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Detecting Power Grid Synchronization Failure on Sensing Frequency or Voltage beyond Acceptable Range

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Abstract- The system to detect the synchronization failure of any external supply source to the power grid on sensing the abnormalities in frequency and voltage. There are several power generation units connected to the grid such as tidal, thermal, solar etc to supply power to the load. These generating units need to supply power according to the rules of the grid. These rules involve maintaining a voltage variation within limits and also the frequency. If any deviation will occurs then automatically disconnect the grid line. This prevents in large scale brown out or black out of the grid power. So it is preferable to have a system which can warn the grid in advance so that alternate arrangements are kept on standby to avoid complete grid failure. This system is based on a microcontroller of 8051 family. The microcontroller monitors the under/over voltage being derived from a set of comparators. As the frequency of the mains supply cannot be changed, so by using variable frequency generator (555-timer) frequency can changed. A lamp load (indicating a predictable blackout, brownout) being driven from the microcontroller in case of voltage/frequency going out of acceptable range.

Keywords*:* Frequency, Grid, Power, synchronization**,** Voltage.

1. INTRODUCTION

In day to day life electrical energy has evolved as one of the most basic needs of human being. As we know that electricity generated at generating station will be transferred to required location accounting into various losses. Though still it is not assured to transfer with required efficiency it is proved to be economical ,as well as it will carry more losses, interruptions, voltage and frequency fluctuations.

The seminar report suggests about designed to develop a system to detect the synchronization failure that means in power distribution systems, the power grid station gets supply from different feeder stations like a thermal power station, a wind power station, a solar power station etc. For feasible transmission, the frequency and voltage of the AC supply should be within the limits as decided by the grid.

In this seminar grid is depending upon the demand of the power supply. There are several power generation units connected to the grid such as hydro, thermal, solar etc. to supply power to the load. These generating units need to supply power according to the rules of the grid. These rules involve maintaining a voltage variation within limits and also the frequency. This prevents in large scale brown out or black out of the grid power. So it is preferable to have a system which can warn the grid in advance so that alternate arrangements are kept on standby to avoid complete grid failure. In case these limits are exceeded and the demand for power is more than the demand for supply, it results in grid failure. In such situations, the feeder unit is completely disconnected from the grid, causing islanding situation. Thus synchronization is needed between the grid and the feeder unit. This paper defines a way to detect the variations in frequency and voltage of the power supply from the feeder unit to determine the synchronization failure. Here a frequency variation detection system and a voltage variation detection system are used. For frequency variation, voltage variations, and for the current variations we uses the sensors here. In case of any voltage ,frequency variations, the lamp is switched on .of any external supply source to the power grid on sensing the abnormalities in frequency and voltage.

1.1 Block Diagram

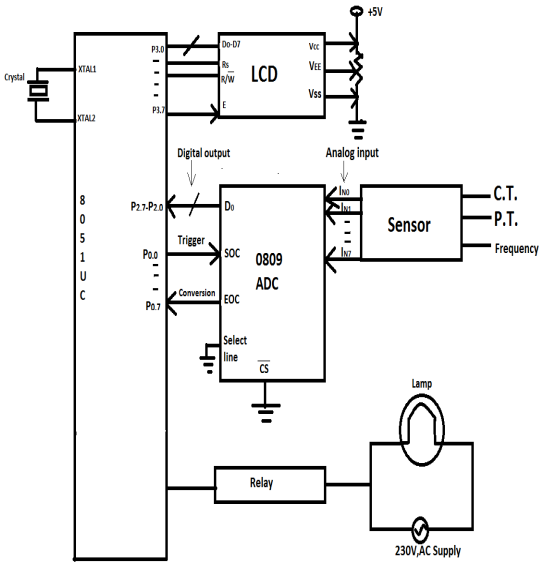

Fig.1: Block Diagram of solar based automatic plant watering system

In this paper we will use Microcontroller 8051, LCD, ADC. 0809, Relay, Lamp, Sensor etc .in block diagram. ADC 0809 have in build 8:1 multiplexer i.e it supposed to interface 8 different analog input connected to the analog input channel no.IN0-IN7.With reference to above to analog input connected to the input no. (IN0&IN1) Select the line used to select desire analog input channel & here they are kept at Ground level to select IN0.This is by using sensor device. From which frequency, voltage can be detected.SOC is the start of conversion signal to initiate the conversion process and EOC indicate conversion over .i.e. EOC =1,the converted digital available at respective port.

1.2: LCD Pin Description

1. **VCC,VSS,VEE**
   While VCC & VSS provide +5v &ground respectively.VEE is used for controlling the LCD contrast.

2. **RS (Register select)**
   There are two important register inside the LCD if, RS=0 a command code register is selected allowing the user to send command such as clear display, cursor at home etc. If, RS=1 data register is selected allowing user to send a data to be display on the LCD unit.

3. **R/W(Read/Write)**
   R/W input allows the user to write the information to the LCD or read the information from it.
   R/W=1 when reading.
   R/W=0 when writing.

4. **(Enable)**
   Enable is for latch the information presented to its data pins when the data is supplied to the data pin a high to low pulse must be applied to this pin in order for the LCD to latch in data present at the data pins.

5. **D0-D7**
   The 8 bit data pins D0-D7 are used to send the information to the LCD internal register .To display the letter , numbers we send the "ASCII" codes of these letters numbers. These are also instruction command codes that can be send to the LCD such as clear display unit force the cursor to home position ,bring the cursor.

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1.3: Relay driver ULN2803APG

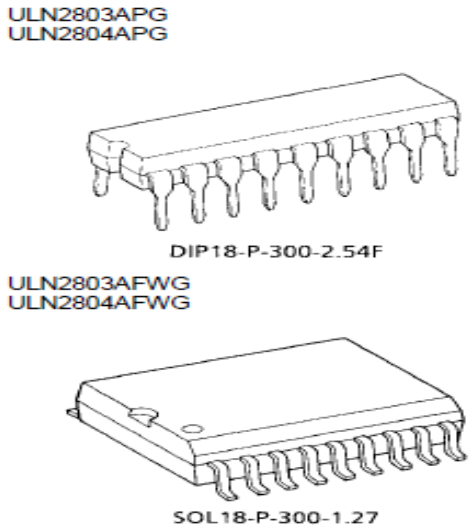

Fig. 2: Relay driver ULN2803APG

V

The ULN2803APG / AFWG Series are high−voltage, high−current drivers comprised of eight NPN pairs. All units feature integral clamp diodes for switching inductive loads. Applications include relay, hammer, lamp and display (LED) drivers. The suffix (G) appended to the part number represents a Lead Free product.

1.3.1: Features of Relay Driver

1. Output current (single output) 500 mA (Max.)
2. High sustaining voltage output 50 V (Min.)

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3. Output clamp diodes
4. Inputs compatible with various types of logic.
5. Package Type−APG : DIP−18pin

1.4: Problems Detected At Power Grid

The main aim of this seminar is to develop design develop a system to detect the synchronization failure of any external supply source to the power grid on sensing the abnormalities in frequency and voltage. So for that purpose here following are the problem which can be overcome by this seminar, like by detecting power grid synchronizationfailure,sag,swell,overvoltage,undervoltage,voltage fluctuations, frequency fluctuations etc.

1.5: Concept of Grid

The term grid usually refers to a network, and should not be taken to imply a particular physical layout or breadth. Grid may also be used to refer to an entire continent's electrical network, a regional transmission network or may be used to describe a sub network such as a local utility's transmission grid or distribution grid .An electrical grid (also referred to as an electricity grid or electric grid) is an interconnected network for delivering electricity from suppliers to consumers. It consists of generating stations that produce electrical power, high-voltage transmission lines that carry power from distant sources to demand centers, and distribution lines that connect individual customers. Power stations may be located near a fuel source, at a dam site, or to take advantage of renewable energy sources, and are often located away from heavily populated areas. They are usually quite large to take advantage of the economies of scale. The electric power which is generated is stepped up to a higher voltage-at which it connects to the transmission network.

On arrival at a substation, the power will be stepped down from a transmission level voltage to a distribution level voltage. As it exits the substation, it enters the distribution wiring. Finally, upon arrival at the service location, the power is stepped down again from the distribution voltage to the required service voltage.

1.6: Benefits of Electric Grid

The level of demand for electricity in any one area is so variable that it is more efficient to combine demand from many sites into an overall regional load. This regional electric load is then met by the output of a fleet of generators that can be controlled and managed for optimal performance. In part, the grid was developed to allow generators to provide backup to each other and share load. The grid also allows generators to be located closer to resources (e.g., fuel supply, water, available land) and ship electricity over the transmission and distribution network to different load centres. Utility-scale solar and wind power plants are conceptually similar to conventional generators they generate electricity where the necessary resources are located, typically in remote areas where the fuel (sunlight or wind) is most abundant. These attributes consolidating variable individual loads into more predictable regional loads, Sitting plants near their resource base, and extensive transmission lines help the grid provide electric power with good reliability and low cost.

1.7: Single line Diagram of Power Grid

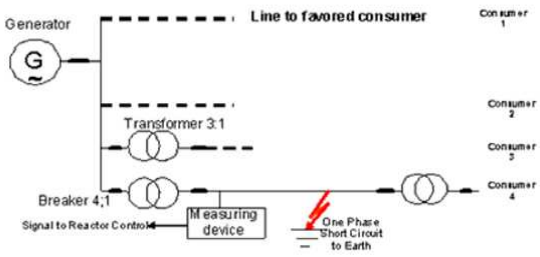

Fig.3: Single Line Diagram of Power Grid

2. ADVANTAGES AND DISADVANTAGE

2.1. Advantages

1. It secured the power of the grid coming from different power stations by detecting the abnormal conditions of frequency and voltage beyond its acceptable range.
2. It prevents the synchronisation failure between power grid and feeder.
3. It requires less maintenance and less time for performing the operation of detection.
4. It does not requires more expensive parts, so it is very cost effective and economical
5. It is more reliable and flexible.

2.3. Disadvantages

1. This detection process is totally depends upon the microcontroller 8051 so that ,if microcontroller gets failed then the whole process will stop.
2. The detection is possible by sensors .and controllers are used if, they may get stop then need of replacement.

3. APPLICATIONS

1. This seminar is applicable for Solar Power Plant where frequency varies; frequency and voltage parameters should match with the Power grid.
2. Microcontroller having various applications by changing the programming.

4. CONCLUSION

In this way, To develop a system to detect the synchronization failure of any external supply source to the power grid on sensing the abnormalities in frequency and voltage. There are several power

generation units connected to the grid such as hydro thermal, solar etc. To supply power to the load. The rules of grid involve maintaining a voltage variation within limits and also the frequency. If any deviation from the acceptable limit of the grid it is mandatory that the same feeder should automatically get disconnected. This prevents in large scale brown out or black out of the grid power by sensing abnormalities of voltage and frequency. This seminar is based on the microcontroller 8051.that are having lot of advantages by changing programming. So that alternate arrangements are kept on standby to avoid complete Grid Failure.

6. ACKNOWLEDGMENTS

Now a days there is a need of power with the proper utility .So that this paper gives the information about this system for the future use also. This is used to Detection any synchronisation failure at power grid then it will sense or detect by sensors .It is by sensing the abnormal conditions of voltage or frequency beyond the acceptable range. By using the simple Assembly language programming microcontroller will control all operation. So that it is also economical for the future use . We use this system for detection as well as protection purpose also this is the main benefit and future scope of this system.

. (A.1)

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