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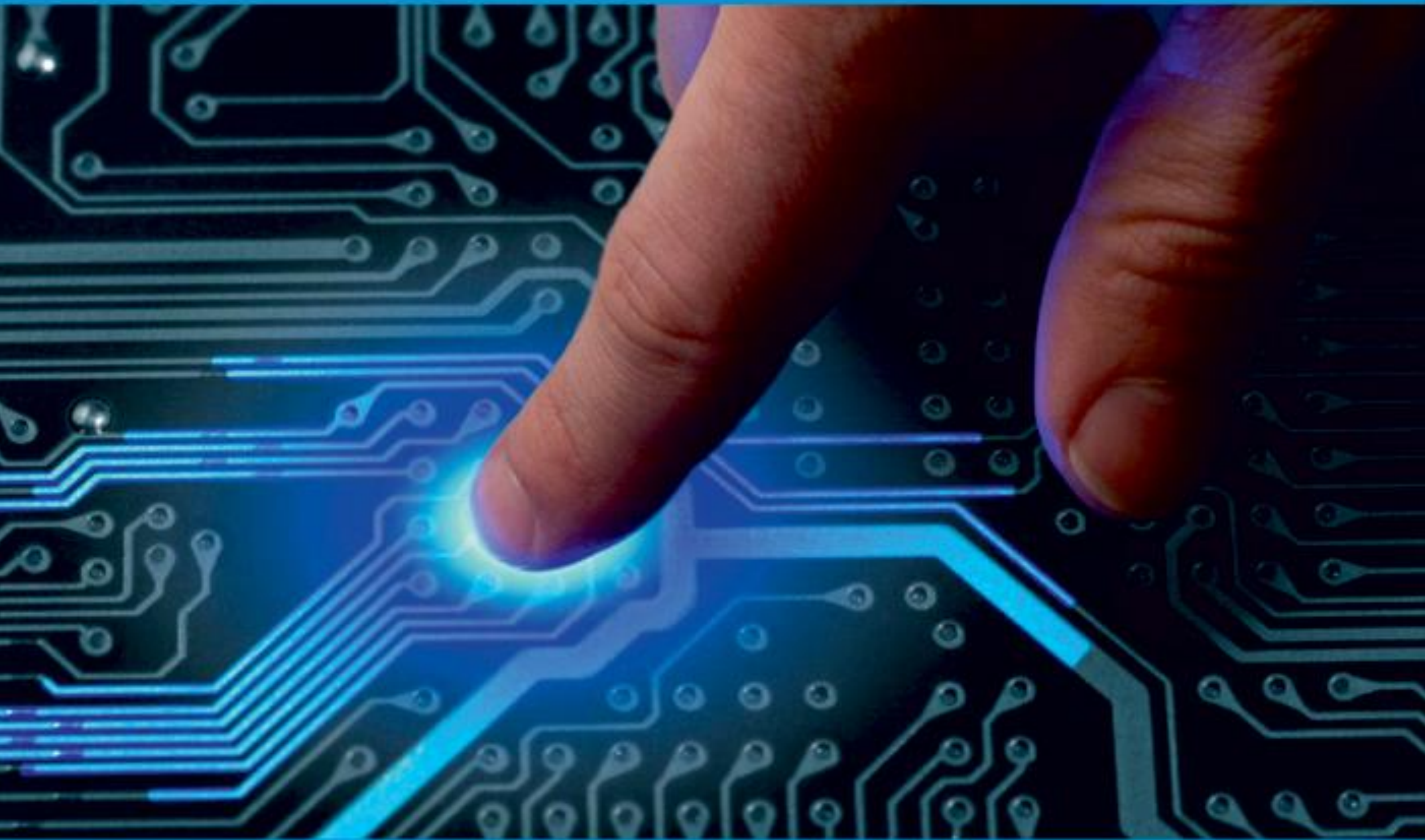

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Smart Power Distribution System

Unmesh Bhosale, Atharv Thakare, Pranav Manjrekar, G.N Gaikwad

UG Student, Dept. of E&TC, SCOE, Savitribai Phule Pune University, Maharashtra, India

UG Student, Dept. of E&TC, SCOE, Savitribai Phule Pune University, Maharashtra, India

UG Student, Dept. of E&TC, SCOE, Savitribai Phule Pune University, Maharashtra, India

Ass. Prof., Dept. of E&TC, SCOE, Savitribai Phule Pune University, Maharashtra, India

ABSTRACT: The demand for electricity is increasing every day and frequent power cut is causing many problems in various areas like industries, hospitals, and houses. An alternative arrangement for power source switching is thus desirable. Uninterrupted automatic power changers are easily available for two sources but with developing power generation systems we have no system to switch over multiple power systems. We work here to create an automatic system of switching over multiple power sources. As the power supply goes missing, the system automatically changes over next available power source. The main objective of this project is to provide uninterrupted power supply to a load and to provide real time reporting. It selects the supply source automatically from any available one in the absence of primary power supply.

KEYWORDS: Smart power distribution, demand for electricity, frequent power cut, power source switching, switching over multiple power switches, real time reporting

I. INTRODUCTION

The invention of electricity and its advancements in the field of electrical engineering has made electrical energy so vast in its applications. A modern house today, cannot be said to be one if it has no use for electricity. This is because most of the items required for making life fit and comfortable in a home function with electricity. Electrical appliances like water heaters, radios, televisions, fans, water pumps etc. all have absolute need for electricity. Unfortunately, though the poor availability of public utility power in India has pushed her citizens to seek alternatives and in dependent means of electricity. This has resulted in individuals buying wind turbines, solar panels, generating sets and so on. Unavoidably this requires careful selection of the one to be ON for their use of alternative power or public power utility. Sequel to this, phase absence is a very common and severe problem in any industry, home, or office.

Keeping this in mind there is a strong requirement of an IoT device which can efficiently carry out the following functions: i) Data collection through precise current sensors ii) providing this data to controller through internet for fast actions iii)analysis of data collected by sensors using IoT platform (Things Speak) iv)communication between two distribution units via internet.

II. RELATED WORK

In [1] authors suggest that as the penetration of renewable energy sources (RES), such as PV modules, continues to increase and reaches a significant level, new technologies will be needed to deal with uncertainties induced by them. By using microgrids to serve critical loads, the resilience of a SDS with respect to extreme events is enhanced.[2]. Authors used an approach where relying on the minimum power losses the optimal output of the DG has been found. In addition, voltage profile can be found in the same time. The job has been done in using fast technique which can be utilized as an offline or online tools to improve the operation of the distribution system under different loading conditions and in the presence of DG. The two-way communication which is the main concept of smart grid is illustrated in this work by monitoring the voltage and adjusting the generation according to the load changes. Future work is ongoing to improve the communication between different elements of the network using multi-agents. In [3] the subjectaddressed in this paper, is proposing a practical demand response program for industrial load management in smart power grids. The main focus of the paper is modelling industrial loads and proposing a novel load scheduling algorithm to achieve a near optimal scheduling by taking into account industrial users satisfaction, dynamic electricity pricing, and constraints regarding to electricity generation capacity.The high convergence speed and the appropriate results are also clarified by comparing the proposed algorithm with Particle Swarm Optimization (PSO) algorithm. In [4] authors comments on the electric power system being complexheavily stressed and thereby vulnerable to cascade outages. The conventional methods in solving the power system design, planning, operation, and control problems have been very extensively used for different applications but these methods suffer from several difficulties due to necessities of derivative existence, providing suboptimal solutions, etc. Computation intelligent (CI) methods can give better solution in several conditions and are being widely applied in the electrical engineering applications. In [5] Authors had modified thereliability and availability of smart grid systems. We described that power outages can be rectified using the combination of control algorithms such as reconfiguration, real-time monitoring, graceful degradation mechanisms and theft detection. To gain increased confidence in the proposed methodologies, the developed hardware and software tools will be tested in close loop with real-time power system simulators, and in actual distribution systems. The results of the research add strategic cross-domain (Power-ICT) insights towards a better utilization of existing European infrastructures that can handle the high availability and reliability requirements of the future real-time smart electrical system.

III. Proposed Methodology

A. *Design Considerations:*

- The system uses three NodeMCU Microcontrollers which demonstrates two distribution unit and one consumer.
- Current Sensors ACS712 are used in order to sense availability of electric supply.
- The system supplies electricity from primary distribution system initially.
- If there is a failure in primary distribution system the system automatically switches off and triggers the secondary system to switch on within a second.
- When the primary distribution system issue is fixed it auto switches on and simultaneously the secondary system is switched off.
- Complete system can be monitored remotely.
- Thing Speak Cloud Server is used for this purpose.

B. *Description of the Proposed design working:*

Aim of the proposed design is tocreate an automatic system of switching over multiple power sources. As the power supply goes missing, the system automatically changes over next available power source. The proposed algorithm is consisting of some steps:

Step 1: Initialize NodeMcu:
First step is to initialize all the NodeMcu for that purpose we power the NodeMcu and feed the code in it. Appropriate connections are made as the circuit diagram are made where we connect relays, LED, Mux, along with current sensors to the NodeMcu.

Step 2: Switching ON the power supply:
In this step we give external power supply to the primary as well as secondary supply units. The maximum current supply depends upon the maximum capacity of current sensors. The relay module is used for internal switching purpose where it act as a current switch.

Step 3: Switching mechanism:
The Current sensor ACS712 first checks the current flow from the primary distribution module and starts reading the values. There are fixed and zero values declared in the code it checks if the value is fixed value, then it remains to be in the working state. If the value in the primary goes zero i.e., there is a power failure then it switches to the secondary power distribution module until the primary one is fixed.
Also, there is an alternate power distribution unit B which can be considered as a secondary module of the distribution system which contains the similar setup of components as the primary distribution unit the only difference being no initial current in the circuit because of ample amount of current flowing through the primary unit. When the primary unit is down due to some problem then the unit B is turned ON and supplies the current.

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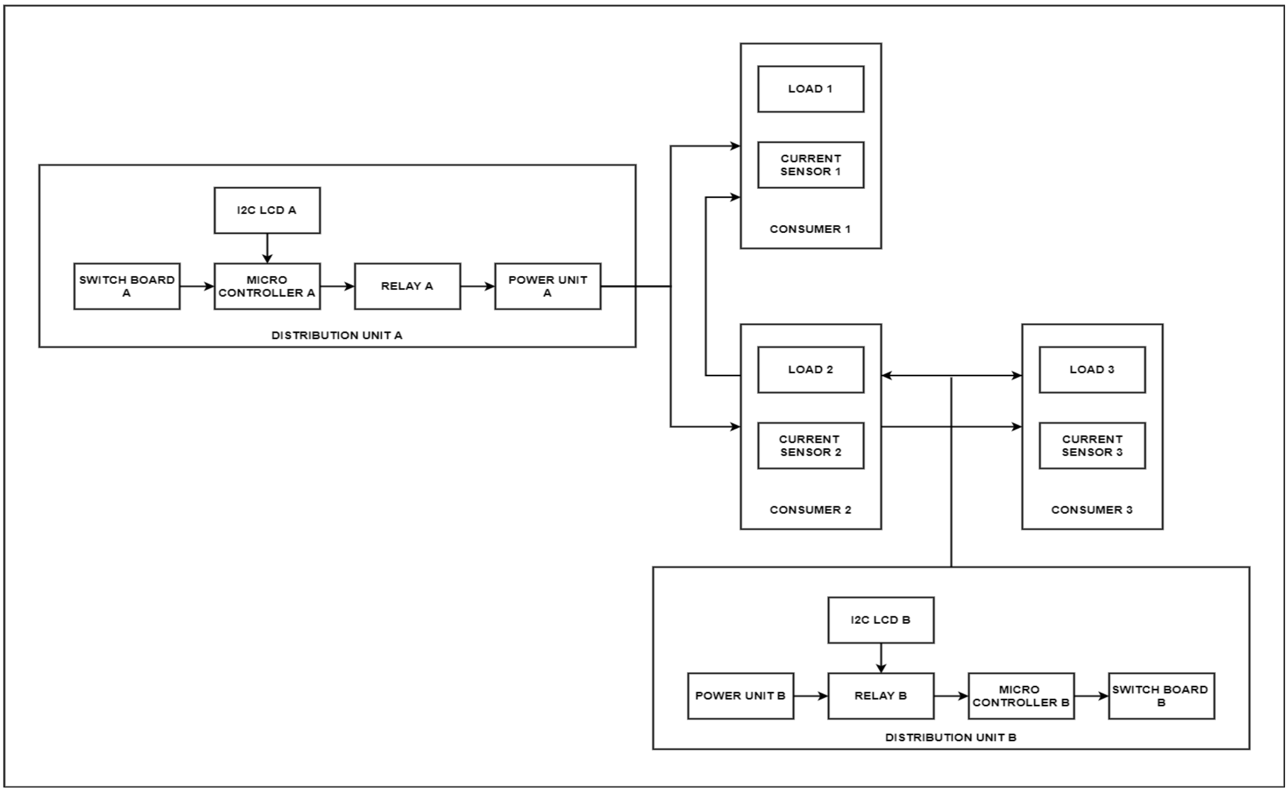
IV. Block And Circuit Diagram

BLOCK DIAGRAM:



BLOCK DIAGRAM DESCRIPTION

- The ACS712 first initialize ESP8266. Check the current flow and from the primary distribution module then started reading the values. There are fixed and zero values declared in the code it checks if the value is fixed value, then it remains to be in the working state. If the value in the primary goes zero i.e., there is a power failure then it switches to the secondary power distribution module until the primary one is fixed.
- As we can see there is a block of distribution unit A which is our primary module of distribution system in which there is a separate power unit consisting of several components such as a main NodeMcu which is our main control unit which relay orders to the other components. Also, there is a relay module for the switching purposes of the current. There is a 16x4 LCD display which reflects the flowing current in the circuit. If there is no current available in the circuit i.e., there is some failure in the primary distribution unit then the LCD will display an alert of no current in the circuit.
- Also, there is an alternate power distribution unit B which can be considered as a secondary module of the distribution system which contains the similar setup of components as the primary distribution unit the only difference being no initial current in the circuit because of ample amount of current flowing through the primary unit.
- There are two separate current sensors for each of the two units which calibrates the amount of current flowing through each unit.

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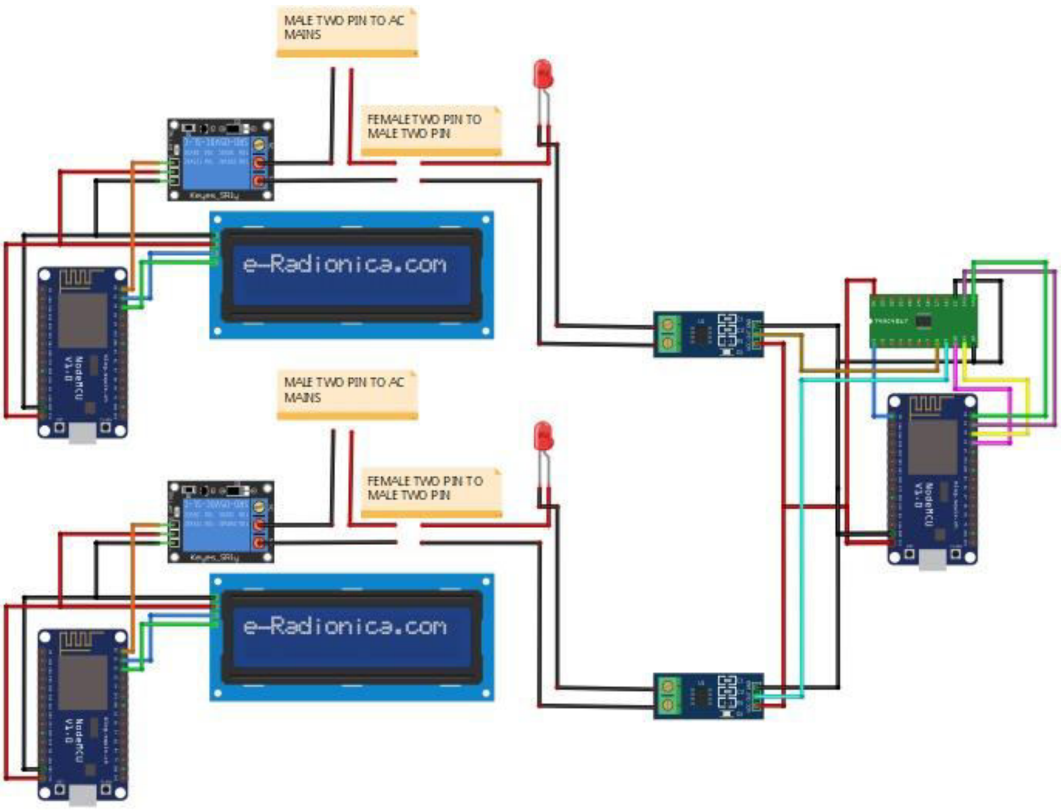
CIRCUIT DIAGRAM:



The above circuit diagram shows the connections and data feed between different components of our power distribution system.

V. Results

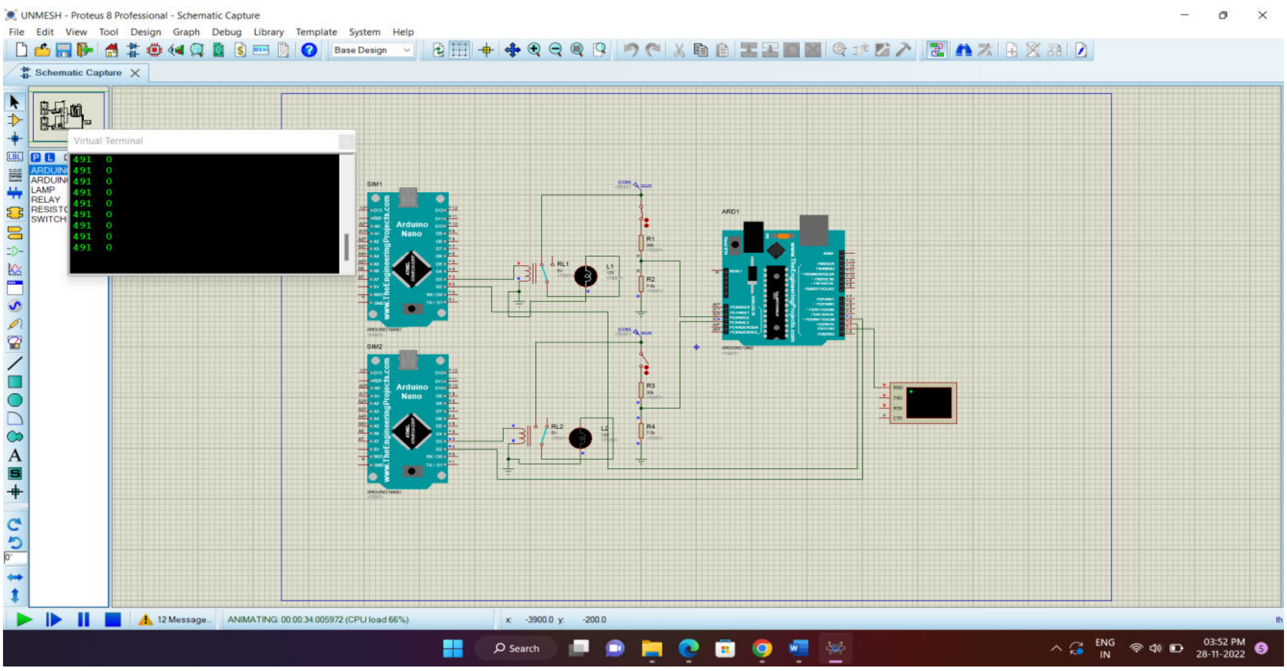


Fig. Simulation when primary circuit is ON

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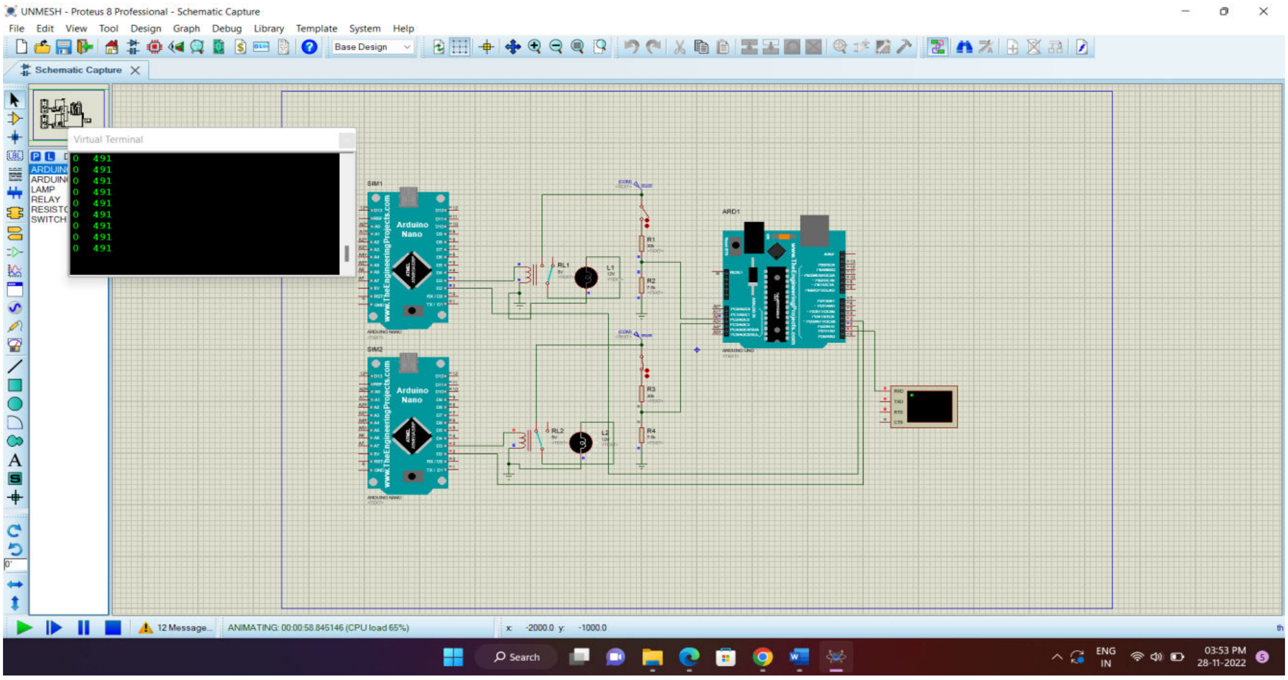

Fig. Simulation when primary circuit is Short

- In the simulation diagram 4.1.a when the external AC supply is ON we can see on the virtual terminal (i.e. LCD display in our case) that the voltage through the primary circuit 491 which is the analog value that can measure the voltage in the given circuit and the secondary circuit comes 0 that is the secondary circuit is currently OFF.
- In the second simulation diagram 4.1.b the virtual terminal shows that the primary circuit is short that means there is some fault in the distribution system so the primary unit shows 0 and the secondary circuit shows 491 that means some voltage flow is there in the circuit.
- Thus from these scenarios it is clear that the circuit switching takes place at much quicker rate than inverter which is a bonus also the fault can be detected by the voltage flow.

Calculations:-

$$\text{Voltage flow} = \frac{\textit{analog value on virtual terminal}}{\textit{Total analog value on virtual terminal}} \times 5V$$

$$\text{Voltage flow} = \frac{491}{1023} \times 5V = 2.399\ \text{V}$$

VI. CONCLUSION AND FUTURE WORK

The design and implementation of programmable power changeover has been implemented in this paper. After designing each key module, the program was written in Embedded C and tested to ensure that the module is responding to the desired output on the display panel. The technology will upon the automation of the existing change over system, add some intelligence to automatic power changeover by allowing user to choose the mode they want their automatic systems to operate on. The present system has improved the existing automatic and manual power change over. This project is designed to check the availability of any live phase, and the load will be connected to the live phase only. In addition, due to problems incurred over interrupted power supply, this led to the discovery of three-phase smart switching system which makes the selection process a lot stress free, efficient, and cost effective.

The three-phase smart switching system makes our network infrastructure smarter. Intelligent switching systems are in a giving phase in that companies are continually developing solutions that will make network systems smarter in the future. The demand for sensitive systems which are able to monitor the violent and devastating effect of fire and vandals at homes, offices etc have increased. This led to the idea of an intelligent switching system which can monitor, control and switch between phases. The switching between the mains and the generator occurs in micro seconds.

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