.Server notification layer [8]

The above data is received by the database in respective table. At the start of the month the user is notified about the way of gas cylinders and the cognitive unit consumed. Automatically the new gas booking also notified along with its unique ID, when the reshould value of gas weight.

ID	Power	Units Consumed	Cost Agg.	Weight
1	1832.7632	152.3200	1066.2400	10.3672
2	1567.2112	153.8100	1076.7300	8.6200
3	1461.3774	155.0810	1085.5600	7.8200
4	1517.1132	156.5700	1096.1300	6.3300

Table 1.Sample database structure

B. Objectives

The sensor node senses the real-time changes in all the variables in the room using various sensors. The microcontroller 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.

C. Implementation Details

1) Data Flow Diagram (DFD): The working model is shown in the form of DFD as given in Figure 5 and explained below:

- The sensors in the sensory nodes detect the values of the variables in the environment and send it to the Analog to Digital Converter.
- The ADC relays the converted data to the microcontroller which processes the obtained value set.
- The microcontroller controls the relays which are connected to the fan and light depending on the sensor value received.
- Then, the microcontroller flashes the information on the serial monitor which in turn is sent to the database.
- A local server is created using XAMPP to transmit the information in the database to the user and thus notify him about the price of the electric bill for every 15 days and the requirement for a new gas cylinder.
- 2).Hardware: In the hardware implementation of the system, we are using NodeMCU ESP8266 as the main microcontroller coupled with Raspberry-pi. NodeMCU ESP8266 comes 128k bytes memory and 4MB of storage. Relays act as a medium between the microcontroller and appliances for their automation. The appliances are turned ON and OFF based Obtained sensor value,total specifications are given TABLE1

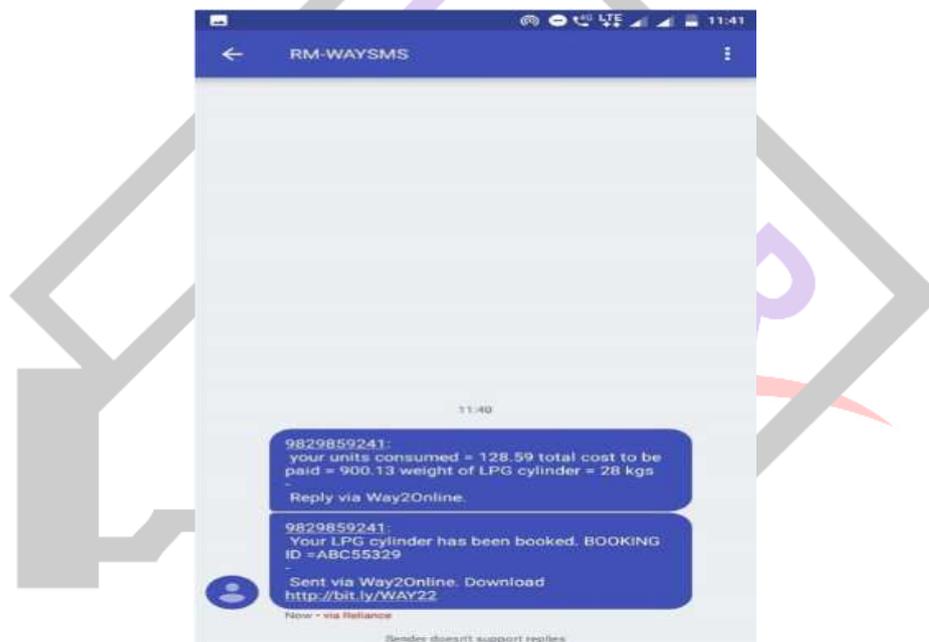


Fig. 4: Sample User notification messages about Electricity bill and Gas Booking reference No

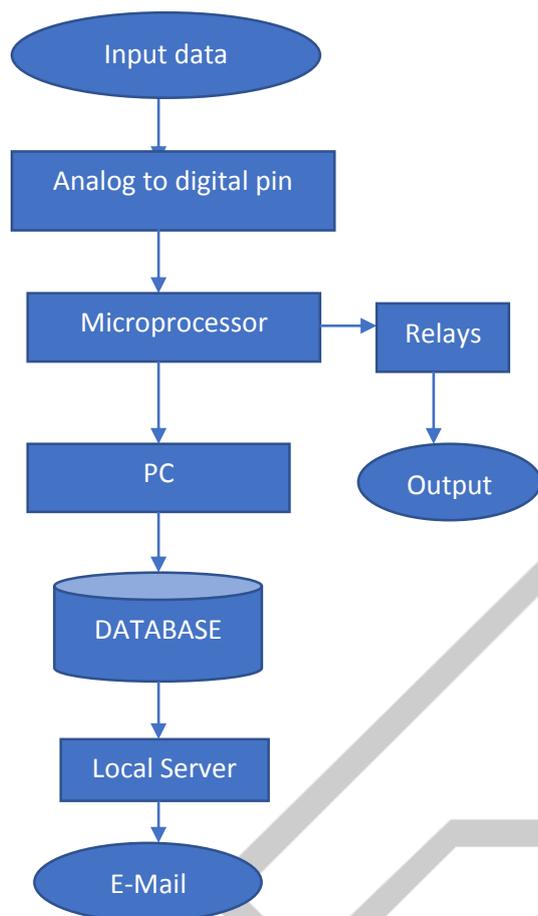


Table 2:HARDWARE MODULE SPECIFICATION

Parameters / Microprocessor	ESP 8266 Node MCU	Raspberry-pi
Memory	32-bit	NA
Processor	LX 106	AT mega 328P
Processor clock	80Mhz 160 MHz	16 MHz
RAM	< 45 KB	8 KB
Storage	16 MB	32 KB
Built-in WiFi	2.4GHz supports 802.11 b/g/n	NA
ADC PIN	1 (10-bit resolution)	6
GPIO Pins	10	14
Operating Voltage	33.6 V	7-12 V

Fig. 5: Data flow diagram of the proposed system

Software: The main software components of the implementation are as follows:

Microcontroller programming: Both the Raspberry-pi UNO and Node MCU ESP8266 have been programmed using the Raspberry-pi IDE. The CT sensor, temperature sensor, and Load cell have been connected to the Raspberry-pi. The Irms value from the CT sensor is used to calculate the total units consumed. The load cell calculates the amount of LPG in the cylinder and stores it in a local variable. The temperature sensor is used to automate the air conditioner. The Raspberry-pi Uno code does all these calculations. The IR sensor and LDR have been connected to Node MCU ESP8266. These are used to control the blinds and lights by triggering the relays. The main advantage of using ESP8266 is that once it is connected to the internet it can be controlled remotely from anywhere in the world by using its unique IP address. The Algorithm-1 and 2 describe the working procedure of Node MCU ESP8266 and functionality of Arduino.

Database and Server Programming: XAMPP has been used to create a local server on the host PC. [10]The database related programming has been done in PHP and MySQL. The sensor data is read into the table created in MySQL is shown in Sample database structure. To send the browser client information to the local server, we use the GET method. In this, the information is encoded using a scheme called URL encoding. The Raspberry-pi program appends this encoded information to the page request thereby sending this information to the PHP program where these values are stored in local variables. Using SQL queries, these values are appended into the database which is being administered by PHPMyAdmin. The PHP program then notifies the user about the units consumed, expected cost and the unique booking ID through SMS using the Way2SMS API.

Conclusion and future works [9]

The paper presents the highly secured and smart home automation system. This home automation system can handle the home appliances and regulate them without any physical activity of the user. The user can automate the home appliances and control them by mobile applications as well as their wifi. The smart phone keeps track of the different environment variables present in the paper and Guides the appliances to work accordingly to the basis of need of the user not only out automation what the energy consumption and bills also can be handled through the paper. Automatic gas booking is included when the level of gas reaches lower than threshold value and all the paper also contain image recognition and description which is very important in the security of the home as when the motion sensor will notified about the motion happening in the home then the user can switch on the

camera and the image description will tell the detailed information of object which is moving inside. There is also a option of Alarm if the user wants.

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