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POWER GRID FAILURE DETECTION

(Based on voltage and frequency variation)

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ABSTRACT: *This project aims to build a system that can detect abnormalities in voltage or frequency in order to detect power synchronization failures. Real-life energy grids include Hydro energy sources, thermal, solar etc. connected to sync to run the industry. These sources must be enabled in accordance with grid rules. These rules include the difference in voltage and frequency within certain limits. Deviations from these limits should result in that data source being disconnected from the grid immediately. This is known as islanding. This is used to avoid large brown or dark discharges from the power grid. Our system is designed to warn the grid in advance of power failure so that the grid can use other backup data sources if needed to avoid a complete power failure.*

Keywords: Arduino Uno, GSM, LCD, Relay, etc.

1. INTRODUCTION

The reliable operation of power grids is essential for modern society's functioning, as any disruption can lead to significant economic losses and social unrest. Power grid failures can result from various factors such as equipment malfunction, natural disasters, or cyber-attacks. Timely detection of grid disturbances is crucial for mitigating their impact and ensuring uninterrupted power supply. Traditional methods for grid failure detection often focus on monitoring either voltage or frequency variations individually. However, these methods may not capture the full spectrum of grid abnormalities or provide sufficient insight into system behavior. In our project we're implementing a strategy by contingency analysis which is used to study behavior of power system, when associated equipment gets outage . A number of operating procedures can be analyzed in contingency conditions, such as the loss of a generator, a transmission line, a transformer, or a load. We're employing a dual approach, allowing for both manual and automatic modes to manage voltage and frequency variations effectively. This comprehensive method ensures not only flexibility but also reliability, crucial for optimizing performance and ensuring system stability under varying conditions.

2. METHODOLOGY

A dual approach has been employed, allowing for both manual and automatic modes to manage voltage and frequency variations.

Automatic Mode:

In this mode, the power supply is provided to the system and it is working in normal condition with a voltage of 230V and frequency 50Hz. Now, when the voltage/ frequency is varied using potentiometer, the under/over voltage or

high/low frequency will be detected by the Arduino Uno and the same will be displayed on the LCD. The relay operates automatically by opening the switch causing the bulb/led to blow off.

Manual Mode:

In this method GSM and OTP comes into picture. The process is same as automatic mode till the LCD displays regarding the fault. But here the voltage and frequency which is varied will be also notified to the phone through GSM. Then a message should be sent from the phone to the GSM to operate the relay. And when the relay switch is opened, the bulb blows off. To reset the relay, Voltage and frequency should be kept to the normal value and an OTP has to be entered which is sent to the phone using 4X4 Keypad. Hence, the System comes to the normal working condition.

2.1 BLOCK DIAGRAM

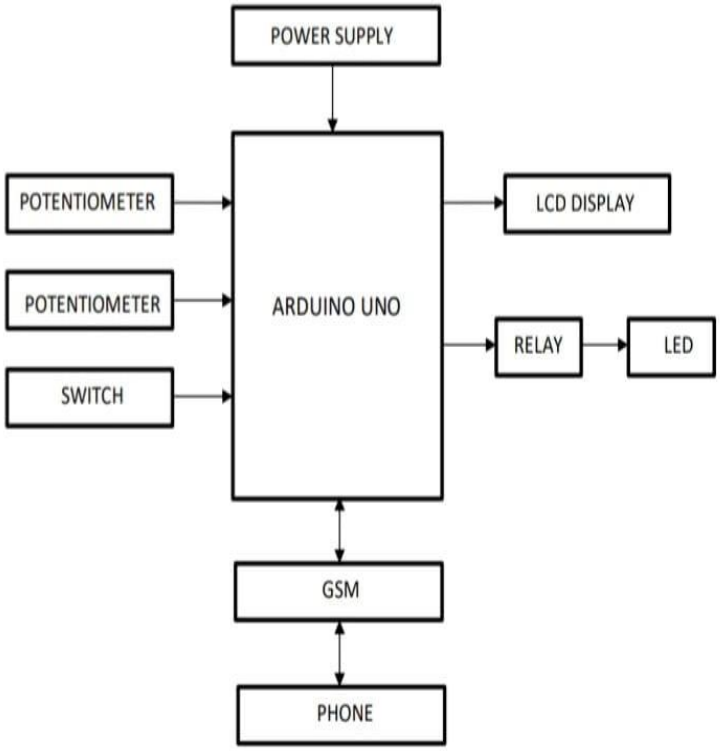

Fig 1: Block Diagram

In this project work, the power supply is used to provide power to the whole system. The potentiometers are used to vary the voltage and frequency values. The signal from the above mentioned potentiometer is processed by the Arduino Uno with the predefined values. LCD Display is used to display the voltage and frequency parameters on the spot and using GSM the abnormality condition is notified to the linked mobile device. Relay acts as a switching device.

3. CIRCUIT DIAGRAM

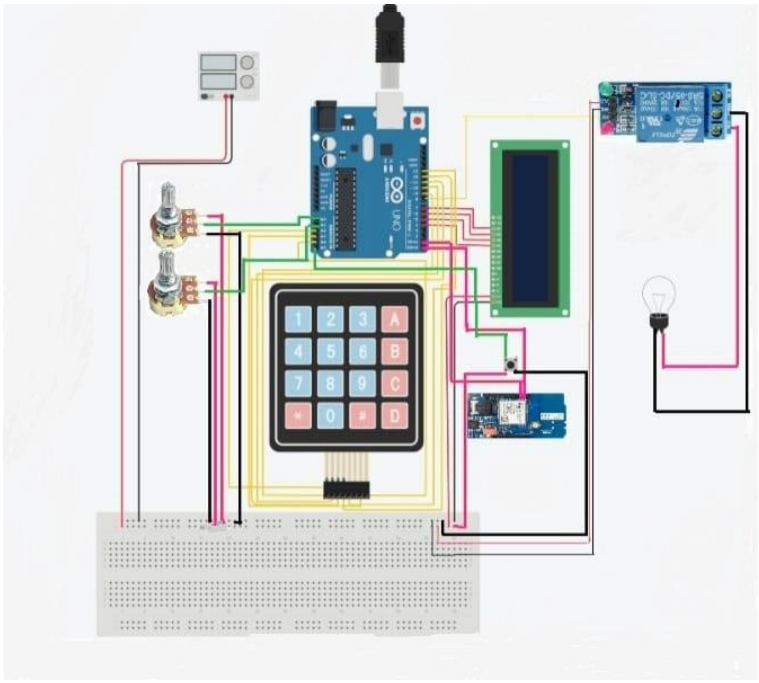

Fig 3: Circuit Diagram

4. HARDWARE MODEL

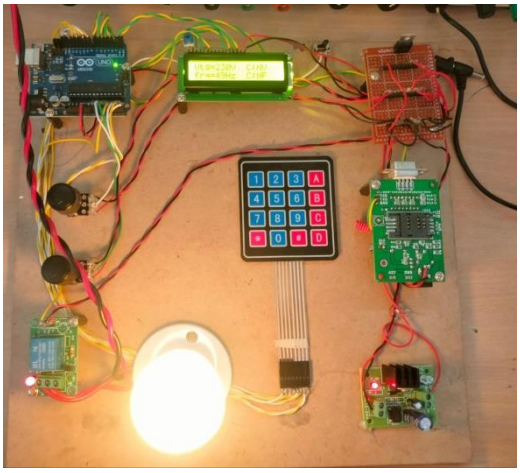

Fig 4: Hardware Model

5. RESULTS

SL NO	Frequency	Relay Operation	Lamp Mode
1.	<48	ON	OFF
2.	48 to 50	OFF	ON
3.	>50	ON	OFF

SL NO	Voltage(V)	Relay Operation	Lamp Mode
1.	<220	ON	OFF
2.	220 to 230	OFF	ON
3.	>230	ON	OFF

5.1 AUTOMATIC MODE

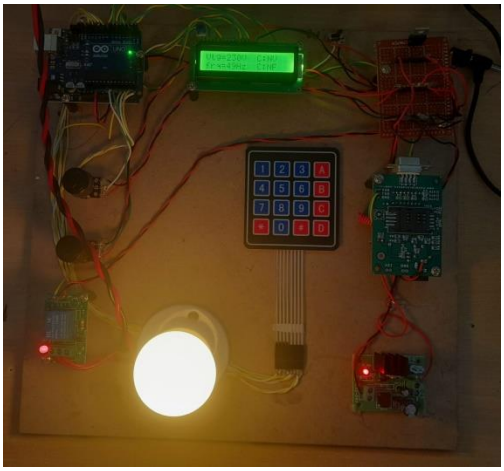

Fig 5.1: Under normal frequency and voltage value

Under normal working condition, the voltage and frequency will be normal. The relay is OFF and the lamp glows. The values are displayed in LCD. Whenever there is a change in voltage and frequency value beyond acceptable limits then the relay operates and turns off the lamp.

5.2 MANUAL MODE

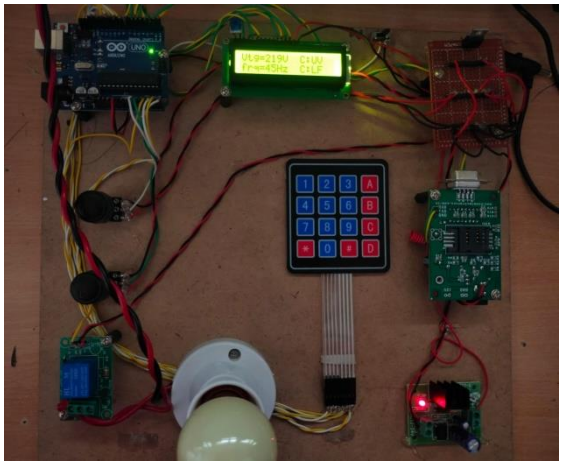

Fig 5.2: Under abnormal voltage and frequency value

Whenever the abnormalities in voltage and frequency value is observed, it is notified to the phone through GSM .The noticed person will make relay to operate immediately by sending the message to the controller to turn on relay

5.3 GSM NOTIFICATION TO SMARTPHONE

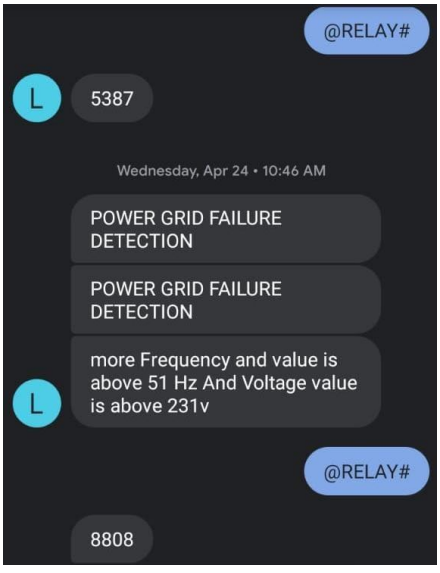

Fig 5.3: Notification from GSM and OTP

When the voltage and frequency value attains normal limit, the OTP will be sent to the phone .Once the correct OTP is entered, the relay turns off and the system comes to normal working condition.

CONCLUSION

It is possible to have a power grid system that is smarter, more effective as well as efficient in its operation, thus proving to be more economical as compared to be the present installations. The challenge is a continuous and uninterrupted transmission which can be very well achieved with the implementation described by this project and in addition to the continuous transmission several other parameters i.e. the passive parameters are being observed regularly and any issues occurring in these, are taken into consideration and accordingly worked upon, thus making the process of management and recovery easier and effective. This system is less expensive as compared to the other system.

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