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Design and Implementation of Power Grid Synchronization Monitoring System

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ABSTRACT- At the end, a simple simulation case is studied to better understand the overall performance of the system under network failure conditions. This work has shown that the microgrid architecture is a viable solution for including distributed generation in the power system. This implementation concludes that it is possible to have an electrical grid system that is smarter, more efficient and more efficient in its operation, thus proving to be more economical compared to current installations. The challenge is continuous and uninterrupted transmission which can be very well achieved by the implementation described in this article and apart from continuous transmission several other parameters i.e. passive parameters are regularly monitored and any discrepancies found in them are taken into account. And worked on accordingly, making the management and recovery process convenient and efficient. This system is cheaper compared to other systems.

I.INTRODUCTION

In India we have five national grids, Western grid, Eastern grid, Northeast grid, Southern grid, Northern grid. North grid, east grid, northeast grid, west grid are synchronized with each other and south grid is asynchronous. Modern society is so dependent on the use of electricity that it has become an integral part of our lives. Several new trends have already taken hold in the electricity infrastructure. It includes the expansion of the existing network with micro grids and mega grids, large-scale sensors, data processing, visualization tools, etc. To synchronize all power plants with the state and national power grid, we have chosen three parameters of voltage, frequency and phase angle between voltage and current, if there is a violation of any of these parameters due to any abnormality or fault, the plant will not be able to meet all three conditions for synchronization, so it will synchronize with the grid and its called ISLANDING situation. Islanding occurs when one or more sources continue to supply power to a part of the network that is disconnected from the main distribution system. Islanding situations can damage the network itself or the devices connected to the network and can even compromise the safety of the maintenance personnel operating the network. Therefore, according to the IEEE1547 standard, islanding should be identified and disconnected within 2 seconds. Several different methods are used to detect islands.

II. OBJECTIVE

The aim of this project is to detect synchronization failures in the power grid. This is a demonstration designed to provide the kind of system that could detect a power grid synchronous failure if any external power source supplying the grid encounters any abnormalities in terms of frequency and voltage levels. This grid synchronization failure detection system at a sensing frequency outside the acceptable range could be used in power plants where different power supplies are connected in parallel to meet the power demand.

III. LITERATURE REVIEW

Proposed an island detection methodology about PV grid-connected power generation system because PV grid-connected power generation system is rapidly developed and used due to cleaning, renewable and wide

distribution of solar energy. This paper addresses the islanding detection problem posed by a grid-connected photovoltaic generation system. First, it analyzes the cause and potential danger of grid islanding and presents the existing method of detection and detection of islanding [1] the idea Detection of power grid synchronization failure by sensing bad voltage or frequency documentation in which it is described in the modern power system Electric power from the generating station is delivered to the final consumers through a vast network of transmission and distribution. There are several grid connected power generation units like hydro, thermal, solar, wind etc. which supply power to the load. For the satisfactory operation of the loads, it is therefore desirable that the appliances are supplied with essentially constant voltage and frequency. [2] generated a Grid Synchronization Failure Detection and Protection system in which they gave an idea, at any deviation from the grid acceptable range limit, it is mandatory for some feeder to automatically disconnect from the grid, which is called islanding, these prevent a large-scale outage or network outage, so it is preferable to have a system that can warn the network in advance so that alternative arrangements are kept in readiness to prevent total network failure.[3] the idea of detecting the failure of the mains synchronization at a sampling frequency or voltage outside the acceptable range. There are several grid connected power generation units such as tidal, thermal, solar etc. that supply power to the load. These generating units must supply energy according to the grid rules. These rules include keeping voltage fluctuations within limits as well as frequency. If there is any deviation, automatically disconnect the mains line. This prevents large-scale browning or blackening of the mesh.[4]

IV. EXISTING SYSTEM

Several grid developments are planned in the future: The use of renewable resources can be changed at both the aggregate and distribution levels grade distribution Intensive customer involvement in production and multi-use increments. automation at the distribution and transmission level. There are many strategies to use risky technologies to deal with uncertainty. Physical security and network security will play an important role in future network developments. Advances in materials will continue into the future, from superconducting materials to new nanoscale structures. This will ensure that the energy needs of society are met in a sustainable way for the 21st century and beyond.

V. PROPOSED SYSTEM

- Voltage and frequency should always be controlled, the load sharing unit constantly monitors the load and during periods of no demand one or both generators are turned off to save electricity consumption.
- As demand increases, the second and third generators will restart, synchronize and reconnect to the load, and if the combined output of each generator cannot provide sufficient power, the entire grid will drop in frequency.
- Therefore, load sensing and voltage and frequency sensing are used for synchronization in this application. Mains synchronous fault detection and trip automatic load protection for induced frequency and voltage outside the acceptable range.
- Here the 230v power supply step-down transformer is input. The transformer is rated for 12v. The rectifier converts AC to DC and the filter suppresses ripple, providing a pure DC signal.
- Microcontroller receives DC power from the rectifier. The output of the microcontroller is connected to the 16×2 LCD screen. If the simultaneous optimization test is done by connecting the worklight, connect the LED worklight.
- Use voltage and current meters for voltage measurement. By changing the potentiometer, after reaching the valid value, the frequency changes and the error is displayed on the LCD.
- Electromechanical relay circuit will open and load will be protected by changing the frequency before opening.

VI. SYSTEM FUNCTION

BLOCK DIAGRAM

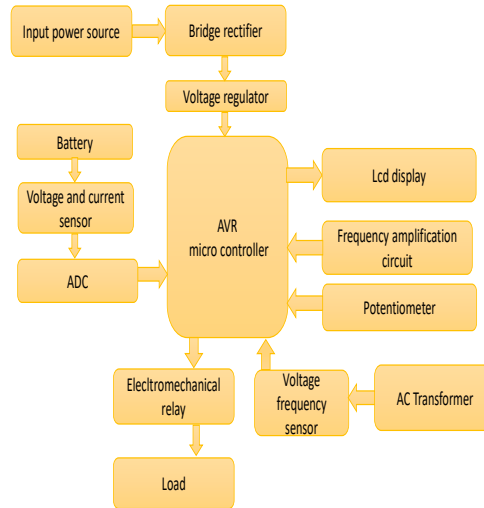
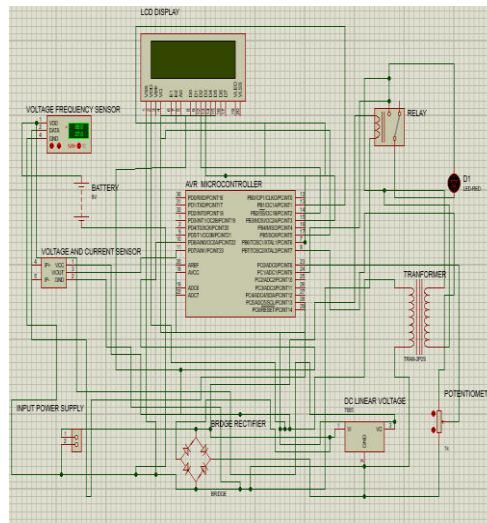


Fig. No.1. Proposed forBlock diagram

CIRCUIT DIAGRAM FOR PROPOSED SYSTEM



VII. HARDWARE REQUIREMENTS

1. AVR MICROCONTROLLER

The AVR is an 8-bit microcontroller belonging to the Reduced Instruction Set Computer (RISC) family. In the RISC architecture, computer instructions are not only smaller, but also simpler and faster. Another classification is CISC (Complex Instruction Set Computer). Click here to learn the difference between RISC and CISC. In the next section, we will examine this in more detail when we look at the structure of the AVR microcontroller. 8-bit means the MCU can send and receive 8-bit data. Existing I/O registers are 8 bits. The figure below shows a simple example of an OR operation between two input names and storing the values in the output.



Fig no.3. AVR Micro controller

2. LCD DISPLAY

LCDs can be used to display random images (as on a target computer monitor) or still images that can be shown or hidden, such as 7-segment displays in preset languages, numbers, and digital clocks. They use the same technology, except that the random image consists of many small pixels, while the other instructions are much larger. They are found in consumer products such as video players, gaming devices, watches, wristwatches, calculators, and phones, and have replaced cathode ray tube (CRT) displays in most applications. They come in larger screen sizes than CRT and plasma screens and are not affected by image burn-in as they do not use phosphors. However, LCDs are subject to image permanence.

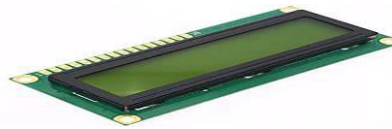


Fig no.4. LCD display

3. Voltage and current sensor

Sensors are basically devices that can sense or identify and respond to certain types of electrical or some optical signals. The implementation of voltage and current sensors and current sensor techniques have become an excellent alternative to conventional current and voltage measurement methods. A voltage and current sensor can actually detect, monitor and measure the voltage supply. It can measure AC and/or DC voltage level. The input to a voltage and current sensor is the voltage itself, and the output can be analog voltage signals, switches, audio signals, analog current level, frequency, or even frequency modulated outputs. This means that some voltage and current sensors can provide sine or pulse trains as output, and others can produce amplitude-modulated, pulse-width-modulated, or frequency-modulated outputs.



Fig no.6. voltage and current sensor

4. LED BULBS

LED bulbs are the future of indoor and outdoor lighting. These bulbs are among the best replacements for light bulbs. 10 watt LED bulbs bring with them a major scientific and technological advance using revolutionary LEDs. Although the cost is slightly higher than CLF and incandescent, the long life and energy efficiency make LED lights much more cost effective. 10W LED bulbs are, as the name suggests, bulbs that work with semiconductor diodes. LED technology is being developed and improved every day based on thorough scientific research and has the potential to become the most cost-effective form of lighting. Statistics show that LED bulbs use up to 90% less energy than halogen bulbs.



Fig no.7. LED Bulb

4. REGULATOR

In this article, we will look at the 7805 voltage regulator IC, which is one of the most used voltage regulator ICs. Controlling the mains supply is important for many electrical appliances because of the current rating and voltage of the electrical equipment used in them. If there is a difference in the fixed value, the device will be damaged. An important DC power source for this is the battery. However, it is not a good idea to use batteries in electronic devices because over time, batteries will discharge over time and lose their capacity.



Fig no.8. Regulator

5.ELECTROMECHANICAL RELAY

Relay is an electrical switch in opens and closes under the control of another electrical circuit. In its original form, the switch was made by an electric motor to open or close one or more contacts. Since the relay can control a more powerful electrical output from electrical equipment, it can be widely considered an electrical amplifier.

6.BATTERY

A BATTERY extends the use of energy generated by a photovoltaic system, providing free, sustainable energy even when the sun is not shining and the panels are not producing power. With a BATTERY, little or no electricity is supplied to the grid and at the same time you avoid buying expensive electricity from the grid later. All batteries consist of three basic components: an anode (the '-' side), a cathode (the '+' side) and some sort of electrolyte (a substance that chemically reacts with the anode and cathode).

7. POWER SUPPLY

This section describes the operation of electronic devices designed to use filters, rectifiers, and voltage regulators. Stable DC voltage is obtained by starting from the AC voltage, rectifying the AC voltage, then filtering it to the DC level, and finally controlling it to obtain the desired DC voltage. The rule is usually derived from an IC regulator unit that uses DC voltage and provides a small DC voltage that remains constant even if the input DC voltage changes or the output load due to the DC voltage changes. .



Fig no.9 Power supply



8. POTENTIOMETER

Potentiometers also known as POTs are nothing but variable resistors. They can provide variable resistance simply by changing a knob on the top of the head. One is their resistance itself (R-Ohms) and the other is their power rating (P-Watts). The value or resistance decides how much resistance it provides to the flow of current. Resistors are also classified by how much current they can allow; this is called power (power in watts). The higher the power rating, the greater the resistance and the greater the current can be. Potentiometers are rated at 0.3W and can therefore only be used for low current circuits.



Fig no:10 potentiometer

9.TRANSFORMER

A transformer can be described in the simplest way as a thing that increases or decreases voltage. In a step-up transformer, the output voltage will increase and in a step-down transformer, the output voltage will decrease. A step-up transformer will step down the output current and a step-down transformer will step up the output current to keep the input and output power of the system at the same level. A transformer is basically a voltage control device that is widely used in alternating current distribution and transmission. However, the general purpose of using transformers was to maintain a balance between electricity that was produced at very high voltage and consumption that was done at very low voltage.

10. ADC DEVICE

ADC converts continuous time and continuous amplitude analog signals to discrete time and discrete amplitude digital signals. The change contains feedback, so it should show little in the form of errors or noise. Also, instead of performing a continuous transformation, ADCs perform periodic transformations by sampling the input and limiting the allowable bandwidth of the input signal. The performance of the ADC is generally characterized by its bandwidth and signal-to-noise ratio (SNR). The bandwidth of an ADC is usually characterized by its numerical value. An ADC's SNR is affected by many factors, including resolution, linearity, and accuracy (how close the equation is to the actual analog signal), aliasing, and jitter. An ADC's SNR is usually the sum of its effective output (ENOB); it's not noise, it's the average number of measurements it returns.

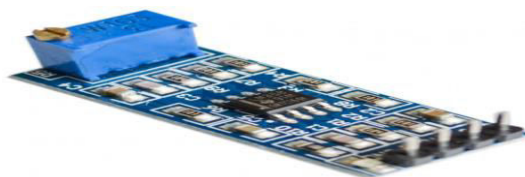


Fig no: 11 ADC Device



11. BRIDGE RECTIFIER

The rectifier circuit is used to convert AC (alternating current) to DC (direct current). Rectifiers are generally divided into three as half-wave, full-wave and bridge rectifiers. Center-guided full-wave rectifiers and bridge rectifiers provide high conversion. Bridge rectifier circuits are part of electronic equipment. Many generators need to adjust DC power to run various electrical devices from available AC. Such rectifiers are widely used in household appliances, motor controllers, tuning systems, welding applications, etc. We can find it in many AC power products such as This article will give an overview of the bridge rectifier and how it works.



Fig no: 12 Bridge rectifier

VIII.RESULTS

We have successfully completed and tested the project. The figures of successfully completed and tested are given below in following. Fig 13is the welcome page and fig 14is registration page, if user has already logged in to their account then just can login page and get inside directly it, if user is new to this applicationthen they have to register their data as shown in fig 15 and alerting message will be automatically send to admin if voltage is over or under and also if frequency is low which is shown in fig 16. At the end fig no 17 show the completed hardware of this project.

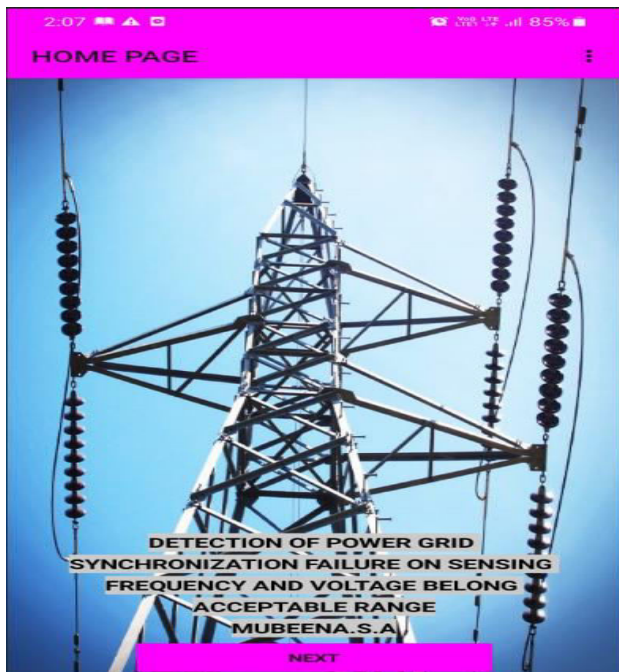


Fig no13: register page



Fig no14: login page



Fig no15: data entering



Fig no16: alerting message

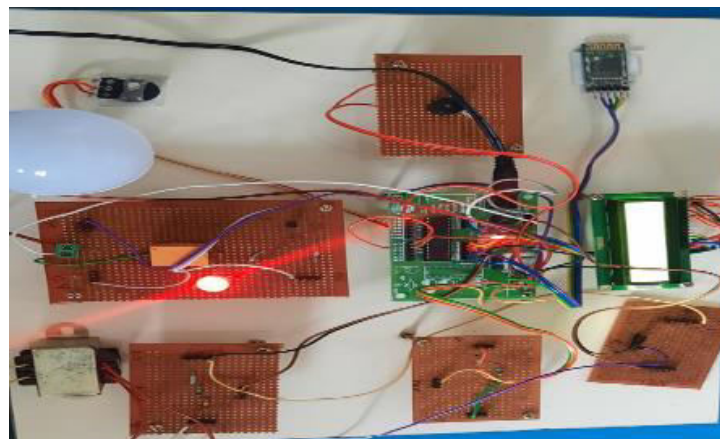


Fig no 17: hardware device

IX. CONCLUSION

A simple and effective system was designed and built in this project. This study shows that microgrid architectures are a good solution for the integration of distribution into power systems. The application concluded that it was possible to make a smarter, more efficient and more efficient grid, proving to be more economical than the existing installation. The challenge is continuous and uninterrupted transmission, which is very successful with the application described in this document and a few other parameters similar to continuous transmission. Regularly monitor and identify and act on inconsistencies that occur, making management and rework easier and more efficient. This system is low cost compared to other systems.

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