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DESIGN OF HYBRID SOLAR/ WIND POWER GENERATION AND DISTRIBUTION SYSTEM ON HOMES & ROADWAYS

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ABSTRACT:
In today's world, due to the growing demands of technology and rise in population, there has been a tremendous pressure on the electricity demands. The world needs to find alternative sources of energy. Hence renewable sources are being considered to meet the growing demands of energy. This project proposes a unique standalone hybrid power generation system; applying advanced power control techniques fed by four power sources are wind power, solar power, storage battery and piezo electric plates, and which is not connected to a commercial power system. This electrical power can utilize for various purpose. Generation of electricity will be takes place at affordable cost. This project deals with the generation of electricity with affordable cost without damaging the nature balance.

A microcontroller ensures the optimum utilization of resources and it also increases the efficiency of the combined system as compared to the individual mode of generation. It helps in decreasing the dependence on one single source and makes the system more reliable. The hybrid system can be used for both industrial and domestic applications. And also to develop the Distribution System on Homes and Roadways by extracting the power from the mechanical vibrations through Piezo Electric Plates and the amount of power generated is given for the immediate utilisation of power to street lights ,traffic signals and also to supply the power to urban and sub-urban areas which reduces the need for New Distribution Networks and to reduce the Transportation cost operating cost of power from longer distance.

KEY WORDS:
Solar power, Wind Power, Power Generation

1. INTRODUCTION

In today's technology driven world electricity is one of th e foremost thing for our day to day life activities. As we all are oblivious of the fact that the renewable sources of energy are depleting at a lightning fast rate. So it's time for us to shift the focus from conventional to non-conventional sources of energy to produce electricity. Renewable sources do not have any detrimental effect on the environment. Solar-wind hybrid system is basically an integration of solar plant and a wind energy plant. It will help in providing the uninterrupted power supply. As during bad weather conditions the production can be shifted from one plant to other with the help of a microcontroller. A microcontroller ensures the optimum utilization of resources and it also increases the efficiency of the combined system as compared to the individual mode of generation. It helps in decreasing the dependence on one single source and makes the system more reliable. And also to generate the energy from mechanical vibrations in roadways and give it to direct utilization of power without any need of new distribution

networks. The hybrid system can be used for both industrial and domestic applications.

2. Proposed system

We require electricity for operating almost all the appliances we use in our day to day life. So it has become an indispensable part of our life. Now there are two ways to produce electricity first by using non-renewable sources of energy and second by renewable sources of energy. With increase in population and advancement of technology, consumption of electricity is also increasing exponentially. Simultaneously, we have to increase the production of electricity also in order to meet the demands of growing population. The biggest disadvantage with the usage of conventional resources is that their usage causes pollution due to the production of various pollutants like ash in case of a coal power plant, smoke in case of diesel power plant, radioactive material in case of nuclear power plant. Maintaining these pollutants is not an easy task and it also requires a lot of money.

So we have to find some other methods to produce electricity. The best possible way is by using non-conventional sources of energy. The Aim of this project is **to develop a Hybrid Solar/wind Power Generation to increase the stability, reliability, efficiency , battery life, voltage profile as well as greater balance in energy supply** and Distribution System on Homes & Roadways (HPSHR) towards Energy-Plus roadways, where energy-plus stands for annual energy consumption is less than production.The output hybrid power is not constant and continuous therefore if in case of generation is less than load demand then by managing loads by using micro-controller. A **Microcontroller** is used for managing the loads and automatic power control and smooth - speed operation by detecting the load in accordance with battery input. Here by managing loads we have done optimized use of generated energy. Therefore, efficiency of the system increases. And HPSHR would be a lower footprint, intelligent, and multilayer power system designed for integration into urban and suburban areas, which reduces the need for new distribution networks The HPSHR represents a dramatic change in the role of the public right- of- way from an energy consumer to an energy producer. And therefore, will aid in reducing transportation system operating cost.

3. BLOCK DIAGRAM

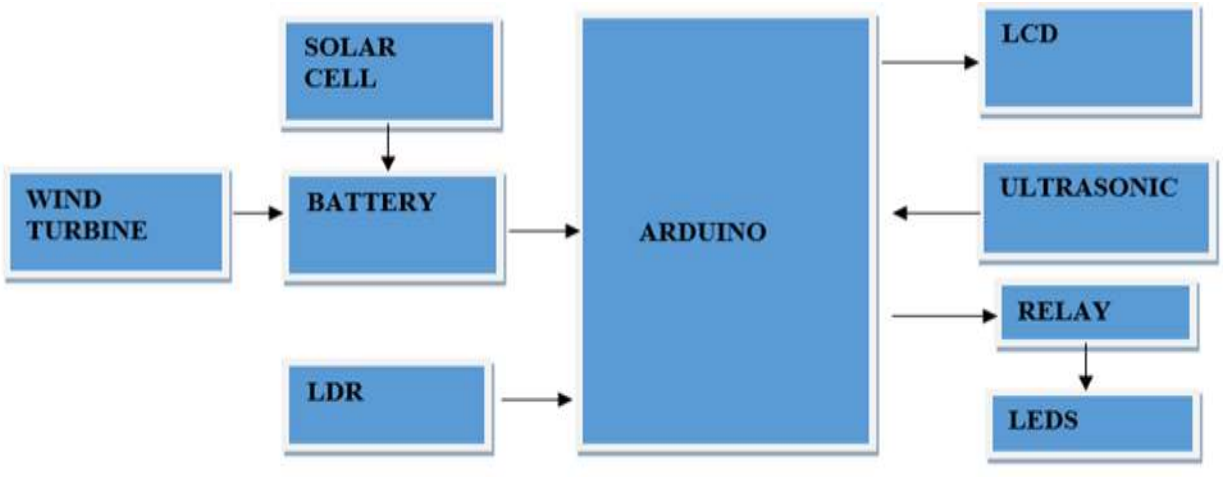

Fig 1: Block Diagram Hybrid Energy Generation using Wind Solar and Piezo

4. IMPLEMENTATION:

Arduino is a prototype platform (open source) based on an easy-to-use hardware and software. It consists of a circuit board, which can be programmed (referred to as a microcontroller) and a ready-made software called Arduino IDE (Integrated Development Environment), which is used to write and upload the computer code to the physical board. Arduino Uno Microcontroller: The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of

which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno differs from all preceding boards in that it does not use the FTDI USBto-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means "One" in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5Vpin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts
to 12 volts The power pins are as follows:·
VIN. The input voltage to the Arduino board when it's using an external power source (as opposed to5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.·
5V. The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.
3.3V.A 3.3volt supply generated by the on board regulator. Maximum current draw is 50 mA.
GND. Ground pins.
Memory: The Atmega328 has 32 KB of flash memory for storing code (of which 0,5 KB is used for the boot loader); It has also 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).
Input and Output: Each of the 14 digital pins on the Uno can be used as an input or output, using pin Mode (), digital Write (), and digital Read () functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 k Ohms. In addition, some pins have specialized functions:
• **Serial**: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.
• **External Interrupts**: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attach Interrupt () function for details.
• **PWM**: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analog Write () function.
• **SPI**: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which although provided by the underlying hardware, is not currently included in the Arduino language
LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED ison, when the pin is LOW, it's off. The Uno has 6 analog inputs, each of which provides 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analog Reference () function. Additionally, some pins have specialized. functionality: • I2C: 4 (SDA) and 5 (SCL). Support I2C (TWI) communication using the Wire library. There are a couple of other pins on the board: • AREF. Reference voltage for the analog inputs. Used with analog Reference(). • Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to shields which block the one

on the board.

4.1 ARDUINO UNO BOARD:

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

Fig 2: ARDUINO UNO

1.USB Interface: Arduino board can be powered by using the USB cable from your computer. All you need to do is connect the USB cable to the USB connection

2.External power supply: Arduino boards can be powered directly from the AC mains power supply by connecting it to the power supply (Barrel Jack)

3.Voltage Regulator: The function of the voltage regulator is to control the voltage given to the Arduino board and stabilize the DC voltages used by the processor and other elements.

4.Crystal Oscillator: The crystal oscillator helps Arduino in dealing with time issues. How does Arduino calculate time? The answer is, by using the crystal oscillator. The number printed on top of the Arduino crystal is 16.000H9H. It tells us that the frequency is 16,000,000 Hertz or 16 MHz.

5,17.Arduino Reset: It can reset your Arduino board, i.e., start your program from the beginning. It can reset the UNO board in two ways. First, by using the reset button (17) on the board. Second, you can connect an external reset button to the Arduino pin labeled RESET (5). **6-9.Pins (3.3, 5, GND, Vin):**

- 3.3V (6): Supply 3.3 output volt
- 5V (7): Supply 5 output volt
- Most of the components used with Arduino board works fine with 3.3 volt and 5 volt.
- GND (8)(Ground): There are several GND pins on the Arduino, any of which can be used to ground your circuit.
- Vin (9): This pin also can be used to power the Arduino board from an external power source, like AC mains power supply.

10.Analog pins: The Arduino UNO board has five analog input pins A0 through A5. These pins can read the signal from an analog sensor like the humidity sensor or temperature sensor and convert it into a digital value that can be read by the microprocessor.

11.Main microcontroller: Each Arduino board has its own microcontroller (11). You can assume it as the brain of your board. The main IC (integrated circuit) on the Arduino is slightly different from board to board. The microcontrollers are usually of the ATMEL Company. You must know what IC your board has before loading up a new program from the Arduino IDE. This information is available on the top of the IC. For more details about the IC construction and functions, you can refer to the data sheet. Tthe Atmega8U2 programmed as a USB-to-serial converter. "Uno" means "One" in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

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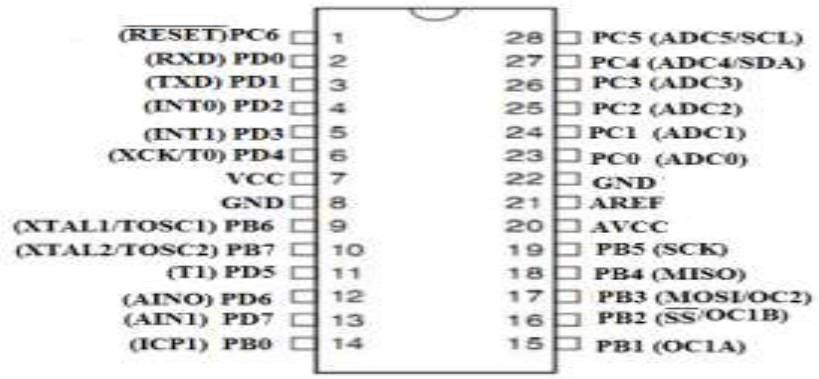

Fig 3 : Pin Diagram

Pin Description:

VCC: Digital supply voltage.

GND: Ground. Port B (PB[7:0])

4.2 XTAL1/XTAL2/TOSC1/TOSC2:

Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running. Depending on the clock selection fuse settings, PB6 can be used as input to the inverting Oscillator amplifier and input to the internal clock operating circuit. Depending on the clock selection fuse settings, PB7 can be used as output from the inverting Oscillator amplifier. If the Internal Calibrated RC Oscillator is used as chip clock source, PB[7:6] is used as TOSC[2:1] input for the Asynchronous Timer/Counter2 if the AS2 bit in ASSR is set.

Port C (PC [5:0]):

Port C is a 7-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The PC [5:0] output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running. This is the model of solar-wind hybrid system; the power developed by the system is transferred to the load as shown in the figure. The output voltage and current of solar panel, wind turbine, batteries and load are measured very precisely and then the final results are calculated. Amount of power produced and consumed are measured.

5. RESULTS

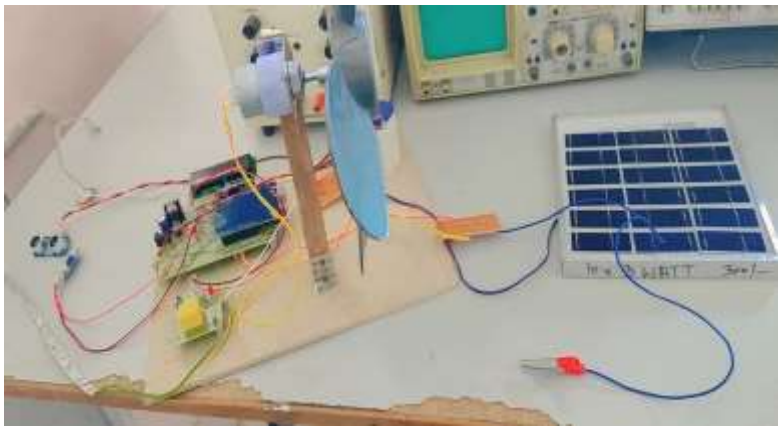

Fig 4: The above figure shows the top view of the hardware prototype belongs to HYBRID POWER GENERATION USING SOLAR, WIND, PIEZO.

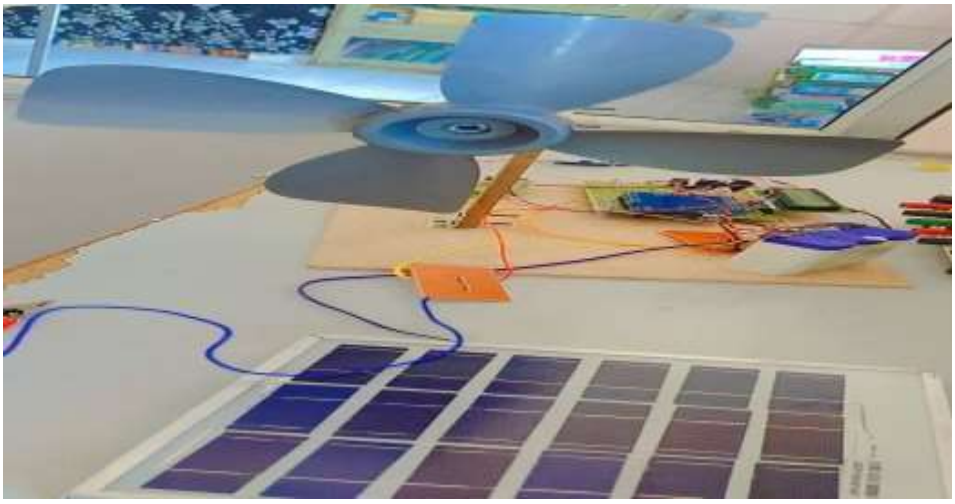

Fig 5 : The figure shows the hybrid power developed by the system is transferred to the load. The output voltage and current of solar panel, wind turbine, batteries and load are measured very precisely and then the final results are calculated.

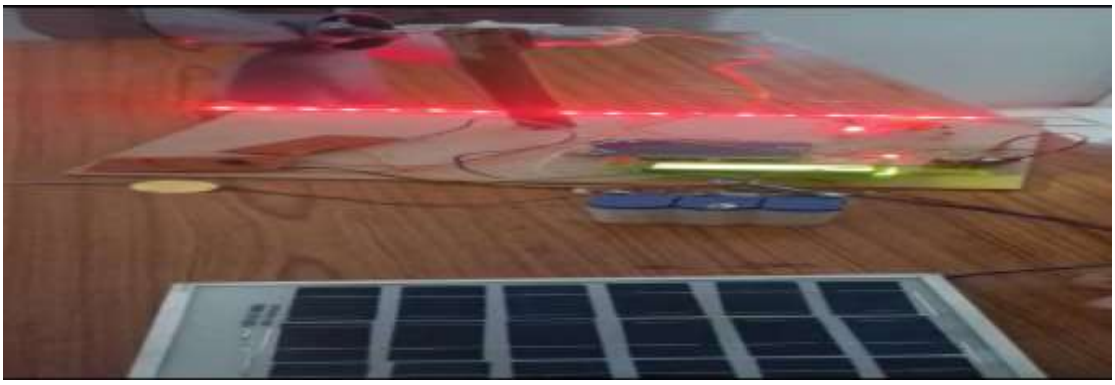

Fig 6 : OUTPUT

6. CONCLUSION AND FUTURESCOPE

Developing hybrid systems is one of the most convenient and effective solution for producing electricity as compared to non-renewable energy resources. It is not only less costly but also it does not cause any harm to the environment. Another thing is that it can be used to generate electricity in hilly areas, where it is quite difficult to transmit electricity by conventional methods. Depending on the requirement its setup can be decided. All the people in this world should be motivated to use non-conventional resources to produce electricity in order to make them self-reliable to some extent. Long life span, less maintenance is some of its plus point. It just requires some high initial investment. But the cost will be cover up in the operation process.

As the awareness of non-renewable sources and pollution causes by them, the clean energy production with renewable sources is widely preferred and day by day implementation of such sources going on, so, research and resources are also increasing for such plants and projects. As, the first time installation cost is higher due to design and manufacturing perspective. But that cost will be cover up by the effective performance of this hybrid system. Also, by using advanced technologies like Machine Learning, and IOT devices and by using the high capacity energy storage batteries we can still improve the overall efficiency and reliability of the system in future. The system can be monitories using graphical user interference on computer. So, the whole information will be available to user and/or stored regarding further applications and development.

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