© September 2021 | IJIRT | Volume 8 Issue 4 | ISSN: 2349-6002

A Real-World Method for Handling Power Demand Using a Pic Microcontroller

Shashirekha Y J [1], Venugopal Gowda D [2], Asma Banu S [3]
[1,2] *Lecturer, Department of Electronics and Communication Engineering, Government Polytechnic for Women Hassan, Karnataka, India.*
[3] *Lecturer, Department of Electronics and Communication Engineering, S J (Government) polytechnic Bengaluru, Karnataka, India.*

***Abstract*—Maximum power demand management is an embedded-based project that may be imposed in industries that need to monitor and regulate the amount of active load, both critical and non-critical. In order to exert control over these specific characteristics, industries must employ a proprietary controller. In the event of a load overflow or the need to operate the generator in an entirely automated mode based on the principle of prioritizing important and non-critical loads, this project's goal is to use a single controller to sequentially distribute electricity from several feeds. Industries, schools, and big consumers may all benefit from this project's power management features. The level of authority is inadequate in a lot of nations. This means that businesses, schools, and other major customers can only get a limited amount of power from the electrical board. They will be subject to a fine if their quantity goes over the limit. Distributing the overall dynamic line load across the various stages in accordance with the specified feeder rating is the primary goal of our project. Whenever demand arises, the phase will automatically distribute the load to the other feeders if a certain feeder's value is surpassed. In addition to monitoring and controlling the settings using an embedded system, the system would automatically start a generator when the maximum power is utilized, a condition known as overload.**

***Index Terms*—PIC Microcontroller, Embedded Systems, Low Power Design. Active Load.**

1. INTRODUCTION AND LITERATURE REVIEW

Despite the standard charge for the number of units consumed, customers are required to pay a maximum demand charge [1]. Screen control is crucial for the purpose of utilizing and deactivating or reducing critical and non-critical burdens. The maximum demand controller is a device that is designed to address the issue of entrepreneurs who are aware of the estimation of load administration [2–4]. When the generator continues to operate on demand, an alarm is emitted as it approaches a predetermined standard. In the event that a remedial action is not taken, the controller will turn off critical burdens in a coherent manner. This arrangement is predetermined by the client and is subject to mutual modification by the client and the device provider. The plant equipment selected for load administration is halted and resumed in accordance with the desired load profile [5, 6]. The demand control method is implemented through the implementation of suitable control schemes. Visual and auditory announcements have also been effectively implemented. This initiative can be employed to manage loads in industries and, in addition, to circumvent penalties and production losses.

The Automatic Power Factor Correction (APFC) unit was the previous approach to managing the highest possible power demand [7]. The power factor is defined as the ratio of genuine power to illusory power. This definition is technically referred to as kW/kVA, where the numerator represents the active power and the denominator represents the evident power or (active + reactive). Reactive power is the non-working power generated by inductive loads in order to generate magnetic flux. When reactive power increases, the apparent power also increases, resulting in a gradual decrease in the power factor [8]. Conversely, the power factor is indicative of the apparent power. A framework that is inefficient is indicated by a low power factor, which will result in power loss. The industry is required to pay a higher price to meet its demand due to the low power factor, which in turn reduces the productivity of the framework. Therefore, the mechanical devices were subjected to a reduced punishment through the use of power factor correction [9]. Synchronous motors, automatic capacitor banks, and static capacitor banks are all components of power factor correction techniques. A capacitor bank, whether static or automatic, has a wide range of applications due to its minimal material cost and straightforward maintenance.

The objective of this initiative is to establish a generator control system that enables load demand management. The address and data lines of each device are individually and customarily associated with a microcontroller when they are associated. The outcome is a significant number of traces on the PCB, which necessitates additional segments to connect everything together. Consequently, these frameworks are expensive to produce and susceptible to interference and noise. An automatic system for the sharing of pipelines, the control of critical and non-critical loads, and the use of generators has been implemented to address these complexities.

2. MAXIMUM DEMAND CONTROL

2.1 Design of a Control System for Maximum Demand

In this illustration, it is made abundantly evident that the loads are controlled by the generator, and that the parameters are both monitored and predetermined. A microcontroller with the model number PIC16F877A is capable of controlling the process of numerous tasks, and an LCD unit can monitor the process. However, when the maximum value is surpassed, the operation will be begun by drivers of relay units. The first stage of the circuit is excellent, but what happens when the maximum value is exceeded? As soon as the value of the restriction and control measure reaches seventy percent, the relay is activated, and the circuit is closed. Second relay is activated when the voltage reaches 75%, and non-critical loads are turned off when the voltage reaches 85%. After reaching 95%, the relay will trip the AC line, which will then cause the generator to turn on automatically. During this procedure, the LCD device will show the information. When the generator is started, the parameters such as current, voltage, and load power will be monitored, and the LCD will be able to show the results of these monitoring operations. A buzzer is responsible for producing a beep alert in the event of an emergency situation. This alarm is then sent to the user or a control engineer for the purpose of acknowledging the power house unit of industries.

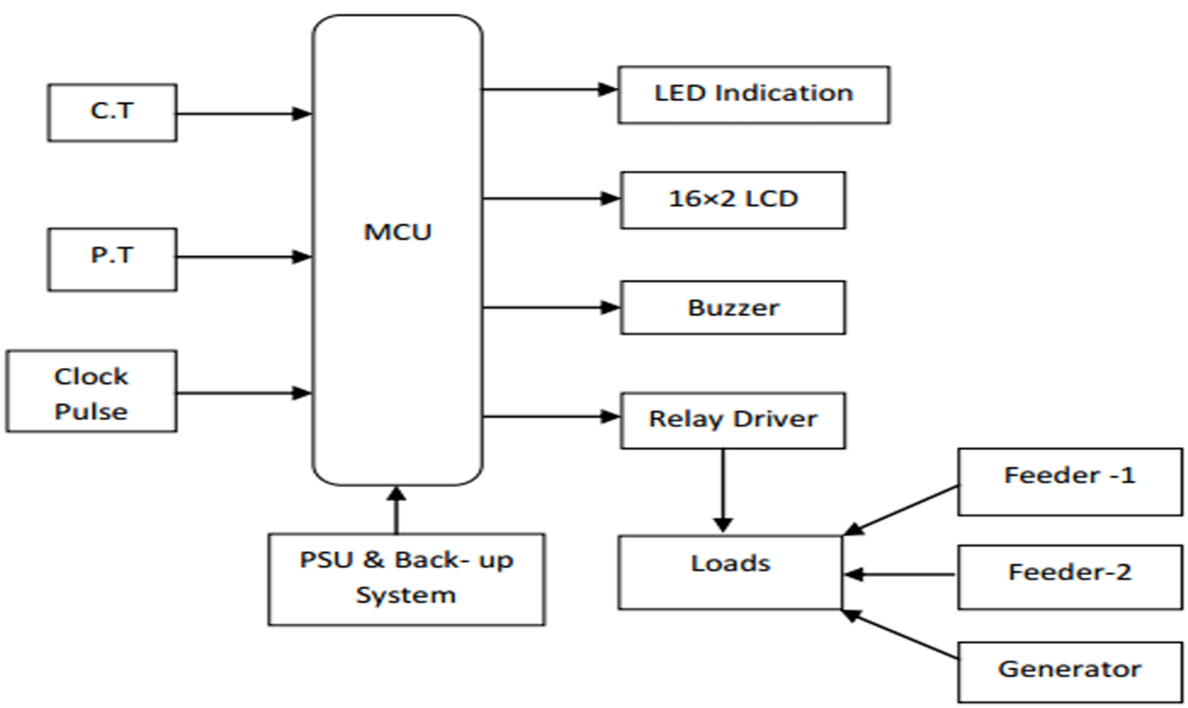


Fig. 1: Block Diagram for Maximum Demand Control in Function.

In Figure 1, the functional block diagram of maximum demand control is shown, as is the entire flow chart that serves as the basis for the design of the control mechanism that is depicted in Figure 2.

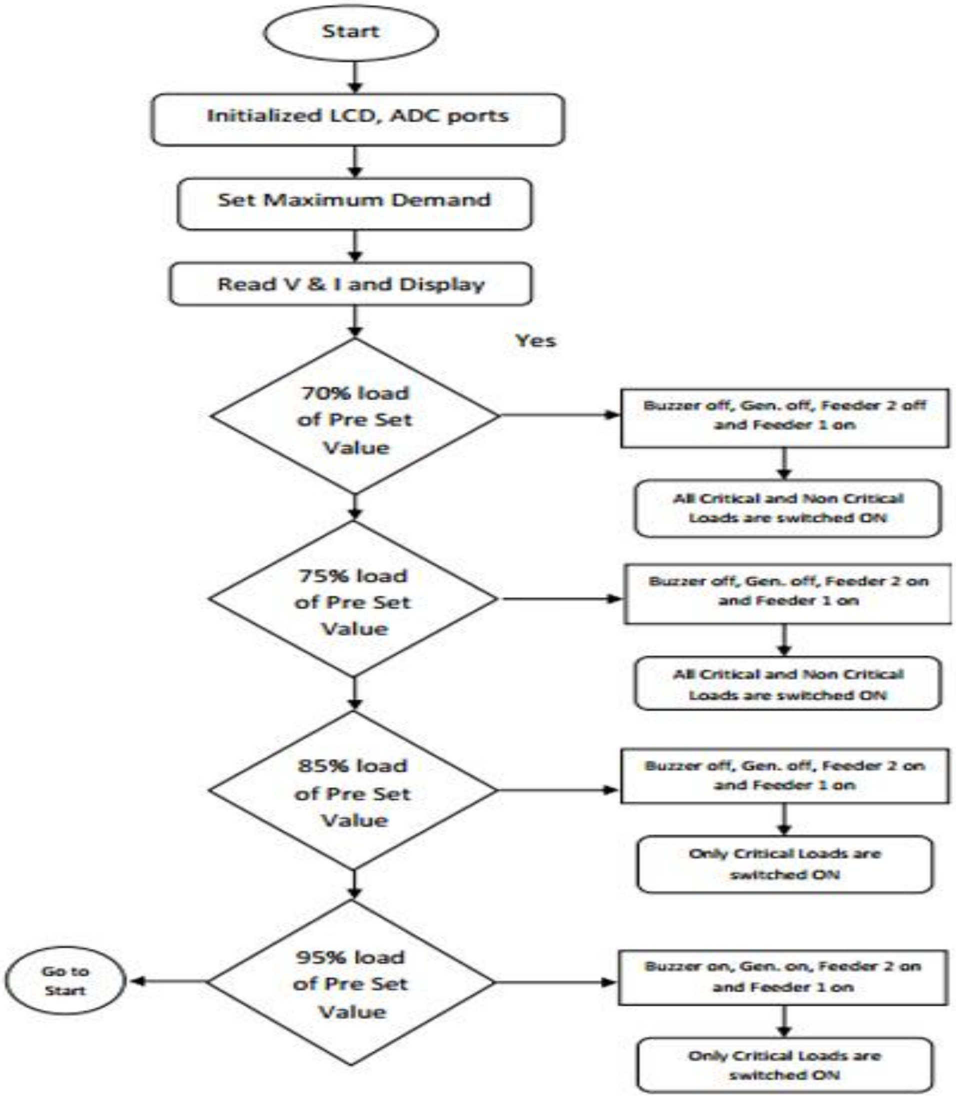


Fig. 2: Maximum Demand Control Flow Chart.

2.2 Program Design and Simulation

This particular project makes use of two distinct kinds of software. C is the programming language that is used for the PIC16F877A. To get the hex file, the C language is assembled with the help of the CCS C Compiler. Through the use of PIC kit 2 burners, the hex file is loaded into the memory of the PIC.

For the purpose of acquiring a more sophisticated automation system, it is feasible to include the security system into this project. A higher number of sensors and loads would be able to be connected to the main integrated circuit serial port as a result of this. As a direct result of this, the PIC would be able to exercise control over the whole of the activities that are carried out by this automation system.

Assume Hardware Implementation and Testing purpose that,

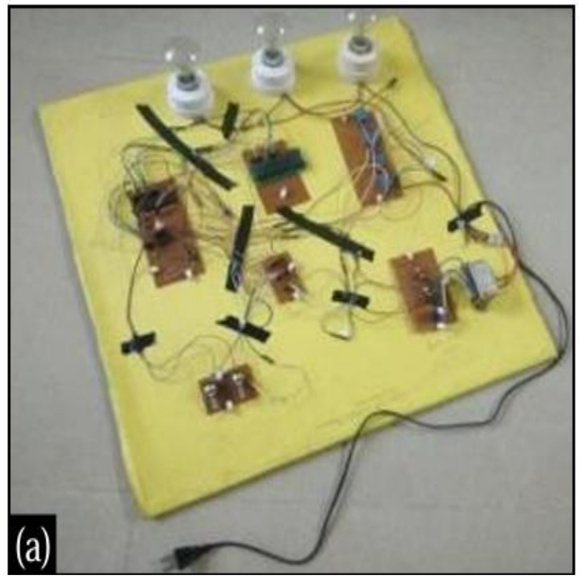
Line voltage =400 V,

Power factor =0.8 lagging,

Total load =4 MW (Full).

- 70% of full load =4×0.70=2.8 MW
- 75% of full load =4×0.75=3.0 MW
- 85% of full load =4×0.85=3.4 MW
- 95% of full load =4×0.95=3.8 MW

As can be seen in Figures 3 and 4, the normal functioning of feeder 1 is maintained after it has exceeded the power limit by seventy percent. As at this moment, both the critical loads and the non-critical loads are functioning to their full potential. In the event that the predetermined figure of load consumption is more than 75%, the feeder 2 will immediately begin operating. Figure 5 illustrates that all of the non-critical loads have been turned off in the event that the power absorption exceeds 85%. The information shown in Figure 6 demonstrates that after the maximum limit has been reached, only the essential loads continue to operate after being connected to the generator at 95% of load. Additionally, a buzzer is engaged and an alert sound is emitted. The liquid crystal display (LCD) device shows this procedure. When the generator is activated, the parameters such as current, voltage, and the amount of power that is spent will be monitored. These actions may be shown on the desktop, and a text message can also be sent to a buzzer or a control engineer using a GSM unit for the purpose of acknowledging the power house unit of industries. It is abundantly evident that the loads are run via the generator, and the parameters are monitored. Additionally, an intelligent choice is made by turning off the vital loads based on the importance of the load classification.



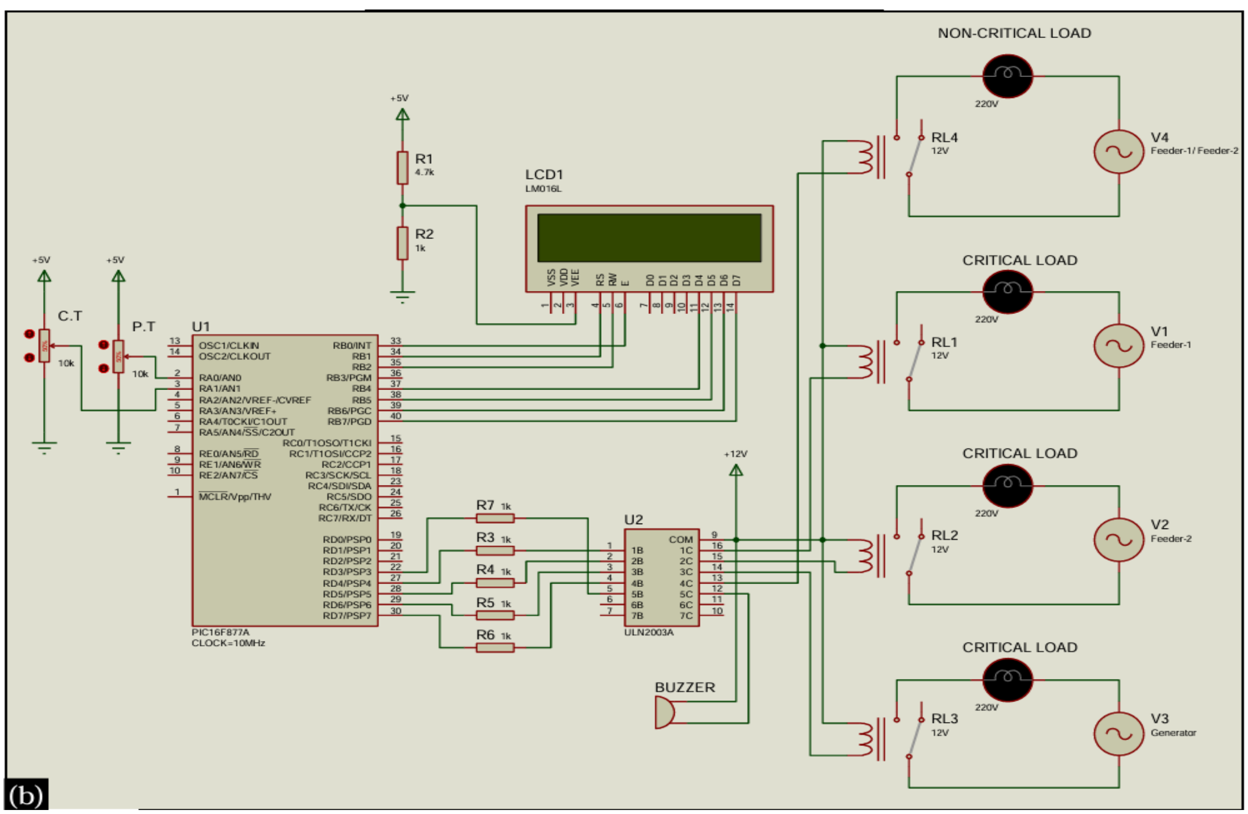


Fig. 3: (a) Complete Hardware Set up of Maximum Demand Control, (b) PROTEUS Circuit Simulation Diagram.

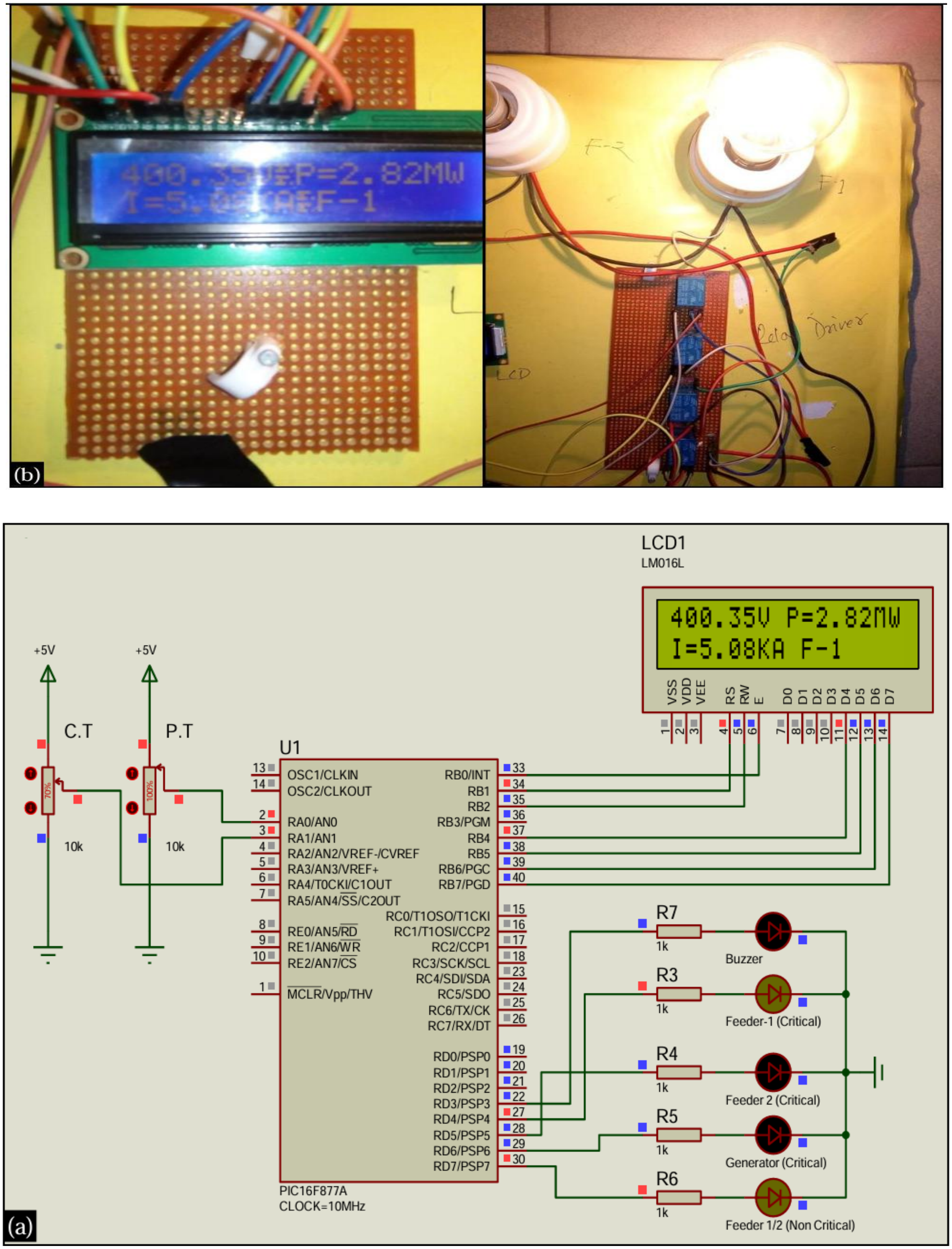


Fig. 4: (a) Simulation and Practical (b) Result for 70% of Full Load, then Gen. OFF, Feeder 2 OFF and Feeder 1 ON, Critical and Non-Critical Loads are Switched ON.

3. CONCLUSIONS

For the purpose of this research, a special focus is placed on the reduction of production losses via continuous operation, the avoidance of power demand, and the improvement of the effective output product through the reduction of maximum power. An efficient demand management project is implemented in order to reduce energy costs, positive constraints among lowered demand, and therefore prevent the penalty and power charges that have an impact on the assembly method. Due to the fact that it is advantageous in load shedding, it helps to utilize the smallest amount of implant generation and maximizes the utilization of each electrical distribution board's power and implant production. This, in turn, ultimately results in a low payback amount and substantial savings of both power and money at the end of the day. The use of simulation and the results of experiments are utilized in order to achieve the verification of the usefulness and effectiveness of the notions that have been offered.

REFERENCES

[1] Tao Xiong, Yukun Bao, Zhongyi Hu. Interval Forecasting of Electricity Demand: A Novel Bivariate EMD-Based Support Vector Regression Modeling Framework. Int J Electr Power Energy Systems. 2014; 63: 353–362p.

[2] Nandha N, Vincent Paul Regun J, Soundarrajan E, et al. Management of Maximum Power Demand with Generator Control Mechanism using I2C Protocol. IJCSMC. 2015; 4(4): 15–20p.

[3] Zhou Jing-Hua, Chen Cheng, Zhang Xiao Wei. Reducing Voltage Energy-Saving Control Method of Induction Motor. IEEE International Conference on Electrical Machines and Systems. 2013; 2159 2162p.

[4] Hanif A, Ahmed M, Choudhury MA. Investigating Voltage Restoration and Power Export in a Distribution System with Series Compensator using Distributed Generation. Arab J Sci Eng. 2009; 4: 265 291p.

[5] Saha S, Tyagi T, Netaji VG. ARM® Microcontroller based Automatic Power Factor Monitoring and Control System. IEEE Conference on Texas Instruments. 2013: 1–6p.

[6] Faisal Shahzad, Aamir Hanif. An Optimized and Cost-Effective Power Management System for End-Users of Electricity. ASRJETS. 2014; 14(1): 214 235p.

[7] Harnekar Aadam Ismail, Gaurang Kumar, Patel B. Automatic Power Factor Correction by Fine Tuning of Graded Capacitors. International Journal of Advance Research, Ideas and Innovations in Technology (IJARIIT). 2017; 3(6): 1425–1431p.

[8] Chao Lin, Chi-Hsiang Liao. A Method for Evaluating Energy Efficiency to Justify Power Factor Correction in Ship Power Systems. IEEE Trans Ind Appl. 2013; 49(6): 2773–2782p.

[9] Ren HP, Zheng T. Optimization Design of Power Factor Correction Converter Based on Genetic Algorithm. 4th International Conference on Genetic and Evolutionary Computing. 2010; 293–296p.

[10] R. Paradiso, G. Loriga, and N. Taccini, “A wearable health care system based on knitted integrated sensors,” IEEE Transactions on Information Technology in Biomedicine, vol. 9, no. 3, pp. 337–344, Sep. 2005.