

Intelligent Electrical Load Shedding in Domestic Load with a Case Study

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Abstract - The purpose of a Load Shedding Control System (LSS) is to prevent a dangerous overloading of the generators and/or a general collapse (blackout) of an electric power system due to a generator failure or any contingency which may diminish the capacity of the operational generators below the active power required by the loads. Such a state may create an imbalance in the power supply and thus lead to frequency decay, voltage collapse and overload on all the power generation units connected to the system. In case the electrical supply is inadequate to meet the demand of the process loads, partial supply to certain areas can be interrupted in order to prevent the failure of the whole electrical system. This process is called load shedding. This is an entirely different concept from a power failure that may occur due to various reasons.

Keywords: Power grid, Fossil-flue, PV distribution.

I. INTRODUCTION

Maintaining the power supply to the critical process loads is vital for an industrial cogeneration power plant, both for the continuous production and the overall safety of the plant during emergencies. A sudden interruption of the production may result in significant economic losses and even cause major safety concerns. The majority of industrial establishments that require an uninterrupted energy supply in the form of electric power and steam choose to install cogeneration units [1].

Though power systems are designed to function under normal conditions, they also include a safety margin for emergencies. The main objective of the electric utility is to operate the power system without exceeding the system constraints and operational limits. However, in certain conditions such as a sudden increase in the system demand or an unexpected power failure, system constraints and operational limits may be exceeded beyond the tolerance limits. In such cases, load shedding is considered an emergency measure to avoid cascaded tripping and a blackout [2].

In this method, different bus voltages are considered as overloads or voltage collapse indices [3]. A second common type of load shedding is frequency load shedding. An imbalance in the active power supply may lead to frequency changes [3]. If voltage and frequency deviate outside the permissible range, the system becomes unstable. Thus, the system controllers attempt to restore the normal voltage and frequency values within the permissible range. If the disturbance is so large that the controllers cannot restore normal function, load shedding is the last resort to avoid the breakdown of the power system [4].

Load shedding is a commonly applied method in states of emergency/extreme emergency where the system is headed for a collapse. Given the appropriate conditions, the load shedding process should be started as soon as possible [5]. For this purpose, different techniques including circuit breakers interlocking, LS based on under-frequency relays, and LSS based on PLC or micro-controllers have been developed over the years. These techniques shed a predefined amount of load (power blocks) in order to reach a balanced power state according to the available generation capacity, thereby providing faster and optimum responses during a sudden loss of power.

II. METHODOLOGY

In the proposed system (figure 1) only one transformer is operating to feed the loads. A standby transformer is connected in parallel through a circuit breaker and relay. The current transformer continuously measures the load current and feeds it to the Microcontroller ADC pin. The reference value or the maximum load limit is entered by the user and priority level of the load is also set by the user or concern authority. As the load demand increase during peak hours, a single transformer would not be able feed all the load. During this condition, when the load demand exceeds the reference value, Microcontroller will give a control signal to energize the relay coil. Thus, the standby transformer will be connected in parallel and share the load equally. Since the transformers are of the same ratings. Thus, all the loads are fed efficiently providing un-interrupted power supply.

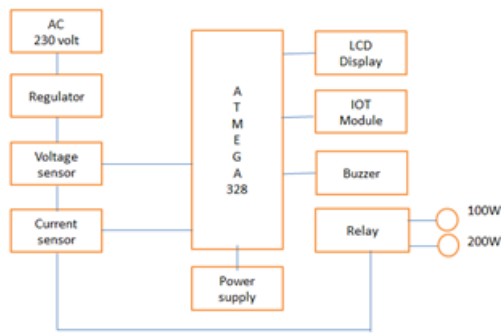


Figure 1: Block Diagram

When the load increases to further to a value which is greater than the capacity of the two transformers, priority-based load shedding will be implemented. The loads which have the lowest priority will be shut down by opening the respective circuit breaker [1]. When the load decreases, and comes to normal working condition, first transformer will be shut down in order to avoid thermal loading. This is done because the first transformer operates for a longer time interval than standby transformer and its body temperature rises.

This will display on the LCD display. In this technique an IOT is implemented, which stores the data about the Load Current, Time, Date and temperature of both transformers. It will be stored in THINGSPEAK (From this a user id and password had generated. By login, data can fetch). This data can extract for every 20seconds and can store about a year of data. Similarly, it is done for standby or secondary or second transformer. By seeing this data, there should be an eye on load limit on transformer as well as duration of load on transformer. This prevents overheating and overloading of transformer. Hence, the transformer will work efficiently. This will be a real time proposed work.

Simulation Conditions

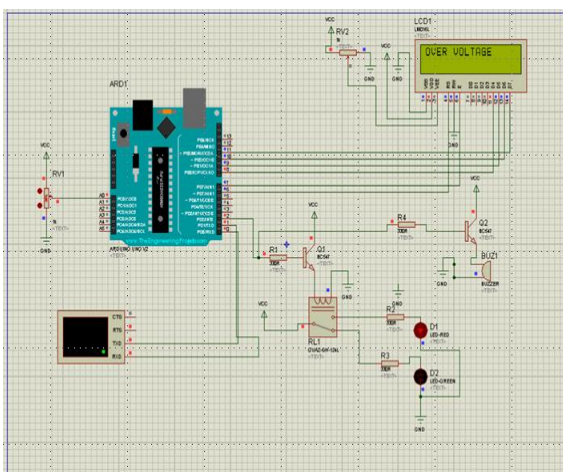
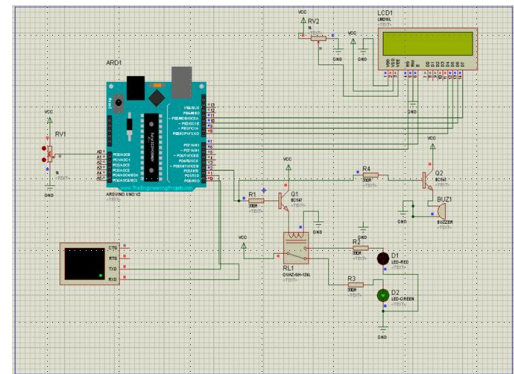
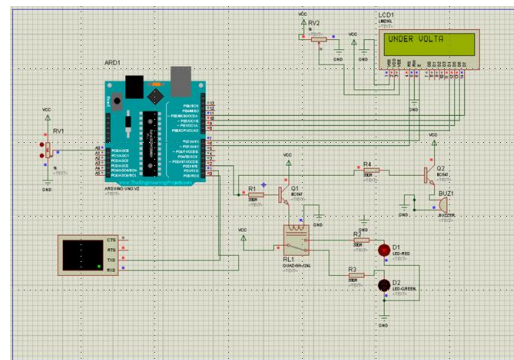


Figure 2: Circuit Diagram

1. Over Voltage



2. Normal Voltage



3. Under Voltage

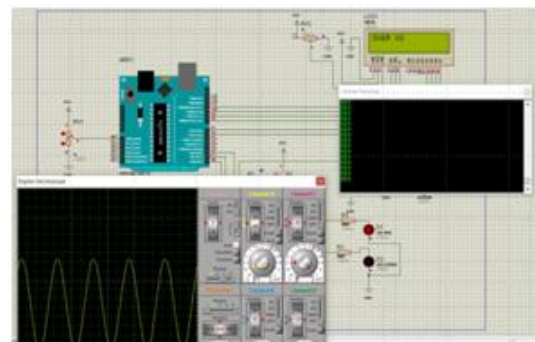
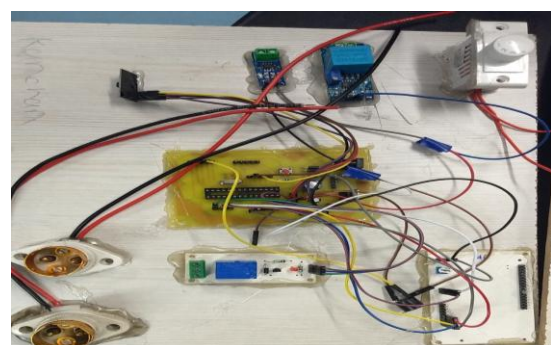


Figure 4: Graphical Representation



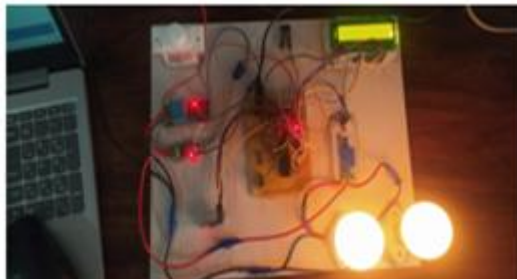


Figure 5: Domestic on Load

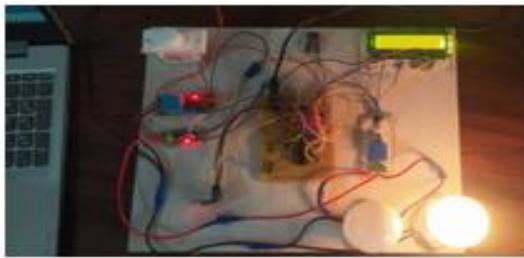


Figure 6: Domestic OFF Load

III. RESULTS AND CONCLUSION

The load shedding system is the last resort as a backup measure in cases where an electrical power system faces a disturbance that causes an imbalance between the mechanical power supplied and the power required by the load. A rapid initiation of preventive measures and the optimum response are the key features for a successful system recovery under these conditions. Based on the evaluation of the power generation capacity, loads, and the interconnection constraints of the new and existing refineries, it is possible to estimate the main load shedding scheme for inadequate generation capacity logic used as the main protection against islanding power imbalance conditions.

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