Automated Hybrid Energy Generation System and its Utilization Using ARM Processor

Siddra Aesaar
Department of Electronics and Communication,
VVCE, Mysuru, Karnataka, India,

Vidyashree
Department of Electronics and Communication,
VVCE, Mysuru, Karnataka, India,

Mahadev Prasad C M
Department of Electronics and Communication,
VVCE, Mysuru, Karnataka, India,

Prabhuraj S Nittali
Department of Electronics and Communication,
VVCE, Mysuru, Karnataka, India,

T P Surekha,
Department of Electronics and Communication,
VVCE, Mysuru, Karnataka, India

Girijamba D L,
Department of Electronics and Communication,
VVCE, Mysuru, Karnataka, India

***Abstract*- Electricity is most needed facility for the human beings. All the conventional energy resources are vanishing. So we have to choose conventional over non-conventional energy resources. The combination of two energy resources i.e. wind and solar energy is called as hybrid energy. To save the electricity and also to reduce our conventional power consumption, we are proposing a system to acquire electricity using renewable resources and utilize the generated energy in an efficient manner by using Passive Infrared (PIR) sensor and Light Dependent Resistance (LDR) sensor .The hybrid power generation systems are reliable and it satisfies the load demand very closely in all seasons. The hybrid power generation systems are cost effective compared to standalone systems. The system can switch automatically between the energy sources available depending on weather conditions, if neither of them is sufficient then it switches to AC mains which ensure uninterrupted power supply .This switching is done by relays and controlling operation is done by the Arm Processor. The controlling of light appliances takes two things into account before taking any action, first presence of human beings and then intensity of light.**

Keywords—Arm Processor, Hybrid Energy, LDR sensor, PIR sensor, Relays

I. INTRODUCTION

Electricity is a part of our daily life. We can generate electricity either by using renewable resources or by non-renewable resources. The main drawback of non-renewable energy resources is that they are limited and soon will get exhausted. It also produces waste like ash in coal power plant, nuclear waste in nuclear power plant which leads to environmental pollution and taking care of this wastage is a big challenge. The waste produced is harmful for human beings and other living organisms. The new source should be reliable, pollution free and economical. The renewable energy resources are a good alternative energy resources over the non-conventional energy resources. There are many non-conventional energy resources such as geothermal, tidal, wind, solar etc. Solar and wind are easily available in all condition. They are good alternative source. We cannot generate electricity from the sun in rainy and cloudy seasons and wind blowing is not consistent so we overcome this drawback by using two energy resources together so that if one of source fails other source will keep generating the electricity. This type of power generation is called hybrid power generation. Under certain geographical conditions solar and wind both are unavailable, in such situations energy is supplied through AC mains. This kind of system ensures continuous power supply to the load. Along with generation of electricity we should also consider its effective utilization and ensuring that it is not wasted. Sometimes people forget to switch off the lighting appliances. Using PIR and LDR sensors we can prevent wastage of electricity.

II. LITERATURE SURVEY

Hybrid power generation model using solar and wind energy is very effective solution for power generation than conventional energy resources. Its efficiency is always better. It can be used in remote areas where government is unable to reach, so that the power can be utilized where it generated. This reduces transmission losses and the cost [1]. The system involves two types of power generations i.e solar and wind based power generation systems. Solar Panels and wind generators are used to generate electricity. The battery can be recharged with the two generation inputs. From this energy load can be controlled using inverter design. The battery is connected to the inverter. This inverter is used to convert DC voltage into AC voltage. This AC voltage is used to activate the loads [2]. The energy generated from solar panel and wind turbine is not sufficient because they are not consistent all the time. Depending upon the weather conditions, the system switches either between the battery and solar energy or the wind energy and the battery [3]. The generated should be utilized effectively and wastage of energy should be avoided. This can be achieved using sensors. The light appliances can be controlled using PIR and LDR sensors depending upon presence of human beings and the intensity of light in the room respectively [4].

III. PROPOSED METHOD

The proposed system ensures complete automated switching between the generated energies. The system is depending on the weather conditions, there might be situations where neither of the energies are available, so the system is capable of switching to the AC mains. Usage of

PIR and LDR sensors ensures that the generated energies are utilized effectively. Block diagram for the proposed system is as shown in the figure below. Here the working of the proposed system is discussed.

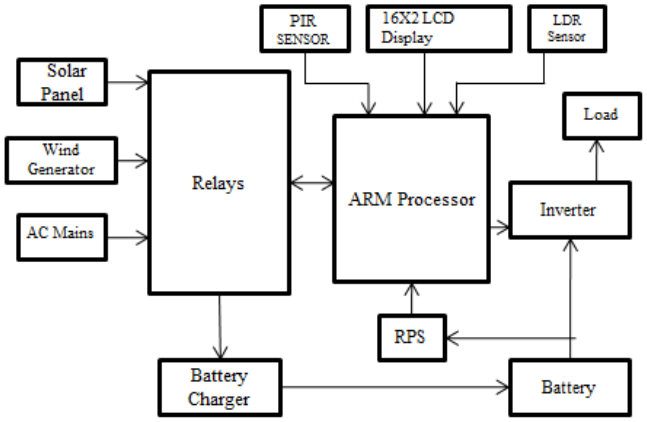

Fig. 1. Block Diagram

A. Solar Panel and Wind Generator

Solar panel is an array of solar cells. Solar cells are made up of semi-conducting materials such as crystalline silicon. Solar cell coverts light energy directly into electrical energy using phenomenon known as photo-voltaic effect. When the light falls on the solar panel then the electrons are excited to generate the electricity.

Wind generator converts kinetic energy of a wind into electrical energy. The electricity is generated when the rotor is moved in between the stator. A permanent magnet DC (PMDC) generator is used to make the wind generator. A PMDC is used to make the wind generator because it provides continuous and constant flux.

B. Battery Charger and Battery

We use buck and boost converter as a battery charger. It is a DC to DC converter in which the output voltage can be increased or decreased with respect to input voltage. Hence it is also called as step up or step down converter. Buck and boost converter is used to bring the input voltage to the desired value to drive the load. A battery is used to store the generated electricity from the renewable sources.

C. Inverter

Inverter is an electronic device or circuit that converts direct current to alternating current. The inverter does not produce any electricity; the electricity is provided by the DC source. The inverter converts the dc power into ac which is stored in the battery received by the renewable energy and it is given to the load.

D. Arm Processor

Processor used here is Arm 9, it is a 32 bit processor and it has Reduced Instruction Set (RISC) Architecture. They are cost efficient compared to other processors and consumes less power. Processor is used to monitor the entire system. The analog inputs from the solar panel and the wind generator are read by the processor and controls the switching operations based on these values through relays. It also reads the analog signals from the PIR and LDR sensors and accordingly controls the switching ON and switching OFF of the load. The arm processor is activated through the regulated power supply (RPS) of 5V.

E. Relays

Relays are electro-mechanical switches. If the energy available from solar and wind are not sufficient then load will be driven from the AC mains, this switching happens through the relays. We use 12V relays for this purpose. If the incoming voltage from solar or wind is below this value then relay will automatically switches to AC mains. After sometime when energy from solar or wind is sufficient enough to drive the load then relay will switch back to renewable energy.

F. PIR and LDR Sensors

The PIR is used to sense the human interference in the room and LDR sensor checks the intensity of light. The LDR sensor is a light dependent resister where the resistance varies with respect to light. The resistance and intensity are inversely proportional to each other. First the presence of human beings in the room is checked, if human beings are present then it checks for the intensity of light. When both the conditions are satisfied then the message “NIGHT” is displayed on the LCD and simultaneously the bulb is switched on. When the intensity of light is sufficient then the message “DAY is displayed on the LCD and the bulb remains off.

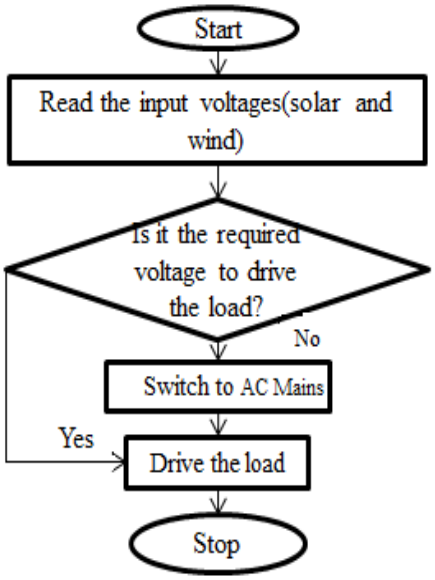

Fig. 2. Flow Chart for Voltage Switching

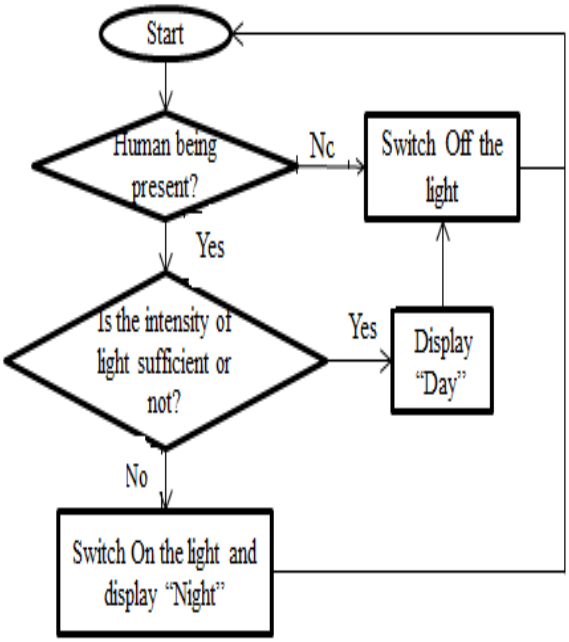

Fig. 3. Flowchart for PIR and LDR sensors

IV. RESULTS

Fig. 4. Proposed System

When the system is ON by giving 5V RPS to ARM processor it will display the message as follows

Fig. 5. The system is ON

Fig. 6. Display when the SW is ON

The SW should be in ON condition for the system to activate. The generated voltage from solar and wind energy is displayed on LCD display.

Fig. 7. Display of mode of switch and intensity of light in room

The SW is ON, system is activated. According to amount of energy produced by renewable energy sources the switching between AC mains and renewable energy sources happens.

Fig. 8. The load (bulb) is ON

According to presence of human being and intensity of light in the room the load (bulb) will glow.

V. CONCLUSION AND FUTUREWORK

Automated hybrid power generation system is designed which switches automatically between the generated energies. Effective utilization of energies is done with the help of the sensors i.e by using PIR and LDR sensors. The system ensures uninterrupted power supply with the help of relays. The system can be further extended to complete home automation using IoT. It can also be further implemented in large buildings and public places.

ACKNOWLEDGMENT

Authors wish to express sincere gratitude to our beloved Principal, Dr. B Sadashive Gowda, Vidyavardhaka College of Engineering, Mysuru. Our sincere thanks to Dr. D J Ravi , Professor and Head, Department of Electronics and Communication Engineering, VVCE. We express our sincere gratitude to our guides, Dr. T P Surekha**,** Professor and Ms. Kavya A P**,** Assistant Professor, Department of Electronics and Communication Engineering, VVCE, Mysuru.

REFERENCES

[1] Soumya Mukherjee, Sougata Jana, Amartya Roy, Swapan Santra "Hybrid Power Generation Model using Wind Energy and Solar Energy". International Journal of Computer Science and Engineering,.Volume-4,Special Issue-6, August 2016.

[2] Ch Ranil Kumar "Hybrid Energy(Wind-Solar) for Rural(Remote Areas) Electrification", International Journal of Engineering Research and Science & Technology,Vol. 6, No.1, February 2017.

[3] Yogesh Diwakar, Ashish Patil , Ashwini Suryawanshi, Amol Dighe, “Home Automation with Hybrid Energy Generation”. IJARIIE-ISSN(O)-2395-4396-2676, Vol-2 Issue-3 2016.

[4] R.Punitha,C.MohanaPriya,C.Mahalakshmi,N.Madhumitha,R.Muthupri yadharshan “Power generation using renewable resources and smart utilization based on embedded system" IJIAREC, Volume-5 Issue-1, 2016.

[5] K.Ramesh. G.Tamizharasi. “Intelligent Hybrid Home Automation System Using Conventional Energy Source”, International Journal of Innovations in Scientific and Engineering Research (IJISER), Vol-1. Issue-2, 2015.

[6] "Efficiency of Nano-antenna comparison with solar panel" http://www.ecogeek.org/content/view/1329 .

[7] N.Sivaramakrishna ,Ch.Kasi Ramakrishna Reddy, "Hybrid Power Generation through combined solar – wind power and modified solar panel", International Journal of Engineering Trends and Technology (IJETT)- Volume 4 Issue 5,May2013.

[8] N.Sivaramakrishna ,Ch.Kasi Ramakrishna Reddy, Hybrid Power Generation through combined solar – wind power and modified solar panel , International Journal of Engineering Trends and Technology (IJETT)- Volume 4 Issue 5,May 2013 .

[9] Ashish S. Ingole, Prof. B. S. Rakhonde, "Hybrid Power Generation System Using Wind Energy and Solar Energy", International Journal of Scientific and Research Publications, Volume 5, Issue 3, March 2015.

[10] Vivek Dixit, J.S.Bhatia, Analysis and Design of a Domestic Solar – Wind Hybrid Energy System for Low Wind Speeds, International Journal of Computer Applications (0975 –8887) Volume72, No.22, June 2013.

[11] Sandeep Kumar, Vijay Kumar Garg “A Hybrid Model Of Solar-Wind Power Generation System” International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 2, Issue 8, August 2013.

[12] Burton T., Sharpe D., Jenkins N., Bossanyi E., “Wind Energy Handbook”, John Wiley & Sons Ltd., England, 2001, pp. 41-170.