

# An Embedded Web Server Based Automatic Smart Home Monitoring System

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**Abstract:** Smart home is an observing, controlling and investigating service which includes Wireless transmission technology and electronic sensor innovation. It allows the client to get the full scope of services, the opportunity for continuous monitoring and controlling of home environment. An embedded web server is developed which consists of screens for home environment parameters, for example, room temperature, light intensity, LDR sensor, PIR sensor, motion detection, fire detection, smoke sensor, humidity sensor and LPG gas leakage for monitoring and controlling remotely. In this project Raspberry Pi3B+ is used for monitoring, processing, controlling different sensors and communicating with embedded web server, because of its advanced features and easy of communicating through Internet of Things (IoT).

**Keywords:** Internet of Things (IoT), Sensor node, Raspberry pi, Embedded Web server.

## 1. INTRODUCTION

Nowadays the technological global centralized principle is to automate every possible aspect for simplicity in existence, supplying security, saving strength and time. In that, home automation is one of the important aspect to automatically ON/OFF the home appliances. Home automation may be characterized as a technique for doing something without human inclusion. It is able to comprise delivered collectively to govern of lighting, heating, air flow, air-conditioning, machines, protection door locking and one of a kind structures, to offer progressed comfort, energy efficiency and safety. The idea of automate each appliances in domestic is executed from many years in the past, it started out with connecting electric powered wires to the battery and close the circuit by means of connecting load as a mild. Later it is able to be advanced by way of one-of-a-kind businesses, creates its own automation systems with distinct gadgets like sensors, controllers, actuators, buses, and interfaces. There are few strategies for controlling domestic automation systems.

Smart phone traces and even coaxial links are generally applied as part of domestic security gadget. In these days most of the automated structures make use of the hardwired and wireless structures for managing the home equipment. It needs to have both gadget and programming set up for proficient structures.

The superiority of home automation has been expanding fantastically due to a whole lot higher reasonableness and simplicity through smart phone's and wireless networks. Internet of Things (IoT) is interlinked via those networks, due to the popularity of the home automation is advanced by using the nice of provider supplied by using the devices. Extraordinary home automation systems are proposed with the aid of one-of-a-kind authors for robotically on and stale the appliances with one of a kind programs. In that, layout and development of Activation and Controlling of Home Automation System through SMS the usage of Micro- controller [1]. It predominantly concentrates on the manager of domestic-home equipment remotely while the individual is a ways from the house. In this machine GSM module is used for sending message, from at some stage in the arena and 8051 micro controller as a processing unit [12]. It is a highly

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priced architecture and has low reliability. This principle control system executes remote Bluetooth innovation to give a way get right of entry to from computer/transportable computer or advanced cell with layout of low price, consumer pleasant -interface and installation is straightforward in way. By using this it has low range of distance, not flexible and no safety [2]. This paper is broadly speaking worried with the programmed control of mild or something different home machines through Internet using raspberry pi, micro controller and sensors. It has complicated and luxurious architecture and high price [3]. This paper intends that a gadget is being created to sign up for any entry level with the Internet. There after the doorway controls that system and can be managed from anywhere on the earth. It costs fairly and difficult to function to manipulate the Door and Home Security by means of Raspberry Pi through Internet [4]. This paper pursuits controlling home equipment through android mobiles. The use of Wi-Fi is to exchange protocol interfaces and Raspberry Pi as processing unit. The server is interfaced with relay board that controls the home equipment that is going for walks in the domestic. It has high price flexibility [5].

## 2. DESIGN AND IMPLEMENTATION

The point of interest of in this assignment is, to serve customers and function domestic appliances with their smart phone's. This is to help older or handicapped people live a greater independent life as long as possible. The objective of our device is to attend to more home systems that can typically be hard for those who are handicap or aged to take care of. The proposed idea will allow a person with any web server enabled device to control and monitor their home. This utility will allow the person to manipulate a tool that is related to any domestic equipment this is Pi enabled. The focus of this application may be to direct a protection gadget with different types of sensors. Sensors are connected to the house appliances with Raspberry pi in order that they'll be monitored and controlled through web page [7].

In this system we are using the "way 2 SMS" instead of GSM technology for sending the alert messages for each and every sensor when they are sense any information. By using this **url = 'http://site24.way2sms.com/Login1.action?'**link we are automatically Logging into the SMS Site and send the SMS to the user.

Assume a worker who has gone to work and during this period a thief enters into the house through a window. Then the machine could not permits the consumer to enter into home, because the PIR sensor triggers the LED and automatically an alert message was send to local authority.

The Client can also check the status of the lights, fans and some other home appliances whether turned ON/OFF without the need of any single movement. Those devices might additionally benefit users with limited mobility which could have a tough time getting to or even reaching their light switch. Those targets require a big amount of technology. The consumer interfaces have to be as easy and effective as possible and operate in a self-controlled manner. User can control all the home appliances through web server only

Temperature sensor is used to find out the temperature levels in home. When the temperature exceeds its maximum level in the home, automatically the exhausted fan gets ON and cool that particular room in the home. When the temperature in the room comes to its normal condition then automatically fan goes to OFF state. Later an alert message goes to user as a SMS, a MAIL is displayed on webpage.

Fire sensor is used to sense fire accidents that occurs in home and the surroundings. If fire occurs then automatically buzzer rings and an alert message will be send to user as a SMS and a MAIL is displayed on webpage.

In order to find gas (smoke) leakages in home we use gas sensor. The GAS sensor finds any gas leakages in the home, and automatically the exhausted fan goes to ON state. When the gas level in the room reaches its normal state then automatically fan goes to OFF state. There after an alert message will be send to user as an SMS and E-MAIL displays in user's webpage.

### 3. HARDWARE DESIGN

#### Raspberry PI

It is aboard with miniature marvel, packing vast computing electricity into a footprint no larger than a credit card. The PC on the guts of the RASPBERRY PI 3B+ Model will be a Broad com BCM2835 machine-on-chip (SoC) multimedia system processor because of this the sizable majority of the device's factors, in addition to its applicable and images processing devices beside the audio and communications hardware, are built onto that unmarried detail hidden to a lower location the 256 MB silicon chip on the center of the board. It's no longer true that this SOC technique produces certainly the BCM2835 which is a processor positioned to your computer. Moreover it used a unique instruction set format (ISA), known as ARM [6].

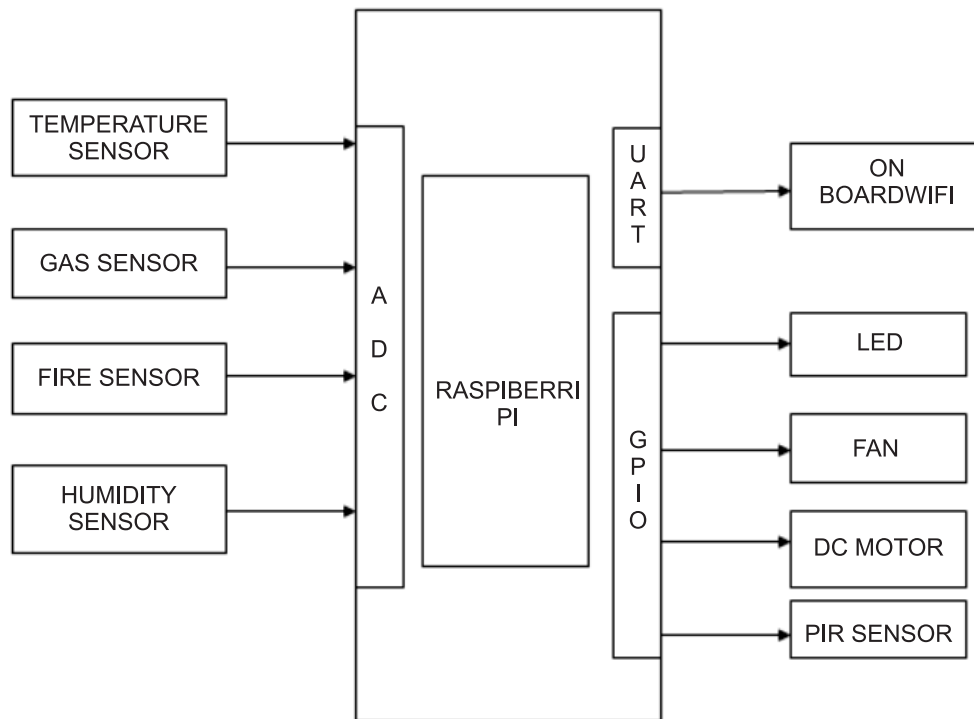


Figure 1: Block Diagram

The BCM2835 SOC settled to a lower area a Hynix silicon chip advanced with the resource of Acorn computer systems returned within the past due 1980s, the ARM design may be a enormously unusual sight in the pc international. Anywhere it excels, however, is in cellular gadgets [10]. The Smartphone in your pocket almost actually has at minimal of one ARM-based absolutely processing middle hidden away inner. Its aggregate of an easy decreased training set (RISC) layout and coffee electricity draw create it the proper possibility over laptop chips with excessive strength desires and complicated exercise set (CISC) architectures. The ARM-primarily based absolutely BCM2835 is that the name of the game of but the RASPBERRY PI is able to artwork on sincerely the 5V 1A energy provide provided via using the aboard micro-USB port. It's moreover the cause why you won't recognize any warm temperature-sinks on the device: the chip's low strength draw right now interprets into very little waste warmth, even in some unspecified time in the future of difficult technique duties.

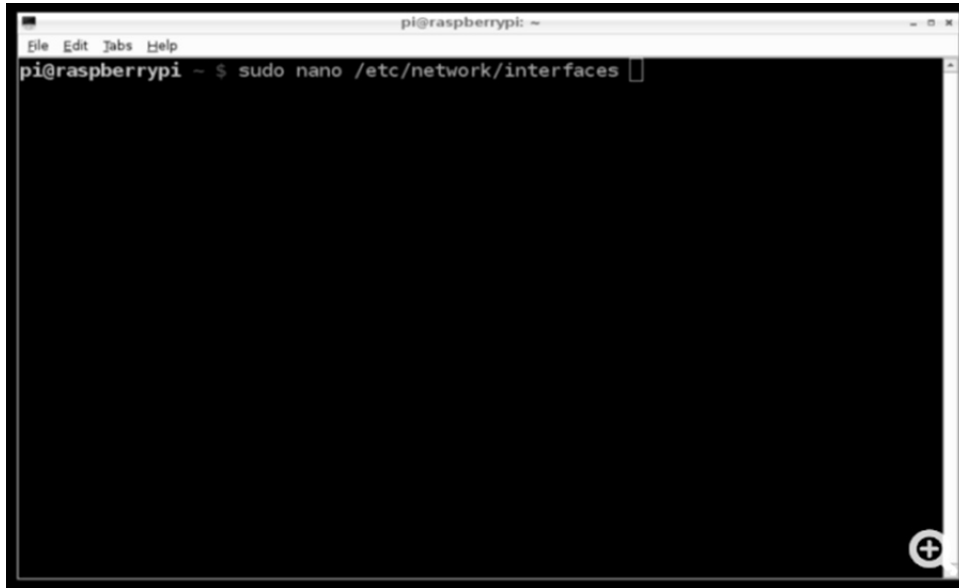
#### WI-FI

Now in this project we are using the raspberry Pi3. The Raspberry Pi3 also has inbuilt 802.11b/g/n Wi-Fi which greatly expands the variety of things you can do with it.

## Wi-Fi Router Configuration

The Wi-Fi unit acts as a medium for communication, it can be also organized to make security services. The Wi-Fi should be organized with a certain address and user commands will be directing through Wi-Fi unit.

**Step 1:** You may use `sudo nano /etc/network/interfaces` for configuring Wi-Fi with raspberry-pi.



```
pi@raspberrypi: ~  
File Edit Tabs Help  
pi@raspberrypi ~ $ sudo nano /etc/network/interfaces
```

**Step 2:** This opens the editor window in editor window *u* have to change the WIFI configuration file.



```
pi@raspberrypi: ~  
File Edit Tabs Help  
pi@raspberrypi ~ $ sudo nano /etc/network/interfaces
```

You can get your allocated IP address by typing in following command: `ifconfig`.

## Sensor Nodes

- A. **Temperature Sensor:** The LM35 can be added honestly within the same method as alternative micro circuit temperature sensors. It may be jammed or hooked up to a floor and its temperature can be inside around the range of zero. 01°C of the floor temperature [8]. This presumes that the close air temperature is clearly approximately similar to the surface temperature, if the air

temperatures has been precise better or lower than the floor temperature, the particular temperature of the LM35 die is probably at an intermediate temperature between the surface temperature and the air temperature. The temperature sensors have trendy packages in environmental and manner manipulate and additionally in analysis, communications and measurements.

```

pi@raspberrypi: ~
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Fri Jul 19 12:49:54 2013 from 192.168.1.86
pi@raspberrypi ~ $ ifconfig
eth0      Link encap:Ethernet  HWaddr b8:27:eb:b3:fc:2e
          inet addr:192.168.1.81  Bcast:192.168.1.255  Mask:255.255.255.0
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:177 errors:0 dropped:0 overruns:0 frame:0
          TX packets:74 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:14754 (14.4 KiB)  TX bytes:10131 (9.8 KiB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:1 errors:0 dropped:0 overruns:0 frame:0
          TX packets:1 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:95 (95.0 B)  TX bytes:95 (95.0 B)

wlan0     Link encap:Ethernet  HWaddr 00:0f:54:12:15:97
          UP BROADCAST MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

pi@raspberrypi ~ $

```

- B. **Gas Sensor:** It is an ideal detector that is used to detect the presence of a dangerous LPG leak in your home or in an exceedingly station, tank atmosphere. This unit will be simply incorporated into associate alarm unit, or provides a visual indication of the LPG mixture. The detector has magnificent sensitivity combined with a fast latency. The detector can sense iso-butane, propane, LNG and also tobacco smoke.
- C. **PIR Sensor:** Passive Infrared sensors (PIRs) are digital devices that are hired in protection of alarm structures to insight the movement of an infrared emitting, commonly a person frame. The pyroelectric detector is manufactured from a crystalline cloth that generates a surface electrical occurrence. When it is exposed to heat inside, some sort of infrared emissions takes place. Once the amount of radiation placing the crystal changes, the amount of price changes and it can be measured with a sensitive FET tool embedded within the detector. This radiation (electricity) is invisible to the human eye but is detected by means of digital devices designed for this kind of motive [8].
- D. **Humidity Sensor:** Humidity is the presence of water percent in air. The amount of water vapor in air would effects the human comforts as severe generating processes in industries. The presence of water vapor mixture influences various chemical, physical and biological strategies. Humidity with in industries is crucial because it effects on the enterprise cost of the products and moreover the suitability and safety of the personnel. Hence, humidity sensing is extremely necessary, especially for control structures in industrial approaches and human comfort [8].

Controlling or observance of humidity is of dominant significance in several domestic & industrial applications. In semiconductor business, humidity or moisture level ought to be managed perfectly & monitored by layer manner. In scientific applications, humidity management is needed for pharmaceutical process, incubators, metabolize equipment, sterilizers and biological stock. Humidity control is additionally necessary in chemical gas purification, dryers, ovens, movie aridness, paper and fabric manufacturing. Particularly in agriculture, area of humidity is essential for safe plantation (dew prevention), wet soil observance, and so on. For home applications, humidity management is for home environment in buildings, cooking control for microwave ovens, and so on. Altogether such applications are plenty. Humidity sensors are used to supply a sign of moisture level within the ecosystem.

- E. **Cooling Fan:** The basic physics principle behind CPU cooling is convection. A hot object transfers a number of that heat to the air molecules close to its surface, cooling slightly within the method. If the air is moving, then these heated molecules can float away, permitting cooler air to switch them and absorb a lot of heat. Employing a fan forces the air to maneuver, providing constant stream of cooler air absorbs heat from the article and considerably increasing the speed of cooling.
- F. **DC Motor:** In this project we are using the a small 9v dc motor as our home appliances like AC, refrigerator.

#### 4. SOFTWARE DESIGN

A server is designed on a Raspberry pi 3 improvement board in Linux environment, which reinforces HTTP, TCP/IP, AT Commands and SLIP conventions. The web server Flash File System supports progressively created documents that can incorporate information from transducers and equipment assets. This sort of document is called an embedded web server page (ESP).

##### Front End Design:

##### HTML:

HTML is a particular kind of all complete languages used for adorning a website page. HTML acronyms for Hypertext Markup Language. Hypertext is a context that spends a lot on additional determinations. For example, arranging, image processing and so on. Markup is a procedure of including the additional images. HTML has its own protocols, Hyper Text Transfer Protocol (http) is one among them. HTML is an universal language to communicate with different web pages. It demonstrates the details of user name and address which portion is highlighted and where an image includes and so on [9].

It uses various tag lines such as Header Tag, Button tag and frame stage. There are several type of format instructions that are taken into consideration like head, title, body etc.

Python is a general purpose, high level programming language its acts as interpreter. It is easy to compile and understandable language. Python supports multi programming model like object oriented, functional programming, imperative and procedural styles. It features is automatic memory management and dynamic type system.

There are different directions that are utilized and runs the putty setup in that stage. Likewise it is utilized for booting up the raspberry pi working framework. It mostly accessible as an open source.

In this project, the address, communication changes and information transmission are composed utilizing “python” programming. It is simple to understand and compile and gives accurate results. The programs for collection and information storing are composed utilizing “python” and Web interface is created utilizing Java Script and PHP.



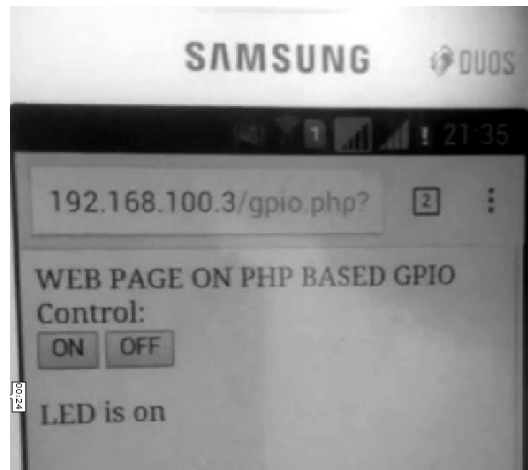


Figure 2: Web server based system

A Linux based server gathers investigated information by accepting the UDP packages containing test information from the Internet of Things (IoT), application portal and store them in a database. These specimens are from the database through a site facilitated on the server. A crude example information, test source and time of landing are put away in the database. This empowers the examples that are requested by date and sorted out by their sources.

## 5. MODEL SIMULATION AND RESULTS

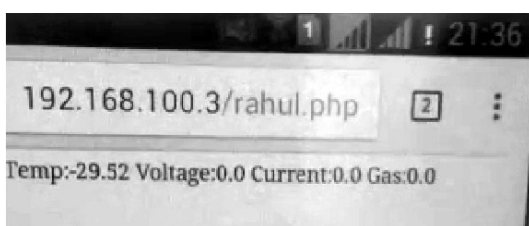


Figure 3: Sensor readings in web page

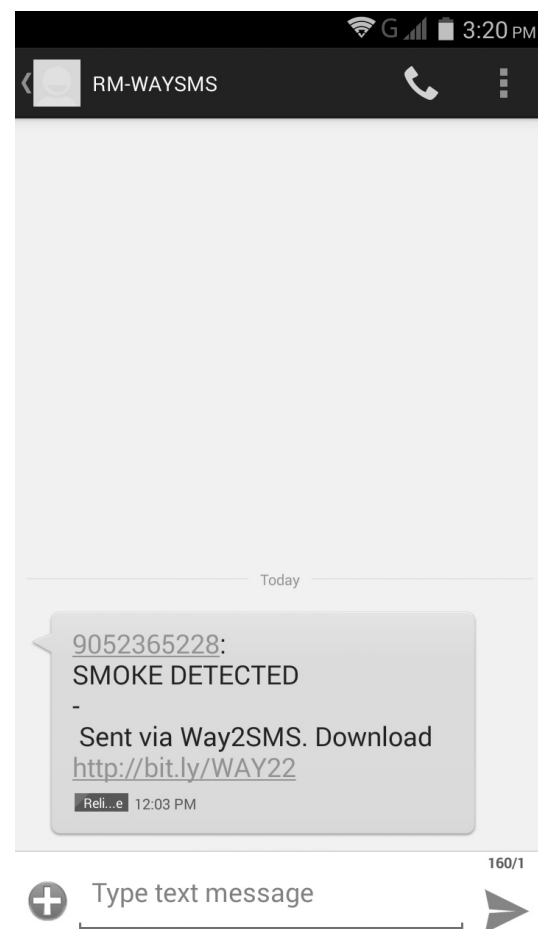


Figure 4: Screenshot of mobile notifications

## 6. CONCLUSION

This intelligent system is used for remote controlling and monitoring of home appliances in an Internet of Things (IoT) environment using RASPBERRY PI. This architecture can also be used for video surveillance applications, industrial monitoring and controlling and precision agriculture by integrating appropriate sensors and actuators. .

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