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INDUSTRIAL LOAD CONDITIONING MONITORINGSYSTEM

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Abstract: This paper aims at helping people manage the various load conditions. This system is a compressive system designed to provide real time monitoring of the condition of industrial machinery. Here load condition monitor system which will detect maximum demand and present power factor. This project introduces the Industrial Conditioning Monitoring System to manage the industrial power load easily. Various condition for load crosses the demand value, based on this approach we design an industry system with the implementation of simulation software and also prototype hardware. It uses a combination of sensors and data acquisition hardware. Testing on industrial load will be carried out on small prototype for the load demand an also power factor. It has several advantages, such as better utilization of power, improved load factor. It is microcontroller based system which continuously monitor the present power consumption by the end user. We also keep alert system and automatically trip at level so as to avoid the penalty from provider.

Index Terms **– Load Conditions Monitoring, load factor.**

1. INTRODUCTION

Our project implement on microcontroller based industrial load management system. The developed system fully operated on digital microcontroller based system. The growth in the electricity uses and diversity of end use segments in time of use has led to shortfalls in capacity to meet demand. As capacity addition is costly and only a long-time prospect, better load management at user end helps to minimize peak demands on the utility infrastructure as well as better utilization of power plant capacities. The utilities (State Electricity Boards) use power tariff structure to influence end user in better load management through measures like time of use tariffs, penalties on exceeding allowed maximum demand, night tariff concessions etc. Load management is a powerful means of efficiency improvement both for end user as well as utility. As the demand charges constitute a considerable portion of the electricity bill, from user angle too there is a need for integrated load management to effectively control the maximum demand. Maximum demand refers to the maximum amount of electrical energy that is being consumed at a given time. It is measured in kilowatts per hours, which is measurement of total electricity used for a period of time. The purpose of controlling the demand is, not to exceed the contracted maximum demand limit. There are possible loads to be disconnected such as lights, compressor, air conditioners, pumps, fans and packaging machinery.

2. LITERATURE SURVEY

Mr. V.P Shree Divya et.al [1] introduces proposed methodology the reliable supply to the domestic consumers can be improved by having power supply to only the basic loads say lights and fans during the peak hours and reducing the power cuts during the peak hours and great reduction of peaks in the load curve influences the appreciable improvement in the load factor. In this paper an intelligent hardware system called Maximum Demand Limiter is designed for controlling the domestic loads, that is providing supply for the basic loads only during the electrical energy shortage hours, hence with this the power cut rate can be reduced and it may postpone the capital investments on installation of new power projects and there by reduces the electrical energy crisis during peak hours.

Ms. Kishori Rewatkar.et.al. [2] Introduces, by using Demand Meter, the delinquency of stealing power may be conveyed to an end. This recommended work will help us in preserving power so that our country will be improved. Load management is one of the main functions that allows Industrialist to make up-to-date decisions regarding their power consumption and supports the power suppliers reduce the crest load demand and remake the load profile.

Mr. Syafrudin Masri.et.al. [3] Evaluated the DSM measures to gain the energy saving in terms of reducing the electricity bill. With the

increasing of electricity tariff by power provider since January 2014, the consumer must bridge the alternative way to make sure the operational cost (electricity bill) is not increase. Load management program and load growth plus conservation program. The load management program by clipping technique is proposed in this case study in order to achieve the goals. This technique is chosen because the expected impact on electrical tariff reduction is greater and efficient cost reduction compared to other techniques such as power factor regulation in energy reduction program. The main strategy is to manipulate the maximum demand by changing the main supply from power provider to the alternative power generator during the peak hours.

The efficiency and reliability of energy monitoring thus promoting the comprehensive energy management of specified building or premises. Implementing this method, the consumer that is USM will consume the same amount of electricity demand without interruption operation of the existing system and at the same time, pay the lowest rate. From the case study presented, USM can generate saving almost 15% from the annual billing per year only from Library (LI) building. This is a huge overview how much USM can save by generate it annually if this proposed strategy is implemented to another buildings. On the other hand, the energy saving could be increase if all the DSM measures are incorporate together to achieve a better energy saving scheme. In order to support the sustainability, the alternative power supply instead of using the diesel gen-set can be considered such as photovoltaic power, wind power or biomass diesel which offer more economic features and less maintenance. Last but not least, the management of USM is highly recommended to support the energy management program in order to improve the efficiency of building's energy. Thus, gain the energy saving.

3. BLOCK DIAGRAM

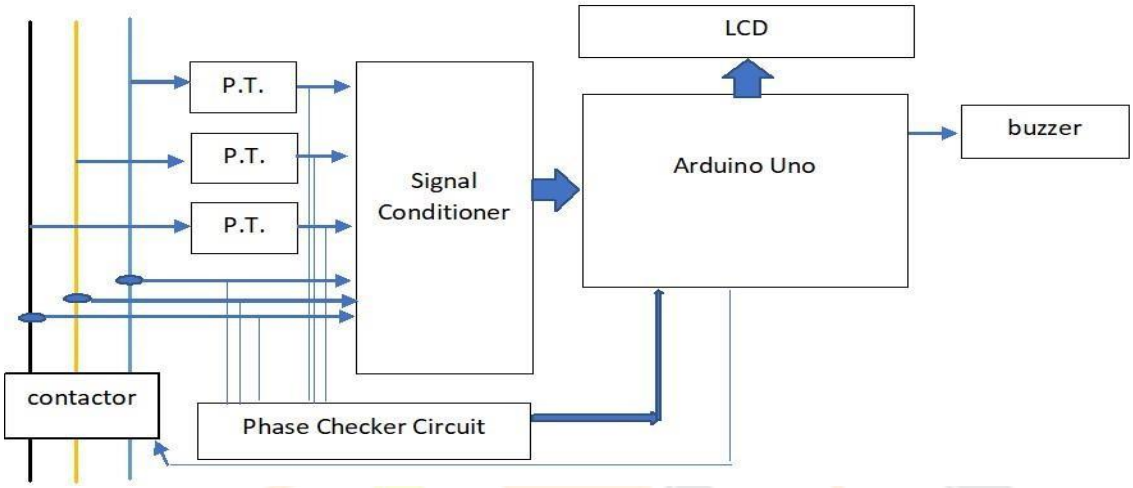


Figure 1: Block Diagram

4. Operation

As shown the above figure for industrial load monitoring. It consists of microcontroller, LCD, signal conditioning circuit as step down transformer. Our project in the first stage we have used Proteus for simulation of project circuit. In the circuit the Arduino Uno is used for sensing the input voltage with the help of step-down transformer. In our project step down transformer is used as P.T. to reduce the voltage level from 230V to 12V and this voltage rectified using rectifier and filtered through C type filter this dc voltage given to voltage divider network which reduces to 12dc to required Arduino voltage level. Hence this voltage is continuously monitored and for current measurementuses the CT for sensing each phase current.

The Arduino Uno will measure the input voltage and current flow and same time it calculates the power and if the system current flow is beyond the above limit, then microcontroller will alert the consumer using buzzer.

5. Hardware design

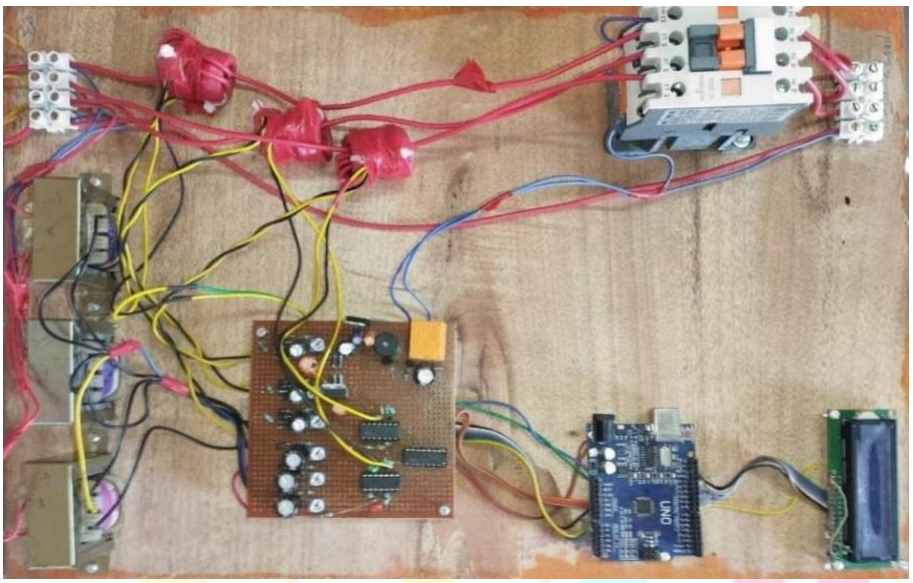


Figure 2: Operational Diagram before Running Condition.

5.1 CONSTRUCTION

Our project implement on microcontroller based industrial load management system the complete system works on DC power supply of 12 volt, so we have used 12 volt adopter which is readily available in the local market. Our final project monitor input voltage, input current, power & present power factor, to achieve this we have use different electronic components which is as follows one by one. To monitor input voltage of each phase we use step down transformer of 0-9 volt, 5 amp capacity transformer. This transformer converts the input voltage of 230 volt into the 9 volt that is the step down the voltage and same time transformer maintain the isolation from higher voltage because on the secondary side we uses microcontroller. The output from the transformer is low voltage AC that is 9 volt this voltage is now converted into DC which is required for measurement of input voltage because microcontroller works on the DC voltage for that purpose we have simple half-wave rectifier and capacitor 'C' type filter to get pure DC. In our project we use IN4007 PN junction diode and 470 microfarad, 25 volt capacitor. The output from this circuit is connected to microcontroller via voltage divider network R and POT the voltage divider network circuit reduce the voltage as we required for operation of Arduino to analog voltage measurement so the Arduino is programmable to measure the analog values which is from MSEB and display on the LCD. The same circuit is used for another phases of Y and B phase to measure input voltage. We have use current transformer to measure the flow of current. To measure power factor we need the phase difference of voltage and current of respective phase to the Arduino.

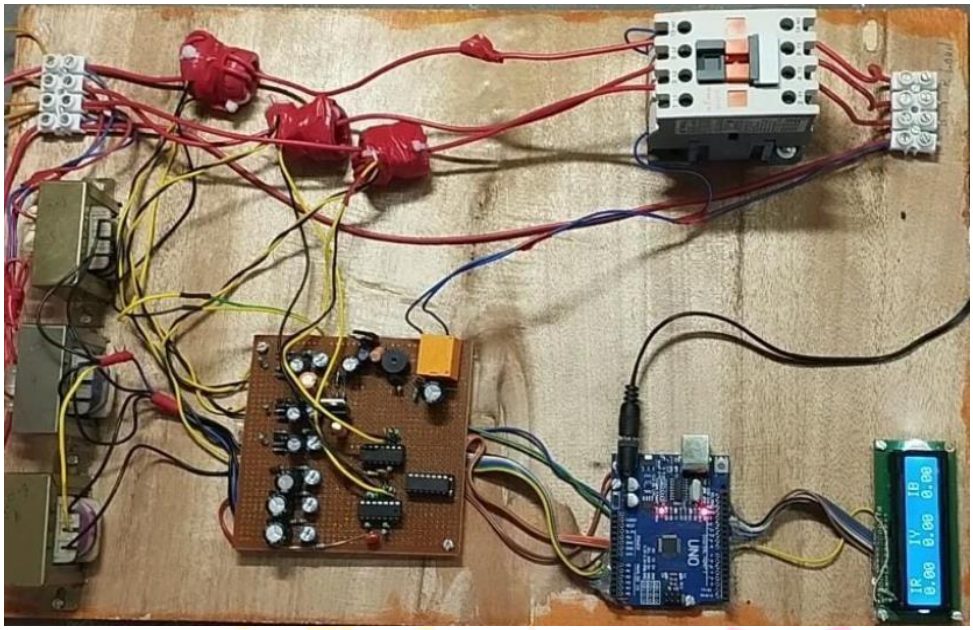
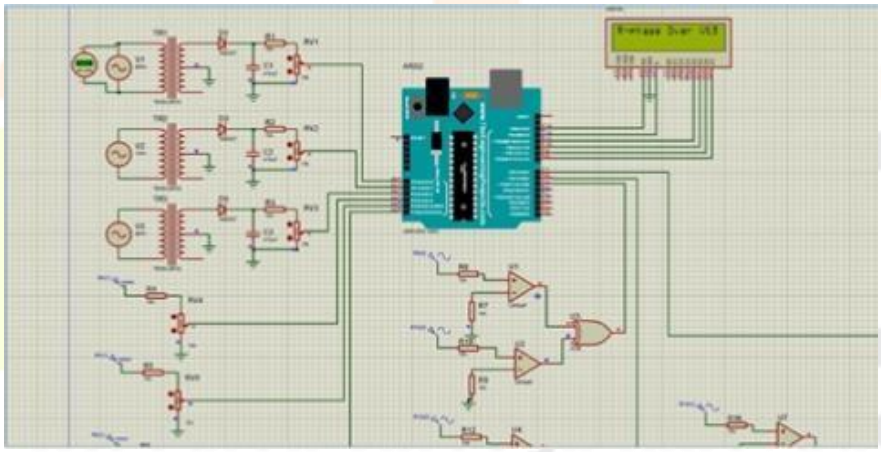


Figure 3: Operational Diagram for after running conditions

5.2 WORKING

In our project the current flow we have use current transformer to measure the flow of current. The current transformer to measure the flow of current. The current transformer generated voltage is depend on the current flow through the circuit. The current transformer develops voltage which is in ac type so we need to convert into dc. Hence we use bridge rectifier and capacitor 'c' filter to get the pure dc. The same circuit is used for Y and B phases. The output of circuit is connect thorough voltage divider now to Arduino pin A3, A4 and A5 respectively of CT R, CT Y and CT B. Then Arduino was programmed into analog read function which was monitor C.T. values and displayed on the LCD.



To measure power factor we need phase difference of voltage and current of respective phase to the Arduino so that Arduino can monitor the phase difference of voltage and current. To get the voltage ad current data we have used X-OR gate for sensing the phase difference between voltage and current but X-OR gate need to get input of square wave. So first we have convert the input voltage and current into square wave by using sine to square converter op-amp circuit for that purpose we gave used IC 324 op-amp which can convert sine wave into square for 3phase as shown the circuit diagram of project. This two square wave output is applied to X-OR gate. The X-OR gate function is that when both the input are equal then output will be zero otherwise output will be one (high). The same concept here used to monitor phase difference is voltage and current. Phase difference occurred the X-OR gate output will be high then Arduino was monitor the high pulse period and calculate the power factor of input signal. This circuit same used for another phases.

For measurement of power Arduino already monitored the voltage, current and power factor then Arduino can easily calculate the power of each phase by multiplying it and displayed on the LCD. Then our system(Arduino) will monitor the power of each phase if power is above 80% capacity of system load capacity then buzzer was indicating is that system 80% loaded and whenever the power reaches to 100% then our system will the capacitor for isolating the load from source side so we can avoid the excessive demand from source side and same time our project protects the load from excess high voltage when any one of the phase goes above the 250 volt then at that time again contactor operatesand load removed from faulty source.

6. Result

Sr. no	Input Voltage			Output current			Output power			Power factor			Contactor operation
	R	Y	B	R	Y	B	R	Y	B	R	Y	B	
1	220	220	220	0	0	0	0	0	0	0	0	0	Normal
2	220	220	220	1	1	1	220	220	220	1	1	1	Normal
3	255	220	220	1	1	1	255	220	220	1	1	1	Contactor trip
4	220	255	220	1	1	1	220	255	220	1	1	1	Contactor trip
5	220	220	255	1	1	1	220	220	255	1	1	1	Contactor trip
6	230	230	230	2.5	2.5	2.5	575	575	575	1	1	1	Normal
7	230	230	230	3.69	2.5	2.5	849	575	575	1	1	1	Buzzer Alarm Contactor Normal
8	230	230	230	2.5	3.69	2.5	575	849	575	0.99	0.99	0.99	Buzzer Alarm Contactor Normal
9	230	230	230	2.5	2.5	3.69	575	575	849	0.99	0.99	0.99	Buzzer Alarm Contactor Normal
10	230	230	230	5	2.5	3	1138	570	570	0.99	0.99	0.99	Contactor trip

7. Conclusion

In this paper we have designed beneficial industrial load management methods and process. The paper which shows the project is auto scaling also predictive control method adopted to optimize demand control. It's economical with smooth, quick response and user friendly.The concept of project is designed in simulator help of digital microcontroller. This report shows the all-operating conditions of project in simulator.

8. Acknowledgment

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