

Arduino Based Hybrid Power Generation for Home Illumination by Solar Tracking System and Wind Turbine

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ABSTRACT: Hybrid system involves both wind and solar energy in order to provide electricity supply and a storage system. The optimum design is obtained by performing a cost benefit analysis for each of the individual systems. Main objective is to design a renewable energy supply system for a rural property with a high level of reliability and total independence from the mains grid. Increase in the output power of the system as a whole will be done by integrating the two energy sources as one. In order not to suffer from the consequence of general blackouts the solar and wind energy system designed for dwelling will be independent of the mains. The merit of renewable energy technologies are flexible, modular and can be used in various configurations.

I. INTRODUCTION

Electricity is one of the major and essential part in day today's life. Almost every component needs electricity to run or to operate. Electricity is an inseparable part of every household. The significance of Electricity as that of food and water for people. From harvesting and cooking, everything has electricity embedded within it. It helps to reduce the labor involved to do a task. Thus, it has helped create an unbreakable bond with humans strongly. As the name implies, Hybrid system is a combination of two or more modes of electricity generation. The world is progressing at a fast rate with the use of renewable energy resources. Hybrid systems provide a high level of energy through the combination of different methods. The solar energy and wind energy is a major renewable resource which can be used to produce the electricity in order to fulfill the requirement of household and also industries.

II. OBJECTIVES

To show a complex, interrelated system that is closer to the "real world" than the usual simple systems covered in society. To motivate learning by introducing such elements as environmental and economic concerns. To provide uninterrupted power supply. To increase the output using hybrid system.

III. LITERATURE SURVEY

A number of papers published in IEEE journals are reviewed. The renewable energy generation, dual axis tracking and role of electronics have been discussed in the literatures.

Mr. Mohammed Mustafa [1]: discussed about combination of different but complementary energy generation systems based on renewable energies of mixed is known as hybrid system. For the generation and use of electrical power the hybrid systems are introduced. These hybrid systems are independent of a large, centralized electricity grid. And also incorporate more than one type of power sources. In general a hybrid system might contain (AC) diesel generator, an AC distribution system, a DC distribution system, loads, renewable power sources, energy storage, power converters, rotary converters, coupled diesel system, dump loads, load management option or a supervisory control system.

A review (Elsevier, Volume 13, Issue 8, October 2009) [2] is discussed about the wind and solar energy are omnipresent, freely available, and environmental friendly. The solar energy systems are technically viable than wind energy because of low wind speeds and being more unpredictable. In developing countries these renewable energy technologies are sufficiently promising to include them for rising power generation capability. The renewable hybrid energy system consists of two or more energy sources to produce electricity. It

consist of a power conditioning equipment, a controller and also an optimal energy storage system. In remote area power generation applications, these hybrid energy systems are becoming popular due to advancements in renewable energy technologies. The current state of the design, operation and control requirement of the PV solar-wind hybrid energy systems with conventional backup source will be reviewed. The other future developments which have the potential to increase the economic attractiveness of such systems and their acceptance by the user of such systems.

Ms. Adhiya N N [3] is discussed about recently solar, wind power generation has attracted special interest; the rapid growth of wind power worldwide has resulted in increased media attention and public awareness of wind generation technology. The output of PV module is dc and then it will convert to ac by inverter. The design and construction of an active dual-axis solar tracking system for tracking the movement of the sun to get maximum power from the solar panels are possible and it is inexpensive.

Due to the demand for renewable energy sources applications, there is a continuing research for improving total efficiency of these applications. In the active tracking system; the sun's position during the day is continuously determined by feedback sensors. The sensors will trigger

motor; which will, in turn, cause the movement of the mounting systems so that the solar panels will always be perpendicular to the sun throughout the day. The main drawback of such a system is, it is very sensitive to certain atmospheric conditions. It might not be able to continue tracking the sun on a cloudy day or during rainy season. The most important factors behind the selection of a tracking system is always be the cost.

Monaem Elmnifi [4] is discussed about Photovoltaic (PV) devices produce electricity straight from sunlight via an electronic procedure that happens naturally in certain forms of material, referred to as semiconductors. In these materials, electrons are freed by solar energy and can be included to travel through an electrical circuit, powering electrical devices or sending electricity to the grid. Wind turbines are electrical producers that use the energy and capacity of the wind to generate clean and emission-free power for a home. Once energy is produced by the wind turbine system, the turbine output is well matched with the utility and therefore the output is fed into the home through the circuit breaker. It is realistic to expect that the use of one same type of renewable energy source systems will present short-term and seasonal variations in terms of their energy production. The hybrid method can use in some cases an alternate energy source, mainly a diesel, gas, or wind.

IV. SYSTEM DESIGN

4.1. Methodology

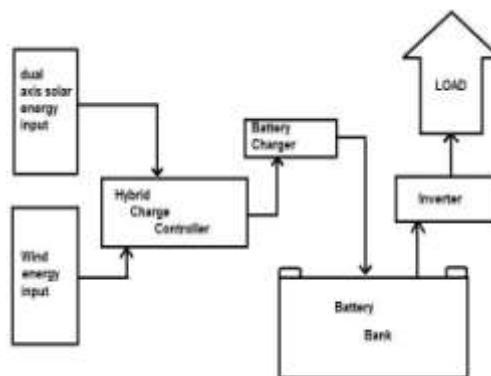


Fig 4.1. Block diagram

The Solar Panel and Solar Tracking system are the two basic components of hybrid power generation. These two parts are connected to the control unit. And this control unit constantly monitors and sends commands to control the functioning of both of them. In this type of combination, the Solar Panel is not only one source for the production of electricity. The Solar Tracking system is also capable of producing electricity. Hence, here two sources side-by-side to produce electricity – which means the effort is less and the production of electricity is more.

4.2. Circuit Diagram

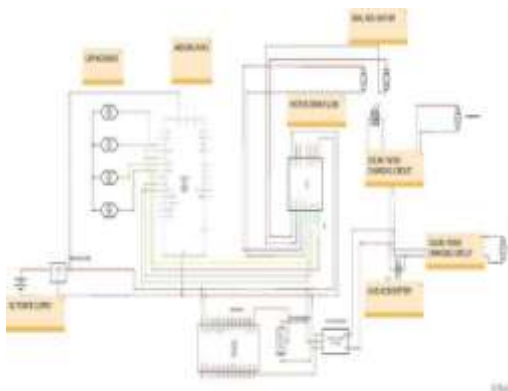


Fig 4.2. Block Diagram

Hybrid means combination of two or more energy systems. In this project solar and wind energy systems are combined to form a hybrid system. In both horizontal and vertical axis the dual axis solar tracker can simultaneously track sun's radiation. The device tracks seasonal variations and daily tilt to achieve maximum efficiency. The work focuses on the design and fabrication of automatic dual axis solar tracker prototype using Arduino code based on microcontroller along with fundamental of solar panel parameter and its use. The performance of the wind power generation unit can be analyzed by the

same procedure carried out for assessing the solar unit. In the first hour, the turbine is made to rotate and generate power and, in the next hour, the battery is made to completely discharge. The values of power generated for each respective hour are noted down by repeating this procedure. The combination of solar power and wind power coming from the solar panels and are stored in the 12V battery. Inverter is a circuitry that converts DC (Direct Current) to AC (Alternating Current). A switch is used to regulate these inverter.

4.3. HARDWARE DESIGN



Fig 4.3.1. Dual axis solar kit



Fig 4.3.2. Vertical and Horizontal axis wind turbine

V. COMPONENT DESCRIPTION

5.1. Solar Panel



Fig.5.1.Solar Panel

A solar panel can be used to generate electricity through photovoltaic effect. It is the collection of solar modules. In this project using dual axis solar tracking system. Which will track

the sun's ray in both horizontal and vertical axis. Solar panels are used to absorb the sun's radiation and convert them to electricity.

5.2. Arduino UNO



Fig 5.2.Arduino UNO

Arduino Uno is a microcontroller board. It is based on 8-bit ATmega328P microcontroller. And also it consists of other components such as crystal oscillator

or, serial communication, voltage regulator, etc. to support the microcontroller for the fast response.

5.3.LDR Module



Fig 5.3. LDR Module

A LDR (Light Dependent Resistor) is also called a photo resistor. Also it is named as cadmium sulfide (CdS) cell. LDR is a photocell, that

will work on the principle of photoconductivity. When the intensity of light decreases the resistance value of passive component (i.e. resistor) decreases.

5.4. Battery



Fig 5.4. Lithium ion battery 3.7V

These batteries are mainly used in portable electronics and electric vehicles. These batteries are popular in military and aerospace applications. The movement of lithium ions when charging and discharging will happen. The ions move from the negative electrode through an electrolyte to the

positive electrode during discharge. Then the ion will move from positive to negative electrode when charging. In diluted sulfuric acid the molecules of the acid split into positive hydrogen ions (H^+) and negative sulphate ions (SO_4^{--}).

5.5. Servo Motor



Fig 5.5. Servo Motor

Servo motors are controlled with a 3-pin input, with two pins being used for power (+ and -) and the third signal used for setting the angle. This signal is a PWM (Pulse Width

Modulation) waveform whose frequency should be approximately 20ms and the duty cycle between 5% and 10% (which represent 0-degrees and 180-degrees, respectively).

5.6. SMPS



Fig 5.6. SMPS

Switching mode power supply (SMPS) will convert wall-voltage AC power to lower voltage DC power. SMPS can be used in any country and could provide stable output of full load. Also SMPS

should function normally under 50Hz to 60Hz frequency as well. Various protection circuits that can be employed in SMPS for safer and reliable operation.

5.7. Charging kit within built inverter



Fig 5.7. Charging kit

The charging kit within built inverter is used to charge the secondary cell and convert it into DC to AC with help of inbuilt inverter.

5.8. Motor Drive L298



Fig 5.8. Motor Drive

In next to solenoids, pneumatics and hydraulics the most commonly used actuator in any electronic device /machine will be motors. These DC machines can be found from a simple vibration

motor inside the mobile phone to complex stepper motors in the CNC machine. The Motor Driver or Motor Controller is used to control a motor using microcontroller or processor.

VI. APPLICATIONS

- Hotels
- Business (Institution and Government)
- Houses and buildings
- Factories and manufacturing facilities
- Commercial power generation street lighting.

VII. ADVANTAGES

- Highly reliable
- High energy output (since both

- are complimentary to each other)
- Cost saving (only one time investment)
- Low maintenance cost
- No pollution, clean and pure energy.
- This system gives quality power output DC to charge the storage battery and then provides AC supply.
- Efficient and easy installation, longer life.
- By this project many villages can be lighted.
- Power cut problems can be avoided.

VIII. OUTCOME



Fig 8. Output

The prototype which includes the vertical wind turbine and the horizontal wind turbine which was capable of producing the voltage of around 5v at the RPM of 60 and also the solar system which has the capability to move the solar panel at the direction of Sun with the tracking system implemented on the prototype. Here the panel produce 6v in summer season. The system monitoring is made simple with the advanced IOT technique using the smart phone application.

CONCLUSION

The hybrid power generation uses a combination of two sources. To continue generating power one source can compensate the absence of the other source. There is less scope for an abrupt halt in power generation. It is very eco-friendly and highly sustainable. This system requires comparatively less investment hence, it is very economical. It can play a very important role in the quest to reduce carbon footprint.

This system is can be used in backward and in rural areas which face severe

shortage of electricity. But these areas have abundant solar and wind energy. Hence it is easy to transport and install this hybrid system in such areas. The working mechanism is not much complicated. Due to solar tracking system the maintenance of maximum irradiance and constant power can be generate. This system can also be installed at top of the buildings so as to meet the minor power requirements at some area.

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Fig 1. Methodology of Smart Healthcare System

Project entitled as smart healthcare system using AI, mainly Used artificial intelligence and machine learning algorithms to develop the system. The user will be alerted every day for a heartbeat check-up by the system app or a smart watch. In case of emergency situation, the application alerts the hospital system about the emergency condition and the hospital will send an ambulance with first aid team to the location and it notifies to a relative also about the situation. The system will have a detailed patient's information such as his sleep record, exercise habits and heartbeat details along with the basic (if new) and updated health record details of patient, these details will be used by doctor/nurse for providing better treatment by saving time and money. Prescription about patient's medicine routine and health condition will be updated to the system such that patient will be reminded about it. Users can contact hospital or request for the disease details through the app.

In this project for the purpose of disease prediction using available data collected from patients we used machine learning algorithm that is K Nearest Neighbour. We have trained the data and then fed the data against the algorithm so that we get more accurate results.

DATASET USED IN KNN ALGORITHM IS:

The dataset has 303 individual's data. There exist 14 columns in the dataset, they are:

1. Age: displays the age of the individual.
2. Sex: displays the gender of the individual in the following way:
 1 = male
 0 = female

3. Chest-pain type: determines and shows the type of chest-pain experienced by the individual considering following format:
 1 = typical angina
 2 = atypical angina
 3 = non — anginal pain
 4 = asymptotic
4. Resting Blood Pressure: shows the resting blood pressure value of a person in mmHg (unit)
5. Serum Cholesterol: determines the serum cholesterol and displays in mg/dl (unit)
6. Fasting Blood Sugar: compares the fasting blood sugar level of an individual with 120mg/dl. If it is greater than 120mg/dl then: 1 (true) else: 0 (false)
7. Resting ECG: shows the resting electrocardiographic results as
 0 = normal
 1 = having ST-T wave abnormality
 2 = left ventricular hypertrophy
8. Max heart rate achieved: displays the maximum heart rate occurred in an individual.
9. Exercise induced angina: this shows as follows:
 1 = yes
 0 = no
10. ST depression induced by exercise relative to rest: shows the value which is an integer or float.
11. Peak exercise ST segment: the values are assigned as follows:
 1 = upsloping
 2 = flat
 3 = down sloping

12. Number of major vessels coloured by fluoroscopy: it determines the value as integer or float.

13. Thal: shows the thalassemia: 3 = normal, 6 = fixed defect and 7 = reversible defect

14. Diagnosis of heart disease: Determines whether the individual is suffering from heart disease or not:

0 = absence

1, 2, 3, 4 = present.

In actual dataset, we had 76 features but for our study, we have chosen only the below 14 because:

1. Age: Age is the most important factor for the cause of heart diseases, with approximately a tripling of risk with each decade of life. Coronary fatty streaks could start to form in adolescence. It is estimated that 82 percent of people who die of heart disease are 65 and above. Simultaneously, after age 55 the risk of stroke doubles every decade.
2. Sex: Men are at greater risk of heart disease than that of women. Once past menopause, it has been argued that a woman's risk is similar to a man's although more recent data from the WHO and Unare against this. If a female has diabetes, she is more likely to develop heart problem than a male with diabetes.
3. Angina (Chest Pain): Angina is chest pain or uncomfotableness caused when the heart muscle doesn't get enough oxygen-rich blood. It mostly feels like the pressure or squeezing in the chest. The discomfort also can occur in human shoulders, arms, neck, jaw, or back. This pain may even feel like indigestion.
4. Resting Blood Pressure: Over time, arteries that feed the heart can be damaged by high blood pressure. High blood pressure will occur with other conditions, such as obesity, high cholesterol or diabetes, increases the risk even more.
5. Serum Cholesterol: Narrow arteries is mostly caused by high level of low-density lipoprotein (LDL) cholesterol. A high level of triglycerides, a type of blood fat related to your diet, also increases the risk of a heart attack. However, a high level of high-density lipoprotein (HDL) cholesterol reduces the risk of a heart attack.
6. Fasting Blood Sugar: Not producing enough of a hormone secreted by your pancreas (insulin) or not responding to insulin properly causes the body's blood sugar levels to increase, which further increases the risk of a heart attack.
7. Resting ECG: For people with low risk of heart disease, the USPSTF summarises as moderate certainty that the potential harms of screening with resting or exercise ECG exceed or maintains the potential benefits. For people with normal to high risk, current resources are insufficient to assess the balance of benefits and harms of screening.
8. Max heart rate achieved: With high blood pressure the increase in cardiovascular risk, associated with the acceleration of heart rate, was comparable to the increase in risk observed. It has been observed that an increase in heart rate by 10 beats per minute is associated with increase in the risk of heart attack by at least 20%, and this increase in the risk is similar to the one observed with an increase in the systolic blood pressure by 10 mm Hg.
9. Exercise induced angina: The discomfort or pain with angina usually feels tight, gripping or squeezing, and can vary from low to high. Angina is usually felt in the centre of your chest but may spread to either or both of the shoulders, or back, neck, jaw or arm. It can even be felt in the hands.
10. Peak exercise ST segment: If there is a horizontal or down sloping ST-segment depression ≥ 1 mm at 60–80 ms after the J point the treadmill ECG stress test is considered abnormal. The duration of ST-segment depression is important, as prolonged recovery after peak stress is consistent with a positive treadmill ECG stress test. Another finding that is highly indicative of significant CAD is the occurrence of ST segment elevation > 1 mm these patients are frequently referred urgently for coronary angiography.

The mobile application shows the basic details required by the user.



IX. SYSTEM REQUIREMENT ANALYSIS AND SPECIFICATION

Software requirements and hardware requirements are given as follows:

- Software Requirements
 - Operating system : windows 10
 - Software : Telegram, PyCharm
 - Languages : Python
- Hardware Requirement
 - Node MCU: For this open-source prototyping board designs are available as it is an open source software. The name is a combination of node and microcontroller. The term "NodeMCU" rather than referring to associated development kits it strictly speaking refers to the firmware.
 - LM 35: A precision Integrated circuit Temperature sensor is LM35, in which the output voltage varies depending on the temperature around it. It is an IC which is used to measure temperature between -55°C to 150°C . It can easily be interfaced with any Microcontroller that has ADC function or any development platform like Arduino. Power the IC by applying a regulated voltage like +5V (V_s) to the input pin and connected the ground pin to the ground of the circuit.
 - Pulse sensor: The change in the volume of a blood vessel that occurs when the heart pumps blood is called pulse wave, and a detector which monitors this change in volume is called a pulse sensor. Electrocardiogram, photoelectric pulse wave, blood pressure measurement, and phonocardiography are four ways to measure heart rate.

- ESP-01: ESP-01 is a less expensive Wi-Fi module which is of small size and consists of TCP/IP stack with a built-in microcontroller. thus, we can bring Wi-Fi capability in our Embedded projects by programming directly in this small chip. It assimilates the antenna switches, Radiofrequency balun, power amplifier, low noise receiver amplifier, and power executive elements and acts as one of the primarily incorporated Wi-Fi chip in the industry. This module allows the microcontroller to connect with a Wi-Fi available.
- Jumper Wires : A jumper is a small metal connector which is used to close or open part of an electrical circuit. It can be used as an alternative to a dual in-line package (DIP) switch. A jumper regulates an electrical circuit board that has two or more connecting points. Jumpers are electrically conducting; these are usually encased in a non-conductive block of plastic . It also avoids the risk that an unshielded jumper will accidentally short out something critical

X. CONCLUSION

The main disadvantage in hospital treatment is that reducing the rate of hospital admission and increasing employee's workload and dissatisfaction. Even though existing smart watch based systems are useful in our life but some time data may be inaccurate thus our system focuses on patient's safety and will have the patients details from a long time and eventually identifies the problem and alerts the hospital in case of emergency situation and ambulance with doctor will be sent to patient immediately. The system

contains patient's health records and data about his medication which helps the patient to know his health in detail using mobile application

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