

Stand Alone Home Automation System

(Smart Home Automation)

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Abstract- Increasing energy demand and limitations of fossil fuels, time to use the renewable resources for energy generation in domestic area. Renewable energy will not run out ever. Other sources of energy are finite and will someday be depleted. Renewable energy offers so many benefits, from cleaning the air and reducing the pollution, to lowering prices and taking us off the destructive boom-and-bust merry-go-round of fossil fuel prices. Energy consumption increases day by day as more appliances used in today's home. This paper proposes a design and development of a prototype based on solar powered solar power home automation system and control through Raspberry Pi and to establish a platform that allows communication between the web-enabled mobile application of the user and the raspberry Pi situated at a remote location anywhere in the world. In this system, it has two main sections : Energy generation and energy consumption. Energy generation is generated by using solar energy and utilized by different loads available in the home. With the intermittent nature of solar energy, the generated power is used to meet the demand of the user at all weather conditions without relying on grid. Thus, this project proposes an efficient solar powered home automation system where the generated power is controlled and monitored by user to their power demand

Keywords- PV panel, Charge controller, Web Server, Raspberry Pi, Battery.

I. INTRODUCTION(Renewable energy)

Now a days Carbon emission of the planet earth has been increased in a large extent due to industrialization, automation, modern life of the people. Use of non-renewable energy sources is very much dependent for it, which has given rise to global warming due to depletion of ozone layer. Renewable energy is generally defined as energy that is collected from resources which are naturally replenished on a human timescale, such as sunlight, wind, tides, waves, and geothermal heat[1]. Renewable energy often provides energy in four important areas: electricity generation, air and water heating/cooling, transportation, and rural (off-grid) energy services. According to CEA ,the all over India installed Capacity as on 31.10.2017 are as follows :

The total energy capacity from all over India 331117.58MW

In thermal power plant would produced an amount of energy which would be equal to 219414.51 MW. And then the energy from Nuclear power plant 6780 MW . In hydro power plant produced an amount of energy which would be equal to 44675.462 MW .The second largest electric source is renewable energy.In a energy obtain from Renewable Energy Source that would be equal to 60157.66 MW.

II. GRID CONNECTION

1. Grid System

Grid-tied or grid connected solar is a solar electricity system without batteries. Both the national grid power smart solar electricity system are hooked up to the house so that it always have electricity available at flick of the switch, even at night, or if it is cloudy. A solar electricity system of any size can be installed in the roof of any residential building and will only ever be billed if the power consumption is in excess of the generated amount. The electricity grid acts as a 100% efficient and maintenance free battery while also providing unlimited 'on demand' energy. This is what makes grid connected solar electricity so attractive. It has all the benefits of being attached to the electricity grid but with a portion of electricity bill never increasing in price.

2. Off -grid system

Off-grid connected solar is a solar electricity system with battery backup. During the day the sun shines and charges the batteries as well as supplies power to home. During the evening or on rainy days when the sun isn't shining use the power stored in the batteries. when house is not connected to the national grid hence the name off-grid.

An off-grid solar system (off-the-grid, standalone) is the obvious alternative to one that is grid-tied. To ensure access to electricity at all times, off-grid solar systems require battery storage and a backup generator (if you live off-the-grid).

The advantage of Off - grid (stand alone) systems are used to increase in reliability and that would be decreased in power reserved capacity. Then the rating of voltage and frequency level to be constant.

The application of Off- grid systems are that would grant no access to the utility grid and this system became a self sufficient.

III. HOME AUTUMATION SYSTEM

There are a wide variety of technology platforms, or protocols, on which a smart home can be built[5]. Home automation is being implemented into more and more homes of older adults and people with disabilities in order to maintain their independence and safety. These smart homes allow older adults and people with disabilities to stay in their homes where they feel comfortable, instead of moving to a costly health care facility. The transition to a health care facility can cause a lot of anxiety and home automation can either prevent or delay this anxiety.

When, now a days, automation plays a crucial role in all work places and living homes. Presently automation techniques are implemented either using microcontroller or computer. The Raspberry Pi is a single board computer and it can be used to overcome these problems. Using these ports, we can control the appliances with the sensors as well as interface the camera for surveillance. Energy consumption increases day by day as more appliances used in today’s home. Increasing energy demand and limitations of fossil fuels, time to use the renewable resources for energy generation in domestic area

IV. PROPOSED SYSTEM

This main objective of this paper is to ease the effort of the people in rural areas where they can control the electrical and electronic devices using their own commands instead of using a remote control unit which they have to carry every time to control the devices.

In recent years, wireless technologies have become very popular in both home and commercial networking applications

Example: webpage

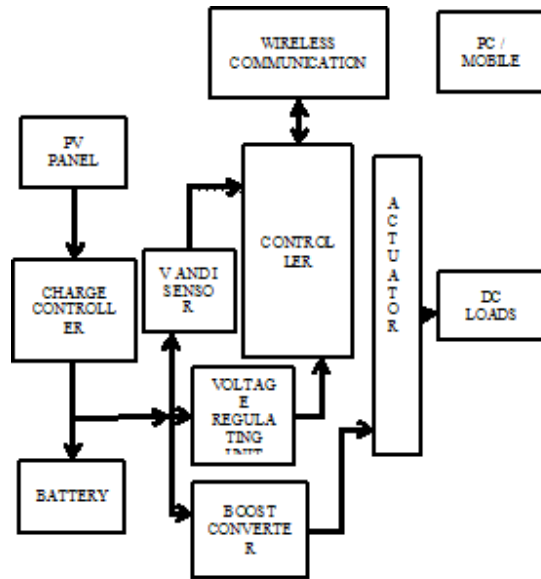


Figure 1. Block Diagram

The photovoltaic solar cell performance may be thus considered by an equivalent electric circuit model containing a diode.

PV panel Equations:

- I_d - current through diode, A

$$I_d = I_0 \left[e^{\frac{U_{sh}}{nVT}} - 1 \right]$$

- I_{sc} - short circuit current, A

$$I_{sc} = I_{pv} - I_0 \left[e^{\frac{I_{sc}R_s}{nVT}} - 1 \right] - \frac{I_{sc}R_s}{R_{sh}}$$

- v_{oc} - open circuit voltage, V

$$V_{OC} \approx \frac{nkT}{q} \ln \left(\frac{I_L}{I_0} + 1 \right).$$

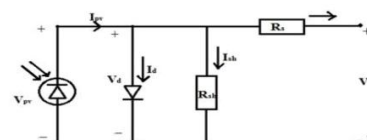


Figure 2.Simplified equivalent circuit of photovoltaic cell

Charge Controller prevents overcharging and may protect against overvoltage, which can reduce battery performance or lifespan, and may pose a safety risk. Charge controllers stop charging a battery when they exceed a set high voltage level, and re-enable charging when battery voltage drops back below that level. Current sensor is a device that detects and converts current to an easily measured output

voltage, which is proportional to the current through the measured path. A voltage sensor can in fact determine, monitor and can measure the supply of voltage. It can measure AC level or/and DC voltage level. The input to the voltage sensor is the voltage itself and the output can be analog voltage signals, switches, audible signals, analog current level, frequency or even frequency modulated outputs

A Boost converter is a switch mode DC to DC converter in which the output voltage is greater than the input voltage[7]. It is also called as step up converter. The name step up converter comes from the fact that analogous to step up transformer the input voltage is stepped up to a level greater than the input voltage. By law of conservation of energy the input power has to be equal to output power (assuming no losses in the circuit).

Boost converter are used in regulated DC power supplies and regenerative braking of DC motors. Low power boost converters are used in portable device applications. Boost converters are used in battery powered applications where there is space constraint to stack more number of batteries in series to achieve higher voltage..An actuator is a motor that converts energy into torque which then moves or controls a mechanism or a system into which it has been incorporated. It can introduce motion as well as prevent it.

	PI	BCM2837 64bit ARMv7 Quad Core Processor powered Single Board Computer running at 1.2GHz ➤ 1GB RAM ➤ BCM43143 Wi-Fi on board ➤ Bluetooth Low Energy (BLE) on board
6	Current Sensor	ACS712
7	Voltage Sensor	

S.No	HARDWARE	SPECIFICATION
1	PV PANEL	<ul style="list-style-type: none"> ➤ Each panel Power-75W ➤ Voltage rating -12V ➤ Current rating -7A
2	BOOST CONVERTER	<ul style="list-style-type: none"> ➤ Power-2200w ➤ Voltage rating -12V ➤ Current rating -8A
3	CHARGE CONROLLER	<ul style="list-style-type: none"> ➤ Voltage rating -150 V
4	8 CHANNEL RELAY	<ul style="list-style-type: none"> ➤ This is a 5V 8-Channel Relay
5	RASHBERRY	<ul style="list-style-type: none"> ➤ Broadcom

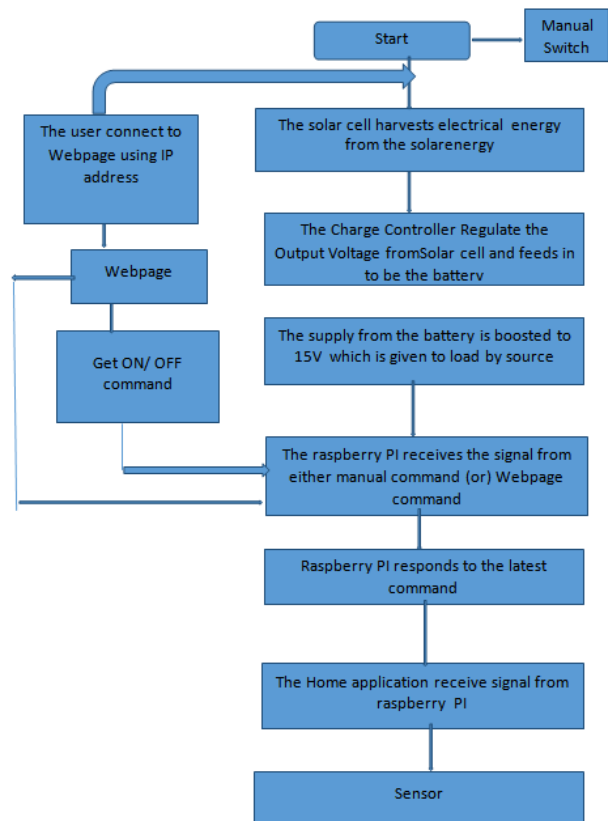


Figure 3. Flow chart

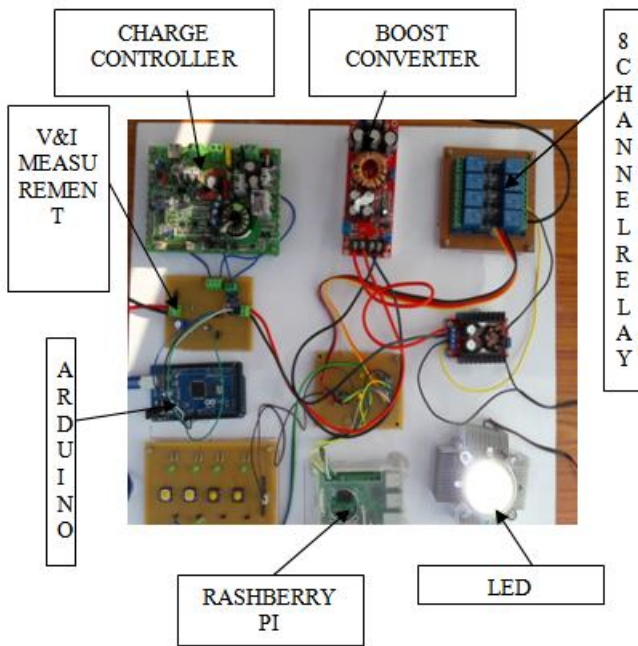


Figure 4. Hardware Setup

V. WORKING

In our project we have aimed at electrifying the home appliances through solar energy alone. The generated energy using solar power is fed to the load directly. The home appliances can be operated at the farther distance through wireless communication, thereby saving the time and the work can be performed even in our absence at home.



Figure 5.1 Experimental setup

To implement our idea we have selected washing machine and LED as a basic load. Battery is charged during morning and can be utilized at night even at morning when the power production by panel is insufficient during cloudy weather. Power produced in panel and power utilized by load is monitored by controller through voltage and current sensor and intimate to the user through wireless/PC. Charge controller used to charge the battery at reliable condition. Boost convert step up the DC power to required voltage to

loads as we are using DC loads only. Actuator turns ON the appliance when it get signal by controller. Our project is completely independent of grid i.e., off grid

VI. WEBPAGE

A web page is a document that is suitable for the World Wide Web and web browsers. A web browser displays a web page on a monitor or mobile device. That is what displays, but the term also refers to a computer file, usually written in HTML or comparable mark-up language. The primary function of a web server is to store, process and deliver web pages to clients. The communication between client and server takes place using the Hypertext Transfer Protocol (HTTP). Pages delivered are most frequently HTML documents, which may include images, style sheets and scripts in addition to text content[6]. A user agent, commonly a web browser or web crawler, initiates communication by making a request for a specific resource using HTTP and the server responds with the content of that resource or an error message if unable to do so. The resource is typically a real file on the server's secondary storage, but this is not necessarily the case and depends on how the web server is implemented. While the primary function is to serve content, a full implementation of HTTP also includes ways of receiving content from clients. This feature is used for submitting web forms, including uploading of files. Many generic web servers also support server-side scripting using Active Server Pages (ASP), PHP, or other scripting languages[2],[3]. This means that the behavior of the web server can be scripted in separate files, while the actual server software remains unchanged. Usually, this function is used to generate HTML documents dynamically ("on-the-fly") as opposed to returning static documents. The former is primarily used for retrieving or modifying information from databases. The latter is typically much faster and more easily cached but cannot deliver dynamic content. Web servers are not only used for serving the World Wide Web. They can also be found embedded in devices such as printers, routers, webcams and serving only a local network. The web server may then be used as a part of a system for monitoring or administering the device in question. This usually means that no additional software has to be installed on the client computer; since only a web browser is required (which now is included with most operating systems).

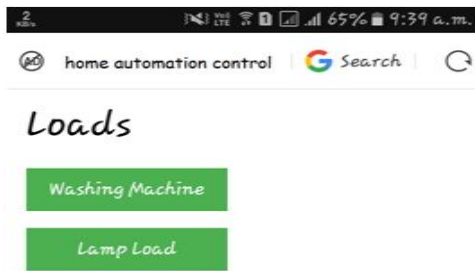


Figure 6.1 Web Page

IP Address 192.168.2.10. This IP is used to control the appliance via web server (Figure 4.8). It controls ON and OFF of the load according to command from the user. The Home Server connects user to hardware via webpage i.e., router via raspberry pi. Home server commands router via Raspberry pi to control loads[4]. Router receive signal and run accordingly to carry out specific operations. And this information like ON/OFF condition of load and power available can be monitors and control through their mobile phone using WESERVER

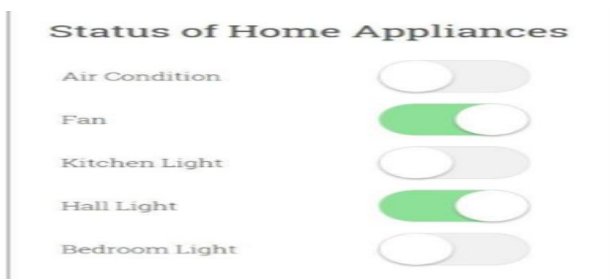


Figure 6.2 Status of Home Appliances

VII. EXPERIMENTAL RESULT

The below output data was obtained (Table 4.1) on 23 October 2017 evening 4.45PM and a LED was electrified using solar power. Thus we can connect various load depend on power generated in the solar panel.



Figure 7.1 PV panel output voltage

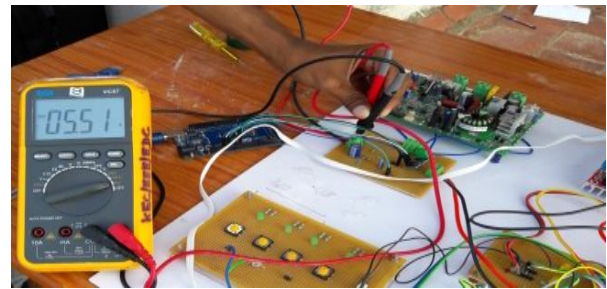


Figure 7.2 PV panel output current

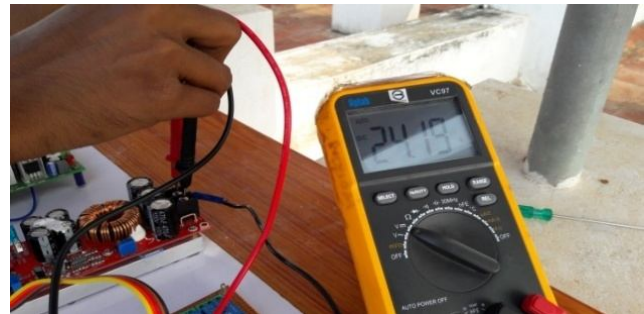


Figure 7.3 Boost converter output

COMPONENTS	OUTPUT	
	VOLTAGE IN V	CURRENT IN A
PV panel	17.76	5.8
Boost converter	24.19	5.51
LED	Glows 100Watts	

FUTURE SCOPE OF SOLAR POWERED HOME AUTOMATION AND CONTROL

The system which we proposed provides reliable automation system to the user with the available power more effectively. It create will have great impact in rural areas for effective use of generated power. It will easily controlled through wireless even at far distance. It would be a Independent of grid (off grid). For further improvement in our project combined with weather forecasting, which is very useful to user for schedule their work accordingly.

VIII. CONCLUSION

In this project, our main focus was the development of an independent energy generation system (stand alone) for smart homes to control renewable (solar) energy and home automation makes this system more effective and controlling home appliance according to the power available reduces the waste of solar energy. Smart Home users use their mobile/laptop/tablet to access the home appliances remotely,

for that we have developed a web page to control and monitor multiple domestic appliances and we have been tested by LED and washing machine, which is operated successfully. The facilities are affordable and even domestic user can provide themselves a micro generation system in their own homes and accordingly reduce natural gas/oil consumption by renewable energy sources as sort of replacement energy. This project has given an example of energy saving model for urban areas and lightening model for rural areas and expected to reduce home energy uses. Finally, it is absolutely an affordable system. It can be associated with various other options like energy monitoring systems and weather monitoring system etc., soon

REFERENCES

- [1] Nupur Sinha, Prof. Rupali, S.Khule “Renewable Energy Management System for Smart Home” IJSET - International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 9, September 2015
- [2] Dipali D. Ghorpade, A. M. Patki “A Review on IOT Based Smart Home Automation Using Renewable Energy Sources” International Journal of Science and Research (IJSR) 2015.
- [3] P.SivaNagendra Reddy, K.Tharun Kumar Reddy, P.Ajay Kumar Reddy “An IoT based Home Automation Using Android Application” International conference on Signal Processing, Communication, Power and Embedded System (SCOPEs) 2016.
- [4] Vamsi Krishna Patchava, HariBabu Kandala, P Ravi Babu “A Smart Home Automation Technique with Raspberry Pi using IoT” International Conference on Smart Sensors and Systems (IC-SSS) 2015.
- [5] SatishPalaniappan, Naveen Hariharan “Home Automation Systems A Study” International Journal of Computer Applications (0975 – 8887) Volume 116 – No. 11, April 2015.
- [6] Pavithra.D, Ranjith Balakrishnan “IoT based Monitoring and Control System for Home Automation” Global Conference on Communication Technologies 2015.
- [7] Ahmad H. Sabry, Wan Zuha Wan Hasan Mohdinal “High efficiency integrated solar home automation System based on dc load matching technique” ARPJ Journal of Engineering and Applied Sciences 2015.
- [8] PuttaSindhuja, M. S. Balamurugan “Smart Power Monitoring and Control System through Internet of things using Cloud Data Storage” Indian Journal of Science and Technology 2015.
- [9] Subhashini.M, A.VenkateswaraRao “Internet Based Sensor Networking & Home Automation Using Cortex Processor On LinuxPlatform (Raspberry Pi2)” International conference on Signal Processing, Communication, Power and Embedded Systems (SCOPEs) 2016.
- [10] Sarthak Jain, AnantVaibhav, Lovely Goyal “Raspberry Pi based Interactive Home Automation System through Email” International Conference on Reliability, Optimization and Information Technology -ICROIT 2014, India, Feb 6-8 2014.
- [11] Louis.JN,Calo.A, Leiviska, K and Pongracz. E “Environmental Impacts and Benefits of Smart Home Automation: Life Cycle Assessment of Home Energy Management System” 8th Vienna International Conference on Mathematical Modelling - MATHMOD 2015, Vol. 48, Issue 1, 2015
- [12] K. A. S. V. Rathnayakeet., al (2016) proposed on topic of “VOICE OPERATED HOME AUTOMATION SYSTEM BASED ON KINECT SENSOR”.