

# Smart & Cost Effective Self Automated Raspberry Pi System for Building Green House

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**Abstract**— Home Automation refers to the branch of automation that deals with the methods dedicated to the reducing human efforts and involvement in completing tasks. The main objective of these Home Automation systems(HAS) using internet of things is to inhibit automatic and electronic control of household features activity and appliances. This paper deals with the wide range connectivity and energy efficient control of the home appliances in a user-friendly manner. These features of connectivity, scalability, power saving can be achieved by the use of Raspberry Pi, which acts as an interface between the hardware and the software of the entire system which can be connected to number of peripherals using USB ports or HDMI port and GPIO, it can be connected to the internet using the Ethernet port or by Wi-Fi connectivity.

**Keywords**—Home automation system(HAS), Raspberry Pi, Wi-fi Connectivity

## I. INTRODUCTION

Now a days human comfort ability is completely depend upon the technology on their hands, the best example for the above mentioned fact is smart mobiles. Either we have usage or not or we are utilizing the features on the mobile or not, no one worried about that. Even most of the peoples never explore features binded with the mobile because of popularity on the market alone attract the customers to buy the phone like Apple phone versions. The same like in the earlier days home automation system is desired to attract the customers to show their royalty. Later so many inventions are conducted on home automation system to achieve green efforts by means of electrical consumptions And so many achievements also achieved on green energy computing.

But our work is mainly concentrating on peoples with disability. We also keeping comfort ability in our mind not for royalty only for disability. Peoples suffered a lot and they depend on other persons to access home appliances not only appliances any stuffs can be accessed and achieved through our system. So disable peoples does not requires additional personal assistance, they can run their daily life normally as others can. This is our aim of work, to prepare this we require a system which should be small in size and able to provide ease f interface with computational resources. So we preferred raspberry pi and arduino microcontrollers as technology system, from the single board we connected and accessed all the things rounded at the environment. We extended our

services to all the stuffs rounded at particular environment to make more feasible we planned to connect with internet so IOT also take part with our system. Connecting and controlling stuffs with remote is not our aim, providing intelligent system to those appliances is our sole aim. Limiting and accessing the appliances through hand gesture is not a big task that can be easily achieved but building self adapting and self healing internally on those appliances is tedious process. If we miss self adaptability features then the system cannot be meaningful for smart, it's just a remote handled device and also disability peoples never gets a good handshake on remote held device. So we preferred a sensible system which act like a robot and more responsive than other smart devices. We imagined and developed a system which should operate themselves based on the presence and absence of human beings and we developed a scenario were one electronic gadget from user hand should be connected with the microcontroller, based on the distance accessibility automatically applications feeded within the system started to operate, this reduces useless burdens for disabled users. And also if any problem occurred on particular appliances means it try to go ahead with self heal as well the problem persist means it give a continuous voice control message to the users as well as summary log of operated device for every entire day. Definitely our system features stands as incredible gift to the disability persons. This helps to reduce power consumption and unwanted utilization of electrical resources on the floor keeps our environment green and safe.

The project found that the purpose to which home automation is put is limited more by the person's imagination than the technical capabilities of home automation systems or the availability of suitable switching mechanisms. In this project alone, home automation was put to 4 different uses:

- 1) To switch on or switch off light.
- 2) To turn on or turn off fan
- 3) To turn on or turn of an alarm
- 4) To start or stop irrigation system

Previous research has found that assistive technology, if it was installed, was often abandoned due to poor device performance, dissatisfaction with equipment and/or changes in user needs or priorities.

## II. BACKGROUND SURVEY ON EXISTING WORK

A plenty of surveys were taken for our investigation, as a result we come with a radical system which is improved model of all existing works. The detailed survey on our work is explained below,

Fan [11] used web based occasion activating calculation of vitality administration in keen family units by utilizing brain activity as final destination helps to diminish the power cost and provide an assurance of solace level for family unit individuals. The proposed vitality administration arrangement can manage the irregular request of buyers and is actualized without client mediation. As a result, family unit individuals don't have to physically set the components function time interim about apparatuses. Another scalar function like Lyapunov enhancement technique is embraced keeping in mind the end goal to plan the controllable load in the family construct just in light of the present data. Besides, from key intend to initiate processing through online calculation, by the way of reducing the speed of flow of execution, recurrence with pointless count, an occasion activated instrument are utilized with the help of creators. Reenactment comes about demonstrate that the proposed arrangement gets successfully diminish the power consumption with the assurance of solace the grade of clients.

An hypothetical temporary alliance for combined action amusement methodology, more than the collaboration amongst family units with the help of consumption serves element among brilliant group also exhibited by Fan[11]. The creators taking the count of valid and possible request reaction capacity in cooling units, intend for utilize all of them and keeping in mind the end goal to diminish the vitality expenses of a brilliant group. The proposed cooling controller is intended to decrease the measure of power bought from the primary framework by controlling ventilating units. This is made conceivable by an online aerating and cooling vitality administration calculation, in light of Lyapunov enhancement, that considers both the ventilating vitality utilization and the warm solace level of shoppers. They got comes about show that the proposed coalitional amusement can possibly fill in as a powerful methods for enhancing the benefit from the heap sourcing element and minimizing the cost of end users.

The author Ikpehai [12] shows a valuable observational appraisal of hybrid min level control Power Line Communication (PLC) framework over then the IPv6 organize (known as 6LoPLC) for a applications vitality administration frameworks. A working approach is created on the NS-3 test system with the system execution get approved within a few estimations. They got comes about give some valuable experiences to framework architects and application engineers. Moreover, the model exhibited in this paper is likewise practical for brilliant matrix program apps along with other digital physical frameworks, when huge unwavering quality and minimal effort were huge need than expected execution response time.

The prediction by Ahmed[13] demonstrate with the lightning seek calculation help by keeping in mind the end goal to take care of the issues raised from techniques like ANN(Artificial Neural Network) for identifying the responding time and the real throttle estimation of available neurons which used in the part of a home vitality of administration booking programmer. Truth be told, which is realized that request reaction controller has been move from max time load to min or off load time, in this way decreasing ozone depleting substance outflows and permitting vitality protection. Therefore, the home vitality administration booking technique in a private reaction controller technique, introduced from the writers, intend additionally to anticipate the state from ideal OFF/ON conditions of end application components. They got comes about demonstrate that the arrangement proposed by the creators accomplish a superior reaction in exchanging the status in the home vitality administration booking controller, permitting a significant vitality sparing.

The point I observed from author Nguyen[14] is, when and how shopper conduct performance varies over the utilization of change in power valuing from nil constant and overall determination of all those progressions. Well all these helps a profound examination centered helped for this exploration field and furthermore talk about these approach ramifications in interest administration to move utilization to days that have more sunlight based radiation, while in the meantime decreasing general utilization. From this end we conceived, a change in valuing test properties are executed on Nushima Island, situated on the top of focal point in Japan, joint along with the support of 50 standing people units. By measuring the outcomes demonstrate that change in charging evaluating achieved by 14% lessening of electrical vitality utilization on the examination for the pre-explore duration. The collected outcomes will be useful for build up an approach for practical vitality protection which situated on remote islands.

Our next investigation developed from author Moon[15] to built up a new technique in ANN forecast demonstrate to control buildup area's warming frameworks. This work contains primary point to assess the climb for time factors for various indoor component temperature units from the misfortune time frame (whenever a buildup area isn't involved) to an objective set point temperature (when a building is possessed). They got esteem in connected keeping in mind the end goal process to desire the best possible minute to begin expanding the temperature unit for various difficulty temperatures enable to achieve main objective aim of observing temperature to a best fit time unit. From this overall process executions from proposed ANN is generally approved and the acquired outcomes is tremendous.

A new component named savvy meter in a basic instrument is used as effective adjusting on request with vitality bend. This instrument permits for connecting for the utilization ratio as well as creation of estimations on the basis of time data which include client's character also, empowering representation in

level value charging with more quick witted arrangements, for example, utilization of time based pricing. From formulae expressed the exploration field, a author Piti[16] survey help continuous circumstance in nations like Europe with respect to constant administrations for the last clients. Also, they dissect the building and innovative choices obtained are considered in assisting off period of the huge Indian second era from savvy component meters.

Another versatile-client & full duplex VLC (Visible Light Communication) framework should be utilized as part of a shrewd home condition is presented by author named Niaz[17]. He introduced a framework is fit for pleasing information for the two clients and keen gadgets on downlink while likewise giving uplink network. The creators consider all of the execution from the existing framework, for the most of the part on the rate per unit and electricity utilization. Recreation comes about demonstrate that the arrangement presented from creators proportional to the prerequisites of information passes towards the developed inner stations, for example, as brilliant portrait home. Moreover, to the extent the charge per unit and electricity utilization, the creators feature for underlying expense of the proposed approach like VLC framework is very responsive, however the older contrasted with the execution charge of cost is directly incorporates the electricity utilization and also support costs, the approached VLC framework ended up being a more savvy arrangement.

The objective of keeping up clients' warm solace conditions in indoor situations may require complex direction techniques and an appropriate vitality administration. Thus, Alamin et al. [18] display a financial Model based Prescient Control (MPC) having fundamental quality t measure utilization of the Day-Ahead value (DAP) by constantly considering the mindset in the achievement to anticipate with vitality consumption directly connected along with the property of warming, ventilation and aerating and cooling (HVAC). Along these lines, the control framework can keep up a high warm solace level by advancing the utilization of the HVAC framework and to diminish, in the meantime, the vitality utilization related with it, however much as could be expected. The acquired outcomes demonstrate that the control framework presented by the creators can accomplish a tradeoff between clients' warm solace and the measure of vitality spent to achieve this warm solace. Thus, the proposed control procedure can deal with the vitality spent using the DAP, while the clients' warm solace is boosted.

### III. MATERIALS

The list of materials (i.e.) components used in our experiment with flow specification is presented below, we shown a special care on choosing the components, why because the consumption of power is also depend upon components involved on experiment, if we failed to choose optimized utilities then we cant achieve end goals. The list of hardware

and software specification with their feature is prescribed below,

#### A. Components and devices used –

- Microprocessor - Raspberry Pi 3 Model B

#### B. Input devices -

- Motion sensor – to detect Motion through Infra-red radiation change in the environment.
- Digital temperature and moisture sensor – DTH 22; Model AM 2302
- Soil Moisture meter – helps to predict and analyse moisture environmental level of the soil
- Light sensor – to detect the brightness of the surrounding

#### C. Output devices -

- Fan motor – Response of Digital temperature and moisture sensor
- Bulb – Response of Light sensor
- Motor for pump – Response of Soil moisture meter
- Buzzer alarm – Response of Motion sensor

#### D. Other components used -

- Power Board 12 V, 2 Amps
- 4 channel relay board controllable with 3.3 or 5 Volts DC signal.
- Wire jumpers (male, female etc)
- Standard bulb holder

## III. METHODOLOGY

### A. SYSTEM DESIGN

The embedded system comprises of a microcontroller (Raspberry Pi 3), a relay board to convert 5V to 220V, sensors like light sensor, temperature sensor, motion sensor and moisture sensor for controlling light, fan, security alarm and irrigation at home automatically. The sensors are initially set to low that is initially no output is generated at first, but once the sensors detect some change in their initially set value they generate a corresponding required output. The output signals are processed by the raspberry pi and a required voltage is provided to the 5V end of the relay which is converted to 220V and the electronic device starts to work.

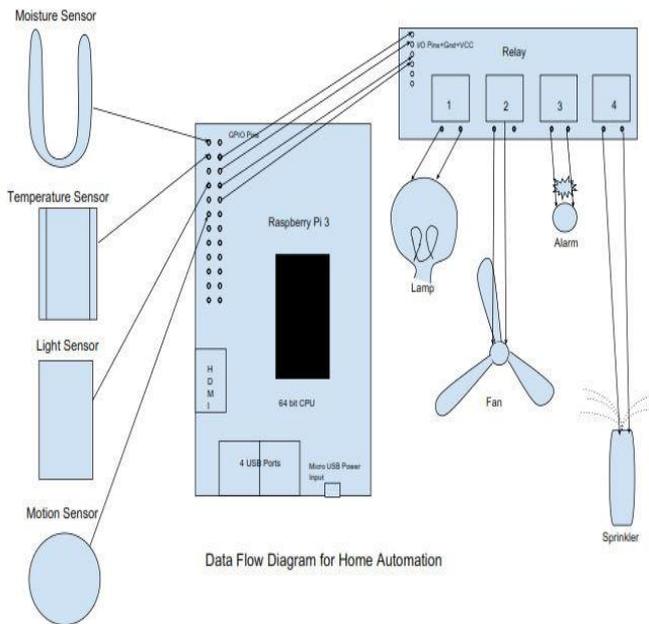


Fig.3.Architecture Representation of Raspberry Pi with Home devices.

**B. Hardware Components**

- RASPBERRY PI 3 MODEL B

**Features**

1.2GHz quad-core Broadcom BCM2837 CPU with 1GB DDR2 RAM with in-built WiFi & Bluetooth VideoCore IV 3D graphics core 40 pin extended pins - with 27 GPIO pins Micro SD slot Multiple ports: Four USB ports, full sized HDMI, four pole stereo output and composite video port. CSI camera port and DSI display port 10/100 Base T Ethernet Micro-USB power source 5V DC

**Function**

It's a Micro controller which is programmed to sense and control the output devices as pre the values set in different codes.

- RELAY BOARD 4 CHANNEL 4 CH 12V ULN2003 BASED MODULE (CONTROLLABLE WITH 5V or 3.3V SIGNAL)

**Feature**

Control signal 5V or 3.3V DC Power supply : 12V (Vcc). Switch capacity of the relay 7A@250VAC / 10A@24VDC

**Function**

This acts like a switch having 4 channels

- DHT 22 TEMPERATURE AND HUMIDITY SENSOR

**Module AM 2302**

**Feature**

It can measure 0-100% humidity readings with 2- 5% accuracy. Reads temperatures ranging from -40 to 80°C with ±0.5°C accuracy.

**Function**

When the sensor sense the temperature above the set temperature it's DO is used by the micro controller and Output is given to a Fan connected to it through relay module. The fan keeps rotating when the ambient temperature is higher than the set temperature.

- SOIL MOISTURE METER

**Features:**

Working voltage: 3.3V~5V; Dual yield mode, simple yield more precise; With control marker (red) and advanced exchanging yield pointer (green); Having LM393 comparator chip, stable VCC: 3.3V-5V DC and ground at 0 V Digital yield interface(0 and 1);Or simple yield interface

**Functions:**

The advanced yield DO is associated specifically with the microcontroller to distinguish high and low by it to identify soil dampness. The computerized yields DO through hand-off module straightforwardly drive the engine for water system reason.

- LM393 OPTICAL PHOTOSENSITIVE LDR LIGHT SENSOR

**Features**

Using the sensitive type photosensitive resistance sensor with operational voltage lies between: 3.3V-5V

Output: DO digital switch change of output (0 and 1)

**Functions**

The module is sensitive to the light and it is used to detect the ambient brightness.

- MOTION SENSOR SR 501

**Functions**

When motion is detected the PIR sensor output gives a high signal (0 to 1) on its yield stick. This rationale flag can beperused by a microcontroller or used to drive a transistor to switch a higher current burden. In my project "Home automation" the micro controller is Raspberry PI and output device is a speaker (Alarm).

**Features**

The operating voltage is 5 Volta DC. Range up to 20 ft. This is a PIR (Passive Infra-Red) Sensor is a pyroelectric device (changes voltages with

temperature) that recognizes movement by measuring changes in the infrared (warm) levels produced by encompassing articles. This movement can be recognized , at the point when the sensor sense a sudden change in the encompassing IR designs.

Python IDLE: IDLE (Integrated Development Environment or Integrated Development and Learning Environment is a coordinated advancement condition for Python, which has been packaged with the default usage of the dialect. It is bundled as a discretionary piece of the Python bundling with numerous Linux conveyances. It is totally composed in Python and the Tkinter GUI toolbox.

Sit without moving is planned to be a basic IDE and reasonable for apprentices, particularly in an instructive domain. With that in mind, it is cross-stage, and maintains a strategic distance from include mess.

CIRCUIT DIAGRAM & TEST CASES

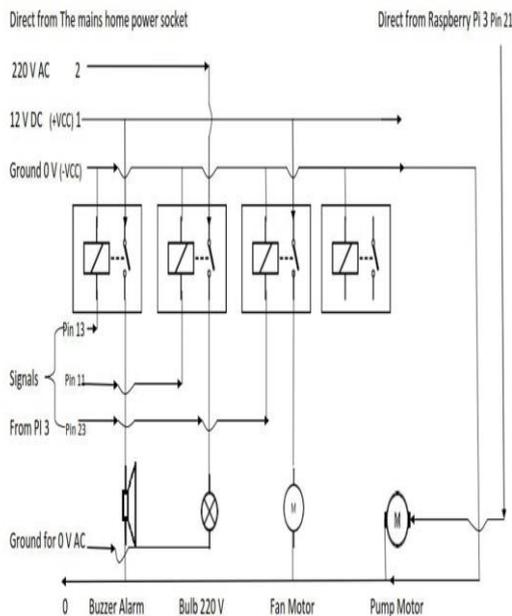


Fig3.1: Circuit Flow Representation

TABLE I

S.No	Step Description	Test Data	Expected Result
1	Making the surrounding dark	Output pin for Light Bulb set to 1	Bulb switches on
2	Making the surrounding bright	Output pin for the bulb set to 0	Bulb switches off

C. Specification Table

Table2:

S.No	Step Description	Test Data	Expected Result
1	Soil is dry	Output pin for water pump set to 1	Sprinklers are on
2	Soil is wet	Output pin for water pump set to 0	Sprinklers are off

Table3:

S.No	Step Description	Test Data	Expected Result
1	There is motion	Output pin for alarm set to 1	Alarm rings
2	There has been no motion for a while	Output pin for alarm set to 0	Alarm goes off

Table 4:

S.No	Step Description	Test Data	Expected Result
1	There is motion	Output pin for alarm set to 1	Alarm rings
2	There has been no motion for a while	Output pin for alarm set to 0	Alarm goes off

IV. RESULTS

After observing all the modules we can conclude that the embedded system is fully operational in nature. The home automation system is a working model. Its four modules combine to give a very convenient automation to certain chores we do in our day to day lives like switching on or switching of light and fan depending on whether it's dark or bright and hot or cold. It helps to make your house more secure at night by detecting any unwanted motion in the surrounding. Moreover this system provides automatic irrigation facility by sensing the moisture in the soil and switching the pump on or off depending on the reading.

When the project is tested altogether it is noticed that, as the processing of temperature sensor is a bit slow, so if the temperature sensor malfunctions and happens to not give an output, all the other devices also come to a halt at that moment of time. The temperature sensor is programmed to give the room temperature and humidity as an output. If the sensor is not able to read the temperature at some point it gives "Failed to give reading" as a warning on the output screen. When this happens the other sensors also don't give an output. But this happens only for a few seconds and gets perfectly working as the temperature sensor starts working again.

## V. FUTURE SCOPE

Anticipating the eventual fate of pretty much anything is extremely hazardous business. Home robotization is an industry that to a great extent began with X10 gadgets in 1980. Exceptional Innovation with their Life/product programming were situating the Windows Media Center PC as the heart and sole of an entire answer for home mechanization depending on web administrations to consistently interface with lighting controls, atmosphere controls, security boards, and IP reconnaissance cameras to compliment the advanced media administration abilities of Windows Media Center. Notwithstanding, Exceptional Innovation quit offering their frameworks for private establishments, and Microsoft Media Center abilities have vanished in the Windows 8 OS.

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