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Automatic Grid Switch Control between Two Electrical Sources

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Abstract: This paper describes about the grid switch control system. The aim of the project is to provide a facility by which we can control the two power sources in the power grid. The purpose of the project is to provide a flexible system by which we can control the two DC power sources. Now days, there is a lot of requirements to control the appliances in an industry or in a home connected to the power grid when we are working. The main aim of the present project is to provide a facility by which we can control the DC power sources connected to the power grid. The only thing is we need to switch the button for a control board to the power control section. The control board which is attached to the power grid control section in the industry. This receives the commands to the microcontroller whenever there is a power cut from the main source. The microcontroller plays a major role in receiving the commands from the main source module and to switch from a Main DC source or from a Battery DC source which is fed to thee DC generator (Wind energy). The particular source is switched according to the command. Here in this project a power grid is connected to motor control unit. The project implements the design of a system by which we can control the power grid of two DC sources.
Keywords: Arduino uno, DC Generator, Grid, Battery.

I. NTRODUCTION

The conventional electrical systems are dominated by AC power. The reason for the success of AC (Alternating Current) over DC (Direct Current) was the invention of the transformer, which can easily convert power from the transmission to distribution systems at different voltage levels. An advantage of DC over AC has been recognized for long-distance power transmission because high-voltage DC lines suffer from lower electrical losses and provide better control of power flows. However, the advantages that AC systems used to have are no longer applicable, as DC/DC converters can also step up or step down the voltage efficiently. Therefore, nowadays, DC systems are more efficient and economical-wise than they were before. So, the DC micro grid is the most logical solution for nowadays trends in every aspect of the present electricity system model. It is quite apparent that native DC loads are growing. Electronics are everywhere, compact fluorescent and LED lamps are ubiquitous, and also, many emerging technologies, such as variable frequency drives (VFDs) that use DC are becoming commonplace. This trend is so clearly not only because of the attractive capabilities, efficiency, and reliability of these devices but also because public policies motivated by energy efficiency and related goals are reinforcing the trend. Likewise, also stimulated by subsidies, the deployment of PV, a DC source especially amenable to building scale systems close to loads, continues to grow exponentially.

There is about 10% energy lost in power conversions in a conventional AC system. A double inversion from DC to AC at the system end and then from AC to DC at the load end in a conventional solar system can only cause unnecessary complexity and energy loss [5]. The rising demand for implementing renewable energy resources is bringing back DC into the energy distribution frame. DC grid is more accessible in integrating renewable sources into the grid in such case. Most loads at the utilization terminal these days are DC. So, many types of exploration have been going on DC systems and their prospective utilization in building applications. DC power grids offer more efficient electricity distribution with less conductor material compared with AC grids.

Hence, DC grids offer both cost reduction and sustainability features. There are many research and application about hybrid DC/AC microgrid which is a more viable option than the full DC microgrid. However, there will be more complexity in control of the conversion. On the other hand, in implementing DC microgrid, the existing devices in building such as heating, ventilation, and air conditioning (HVAC), lighting, power socket, etc, still have conventional AC socket and utilizing AC/DC conversion included in the devices. In the DC microgrid improves the percentage of wind energy that performs useful work to approximately 97% from a baseline value of 90%. The DC microgrid supply loads with less energy loss in conversions, significantly increasing energy efficiency compared to a traditional AC system. However, this paper will discuss the overview of a full-DC microgrid in building its advantages, attraction, and challenges

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II. LITERATURE SURVEY

Many research works on designing the controllers for the control of inverters in a microgrid during grid-connected and islanded operations is conducted by researchers. A commonly adopted control scheme which is detailed contains an inner voltage and current loop and an external power loop to regulate the output voltage and the power flow of the inverters. In a control scheme which uses separate controllers for the inverters during grid-connected and islanded operations is proposed. Design technique for a class of gain-scheduling adaptive controllers for variable-speed constant-frequency (VSCF) wind generator systems using induction generators with an AC/DC/AC rotor link is presented by Ghandakly and Sbeiti.

Ciobotaru et al. discussed the issue of control strategies for single-stage photovoltaic (PV) inverter is addressed. Two different current controllers have been implemented and an experimental comparison between them has been made. A complete control structure for the single-phase PV system is also presented. Smooth mode transfers and accurate current sharing are performed in a multi-inverter-based microgrid system by the designed system level controls with control area network communication proposed by Chen and Wang.

III. BLOCK DIAGRAM

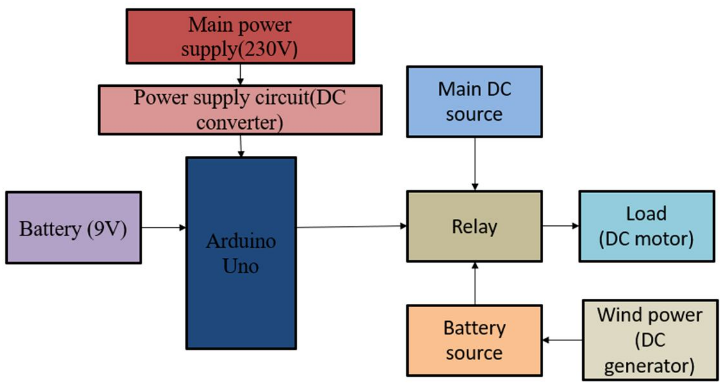

Fig 1: Block Diagram

IV. HARDWARE REQUIREMENTS

A. Arduino UNO

Overview 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 16MHz 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. The Uno differs from all preceding boards in that it does not use the FTDI USB to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to serial converter. DFU mode.

B. Battery

A rechargeable battery, storage battery, or accumulator is a type of electrical battery. It comprises one or more electrochemical cells, and is a type of energy accumulator. It is known as a secondary cell because its electrochemical reactions are electrically reversible. Rechargeable batteries come in many different shapes and sizes, ranging from button cells to megawatt systems connected to stabilize an electrical distribution network. Several different combinations of chemicals are commonly used, including: lead– acid, nickel cadmium (NiCd), nickel metal hydride (NiMH), lithium ion (Li-ion), and Lithium-ion polymer (Li-ion polymer). Rechargeable batteries have lower total cost of use and environmental impact than disposable batteries.

C. Relay

A relay is an electromechanical switch, which perform ON and OFF operations without any human interaction. General representation of double contact relay is shown in fig. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal.

D. DC Motor
A DC motor is an electric motor that runs on direct current (DC) electricity. In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

E. Step Down Transformer
Usually, DC voltages are required to operate various electronic equipment and these voltages are 5V, 9V or 12V. But these voltages cannot be obtained directly. Thus, the a.c input available at the mains supply i.e., 230V is to be brought down to the required voltage level. This is done by a transformer. Thus, a step-down transformer is employed to decrease the voltage to a required level.

F. Voltage Regulator
Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustably set voltage. The regulators can be selected for operation with load currents from hundreds of milli amperes to tens of amperes, corresponding to power ratings from milli watts to tens of watts.
A fixed three-terminal voltage regulator has an unregulated dc input voltage, Vi, applied to one input terminal, a regulated dc output voltage, Vo, from a second terminal, with the third terminal connected to ground.

G. Rectifier
There are several ways of connecting diodes to make a rectifier to convert AC to DC. The bridge rectifier is the most important and it produces full-wave varying DC. A full-wave rectifier can also be made from just two diodes if a center-tap transformer is used, but this method is rarely used now that diodes are cheaper. A single diode can be used as a rectifier but it only uses the positive (+) parts of the AC wave to produce half-wave varying DC.

H. Memory
The ATmega328 has 32 KB (with 0.5 KB used for the boot loader). It also has 2 KB of SRAM and 1 KB of EEPROM.

V. SOFTWARE REQUIRED

A. Arduino IDE
The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++. It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards.

B. C++ Programing Language
C++ is a powerful general-purpose programming language. It can be used to develop operating systems, browsers, games, and so on. C++ supports different ways of programming like procedural, object-oriented, functional, and so on. This makes C++ powerful as well as flexible.

VI. FLOW CHART

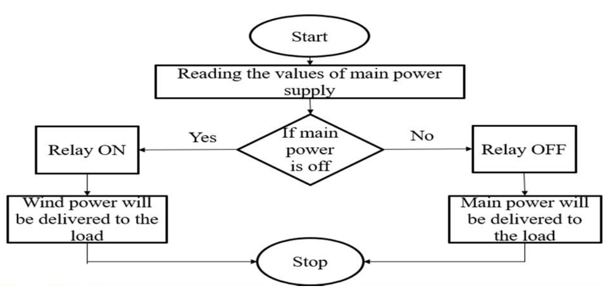

Fig 2: Algorithm

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VII. RESULT AND DISCUSSION

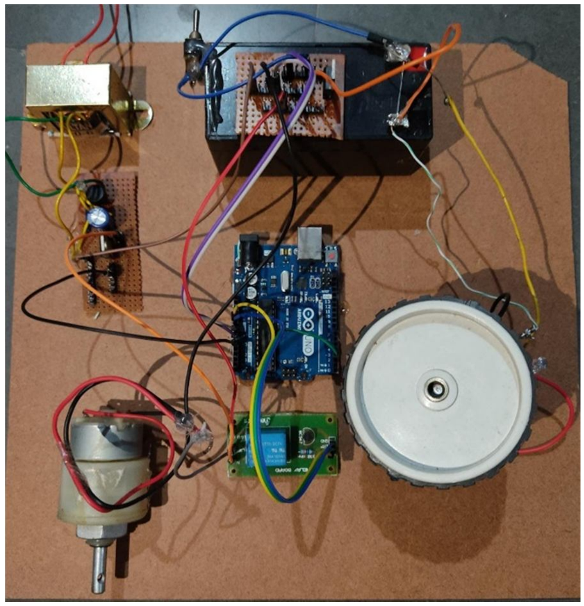

Fig 3: Project Kit

VIII. CONCLUSION AND FUTURE WORK

The Automatic grid switch enables wind system and owners to be powered by the Mains (UMEME) for a specific amount of time. This system requires the following in order to be effective It is based on the “Open transition” operation. The Open transition refers to breaking the connection of the primary source before connecting to the secondary. Therefore, a time-delay is involved in this operation. For this project, a delay of 300ms. By adding IOT to this system, it can be monitored and gets notifications.

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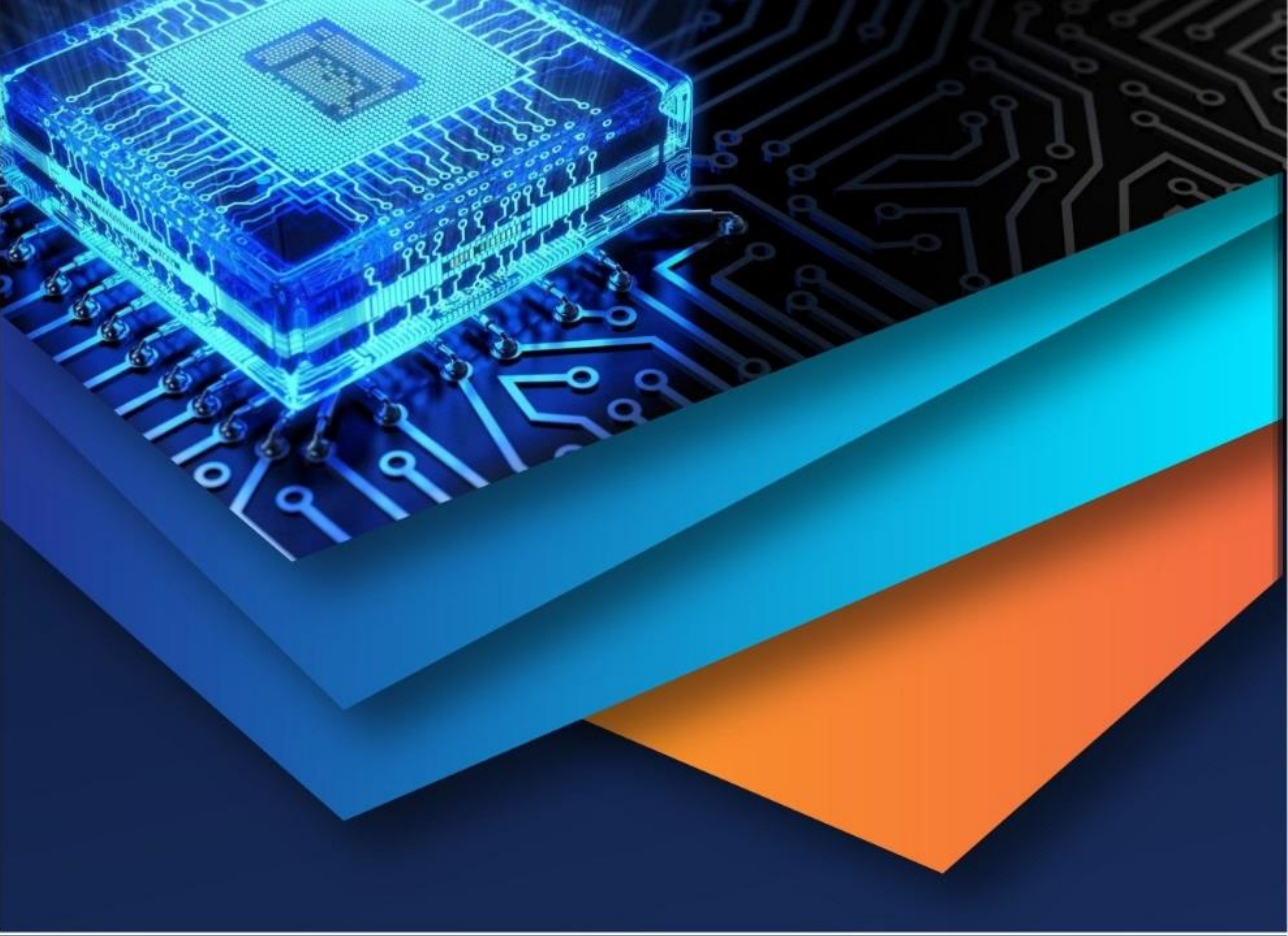

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