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Arduino Technique for Renewable Energy System

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Abstract: The multi power system is one of the developing fields in the electronics. The main problem in this is the switching between the various power sources. This concept is already achieved with the help of fuzzy network and it is designed with the matlab simulation software. The main drawback of this was that the time taken was greater and the power loss was also high. The one method to overcome is by using the modern technology. The one such type is the use of Arduino. The Arduino is a multipurpose device. The main advantage of using this is the multiple input and output. The Arduino is capable of processing multiple tasks in quick period of time. In this project the switch over is done with the help of Arduino. The program is designed in such a way that the renewable energy is used first and the main power source is used when the scarcity of renewable power occurs. It is also designed in such a way that the source gets altered based upon the load we are using in it.

I. Introduction

The increase in the world population also increased the uses of renewable energy. The modern trend of living has made non-renewable resources unavailable. The most commonly used type renewable energy is wind and solar. This allows the renewable energy will be emerging technology.

The selection process between the available renewable sources is very important because it affects the economy of the systems.

The selection between renewable energy sources is already done with the help of PLC along with the computer program [6]. The programming is done with the help of ladder logic. The way of selection is also done with the fuzzy control. The fuzzy control logic is done with the help of MATLAB program [7]. The system must ensure the continuity in power supply. There are many different methodologies that can be enabled.

The method used here is with the help of Arduino controller. Here it is used to switch between the different power sources. The approach for the renewable energy sources is studied in various concepts [3]. This method of using Arduino is a new technology that is being developed. The main aim of using this is to get a maximum power point tracking. It is ensured that maximum power is delivered. The method is conventional method of using hybrid energy system. Otherwise in this paper we can control the solar wind hybrid system with the help of Arduino. This enables easy to know exactly the values at any operating condition.

II. About The Arduino

The one of the easy and open source of using software and hardware is by Arduino. By using Arduino boards we are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and convert to output - activating a motor, turning on an LED, publishing something online[2]. It's become very easy way to communicate with board by sending a set of instructions to the microcontroller on the board. To do so you use hardware program in Arduino (based on Wiring), and the Arduino Software (IDE), based on Processing.

Arduino/Genuino Uno is a type of microcontroller board based on the ATmega328P (datasheet). It contain 14 digital input/output pins (of which 6pins are PWM outputs pins), 6 analog inputs, a power jack, a 16 MHz quartz crystal, an ICSP header and reset button, a USB connection[2]. It has everything that are required to support the microcontroller; It should be connected to computer using USB cable or power supplied using AC-to-DC adapter or power storage battery to get operated. You can also alter with your UNO without worrying about it and doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

In Italian "UNO" is known as one and it is selected to mark the release of Arduino Software (IDE) 1.0[2]. The Uno board and version 1.0 of the Arduino Software (IDE) were the reference version of Arduino.

The Uno board is the first used series of USB Arduino boards, and the reference model for the Arduino platform; and an list of current, past or outdated boards see on the Arduino index of boards. The Arduino Software (IDE) allows you to write programs and upload them

1. By using reliable Internet connection, you should use online IDE (Arduino Web Editor). It will allow you to save your model in the cloud, having them available for other devices and backed up. You should always have the most up-to-date version of the IDE without the need to install updates.

2. To work offline you must use the latest version of the desktop IDE.

There are many types of microcontrollers and their platforms are available for physical computation. MIT's Handyboard, Netmedia's BX-24, Phidgets Parallax Basic Stamp, and many others same functionality [2]. All of these tools uses the messy details of microcontroller programming and wrap it up in an easy way of using those package. Arduino also reduces the process of working with microcontrollers, but it provides advantage for teachers, students, and interested amateurs on other systems.

pins 1 (TX) and 0 (RX) Used to receive (RX) TTL serial data and transmit (TX) TTL serial data. The pins are connected to the corresponding pin of the ATmega8U2 USB-to-TTL Serial chip [2]. Pins 2 and 3. These pins is used to trigger an interrupt to a low value, a change in value or a rising, or falling edge See the attach Interrupt() function for details[2]. 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() functions. The 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pin supports SPI communication using the SPI libraries. Reference voltage for the analog inputs. Used with analogReference(). A4 or SDA pin and A5 or SCL pin. Support TWI communication using the Wire library[2].

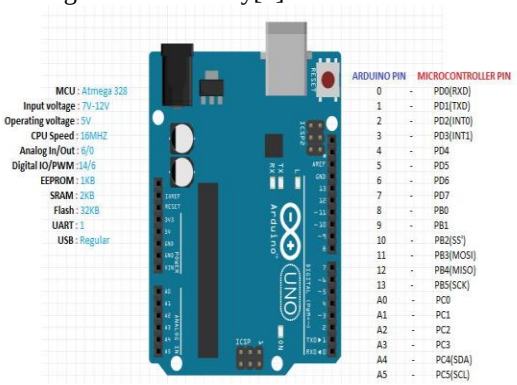

Fig 1:diagram for Arduino board.

III. Architecture of Arduino

Harvard architecture were used in the processor of Arduino board where the program code and program data have separate memory.

It consists of two memories such as program memory and data memory. Whereas in data memory data is stored and the code is stored in the flash program memory. The Atmega328 microcontroller has 32kb of flash memory, 2kb of SRAM 1kb of EPROM and operates with a 16MHz clock speed. The architecture of Arduino is shown in figure 3.

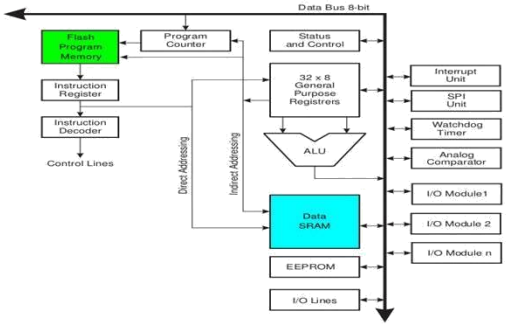

Fig 2. Architecture of Arduino

IV. Advantages of Arduino Technology:

It is cheap. It is an open supply hardware feature that permits users to develop own kit. The software is well-suited with all kinds of in operation systems like Windows, Macintosh and Linux, etc. It also comes with the open supply system feature that permits the software system developers to use Arduino code and merge with the prevailing programing language and can be extended and altered. For beginners, it is very easy to use.

V. Working of relays

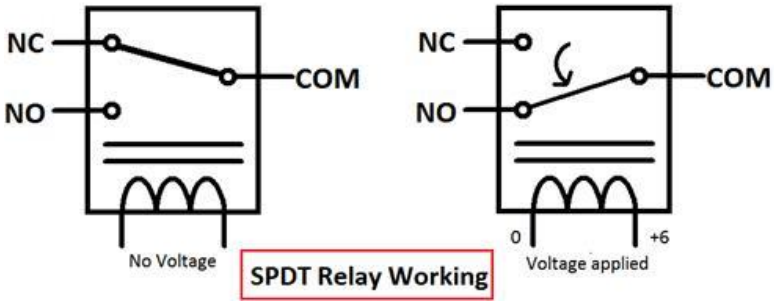

Fig 3. Relay circuit

A relay is a electromagnetic switch which has to be operated by a small electric current that can turn on and off a larger electric current. The heart of a relay is an electromagnet coil. We can think of a relay as a kind of electrical lever: switch it on and off which has a tiny current and it switches on another appliance using a much big current.

But often it is required to drive bigger pieces of apparatus that uses bigger currents. Relays bridge the gaps, making it possible for small currents to activate larger one. That means relays can work either as a switches or as amplifiers.

When power flows through the circuit, it activates the electromagnet, generating a magnetic fields that attracts the contact and activate the second circuit. When the power is turned off, a spring pulls the contact back to the original position, switching the second circuit off again. This is an good example for the "normally open" (NO) relays: by default the contact in the second circuit are not connected, and switches on only when a current flows through the magnet. Other relays are always "normally closed" (NC) the contacts are connected such that the current flows through them by default) and switches off only when the magnet is activated, by pulling or pushing the contacts apart. Normally open relays are the most commonly used type. It's essentially the same thing drawn in a light different ways. On the left side, there is an input circuit powered by a switches or an sensor of any kind. When this circuit gets activated, it feeds current to an electromagnet which pulls a metallic switch closed and activates the second and output circuit.

The relatively small current in the input circuit thus activate the larger current on the output circuit: The input circuit (black loop) is switching off and no current flow through it until something (either a sensor or a switch closing) turn it on. The output circuit (blue loop) is also switched off. When a small current flow in the input circuit, it activates the electromagnet, which produces a magnetic field all around it. The energized electromagnet pulls the bar in the output circuit towards it, closing the switch and allowing a much bigger current to flow through the output circuit.

VI. System Design And Implementation

The system is designed in such a way that it is very compact. The structure of proposed System is indicated in figure 4. The structure includes two main components: Arduino, Relay. Arduino is a development board and it is an important part which controls the entire system. The input to the system is both the solar and the wind energy where they are renewable sources of energy.The relay is also one of the important part of the system which is used to control the entire system.

fig.4Block Diagram of the proposed system

VII. Simulations

Case1-wind energy:

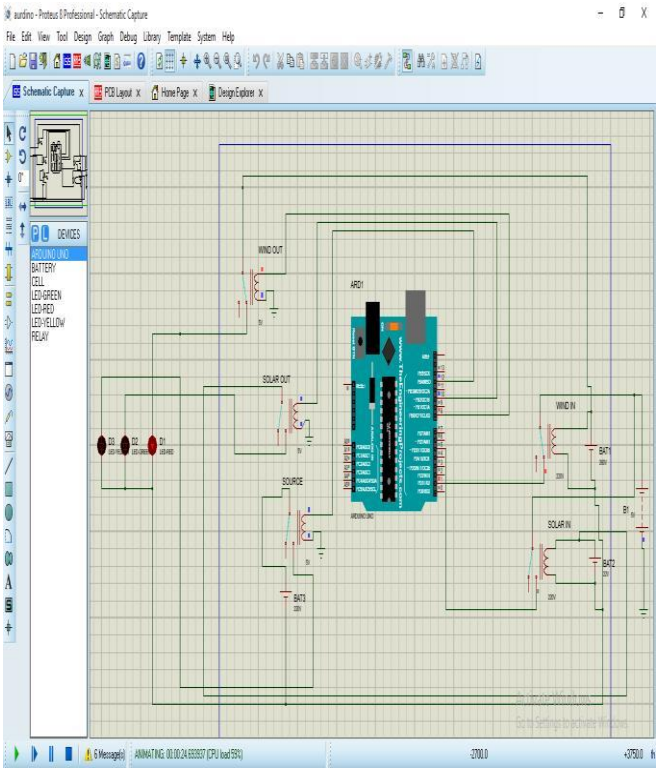

Fig 5. Case 1 simulation

The first case is when the required voltage is obtained from the wind energy, and then the input is voltage is given to the relay through which the input to the Arduino is given [8]. When the relay is actuated then the corresponding output is given from the Arduino. The Arduino then actuates a relay which is connected to another pin of the Arduino [8]. The Arduino thus ensures the continuity in the power supply.

Case 2-solar energy:

The second case is when the power supply from the wind energy fails or not up to the required level, then the next relay which is connected to the solar energy is checked [1]. The second input to the Arduino is through a relay which has the solar power as its input. Now the Arduino checks for the required voltage level and then it gives the corresponding output to another relay, such that the solar energy is given to the load. Thus ensuring the continuity in the source provided to the load [1].

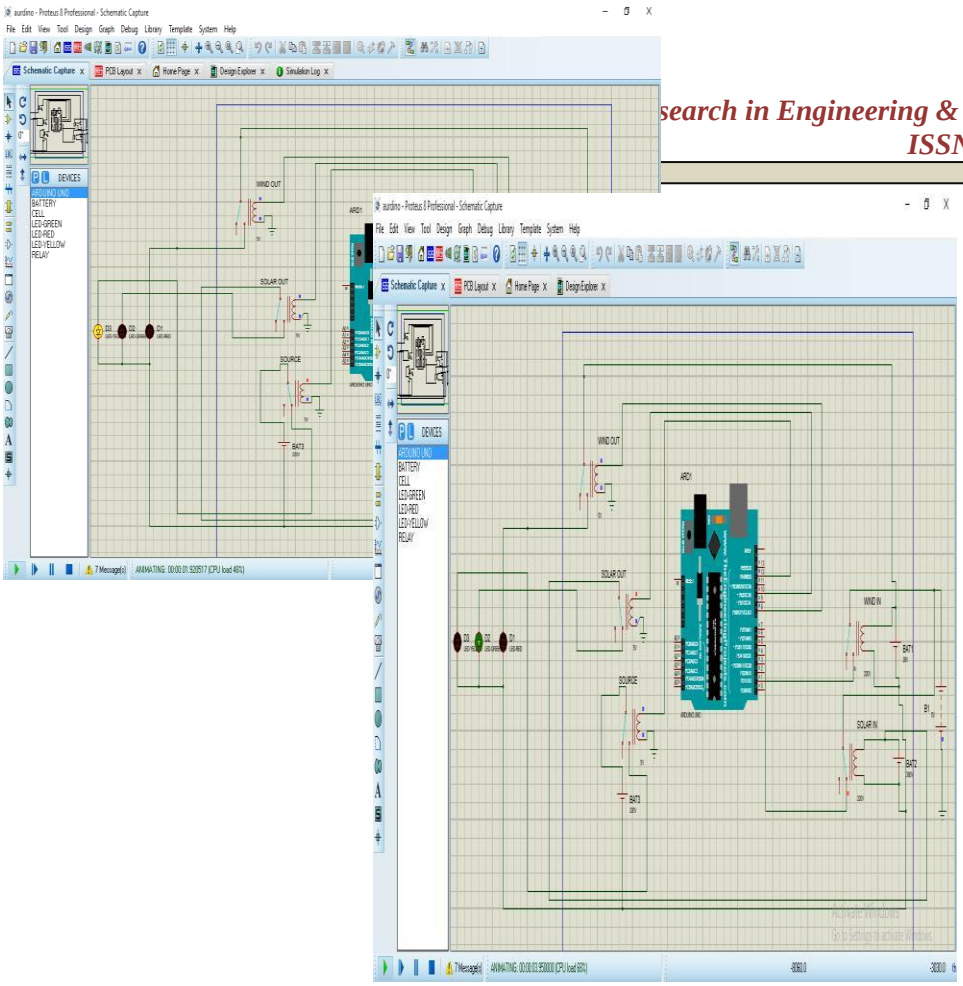

Fig 6. Case 2 simulation

Case3-power source:

The last case is that when both the renewable energy sources are unavailable to the load [5]. At that time the relay for non-renewable source gets activated and the supply is given to the load. In this way the Arduino is programmed to work [3]. The priority is first given to the wind energy and then followed by the solar energy. The last priority is given to the non-renewable source(i.e) when the renewable sources are not available.

FUZZY SYSTEM	ARDUINO
✓ In fuzzy the operation is done in multistage.	✓ In this the operation is done in a single step.
✓ The chance for occurrence of overlap is very high.	✓ The overlap problem is eliminated completely
✓ The time for quick change over is high when compared to other systems.	✓ The time for change over is minimized.
✓ It has more computation process involved. ➢ Fuzzification ➢ Fuzzy operator ➢ Defuzzification	✓ The computation is very simple.

Fig 7. Case 3 simulation

VIII. Comparison between fuzzy system and Arduino:

Conclusion

A multi renewable power source system is proposed and described in this paper based on Arduino controller. This Arduino is used to find the power sources for the load to operate by using the different renewable sources(solar and wind) or battery backup, depending on the power source available. The system has been proposed for three different sources in order to reduce the complexity and to handle uncertainty in the supply. This also has a very good scope in the future.

IX. References

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