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SMART LOAD SHEDDING SYSTEM

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ABSTRACT

When the demand is more than the generation load shedding will be done to relieve stress on the utility grid and during this time, the entire area of the consumer premises including the street lights will be shut down. During such situation, most of the anti-social activities takes place and it will be difficult to cope up with the emergency situation. The main idea of this paper is to manage the available power from the utility grid in a fair manner to all consumers while avoiding complete blackout. Some loads in the consumer premises are assumed to be priority loads while others are non-priority load. In the proposed smart load shedding system, consumer premises will always have a minimum illumination for dealing with emergency situation and all the street lights will be ON. A centralized control supply interrupter where the officials can connect or disconnect a consumer from the utility grid is also employed here. In addition to this the monthly bill and consumption will be displayed at the consumer premises itself by connecting a user interface with system. The main benefit of this project is supplying uninterrupted power supply to consumer without load shedding and displaying the consumption of electricity by the consumers at their premises.

KEYWORDS: Load shedding, Blackout, Priority load and Non-Priority load, uninterrupted power supply, Monthly bill.

I. INTRODUCTION :

The level of demand for electricity is very high as it is human necessities of life either during day time or night. Most of human daily routines such as work, economy, livelihood, healthcare and leisure depend on a constant power supply. Thus, even a temporary power failure can cause chaos, financial loss, and possible loss of life. There are several unexpected causes of power failure such as natural causes like weather, short circuit, components broken and others. As the demand of electricity has increased throughout the decade, the failure of power system will affect the daily routines. Therefore, the methods to overcome power outages are developed and delivered worldwide such as the usage of solar energy, wind energy and biofuels energy as a back-up system. Load shedding is an intentionally-engineered electrical power outage where electricity delivery is stopped for non-overlapping periods of time over geographical regions. For manually maintaining load shading periods, some man power may be employed or by using computer it can be controlled efficiently. In the paper [1] the author describes about SMS based Load Shedding Period Control System. This paper demonstrates the need for a modern load shedding scheme and introduces the idea of developing a SMS based procedure for controlling the load-shedding system where manual work will be minimized by selecting the feeder, substation and duration of shedding time by the user by sending SMS. Simulation results, using the above proposed model, verifies the suitability of choosing such a SMS based automated load shedding period control system. In the paper [2] the author explains about the advanced metering infrastructure for smart grid applications. The paper describes possibility to apply innovation technology of Smart Grid for power system emergency automation. Operational characteristics of existing emergency automation and new suggested one are compared in the paper. The method for liquidation of drawback of existing automation is suggested..In the paper [3] the author gives the idea about electricity and load shedding monitoring. In this paper it will be monitoring current of two zones which are being diverted via the Distribution Point (DP). Two relays are also provided to cut off the loads in these two zones for load shedding or any other emergency purpose. A sensor is provided to check if the door of the DP is open or closed so whenever the door is opened an SMS is sent to the MSEB office as well as to the concerned electrician responsible for that DP. In India the most common problem is that most DPs are openwhich increases the number ofaccidents. If the power in the zones go off due to any wiring problem an SMS is sent to the MSEB office so you do not have to place a complaint for them to come and repair the unit moreover the MSEB can at any instance get the status by just sending an SMS to the DP. In the paper [4] the author gives a clear view about the effect of load shedding strategy on interconnected power systems stability when a blackout occurs. In this paper effect of load shedding strategy on restoring the power system in stable condition and preventing of other blackout in power system are studied. The system may even collapse in severe imbalances. Rapid and selective shedding of loads from the system may be a good option to restore the balance and maintain the system frequency. When a power system is exposed to a disturbance, its dynamic and transient responses are control by two major dynamic loops. These loops are: (A) excitation loop (including AVR), thisloop will control the generator reactive power and voltage. The excitation loop is operating via the excitation current regulation. And (B) frequency loop (including LFC), when the system is exposed to a disturbance this loop control is the active power and frequency of system. This loop is operating via regulating of Governor. In the paper [5] the author gives an idea about the power system load shedding (LS) key issues and new perspectives. This paper presents an overview of the key issues and new challenges on optimal LS synthesis concerning the integration of wind turbine units into the power systems. Following a brief survey on the existing LS methods, the impact of powerfluctuation produced by wind powers on system frequency and voltage performance is presented. The most LS schemes proposed so far used voltage or frequency parameter via under-frequency or under-voltage LS schemes. Here, the necessity of considering both voltage and frequency indices to achieve a more effective and comprehensive LS strategy is emphasized. Then it is clarified that this problem will be more dominated in the presence of wind turbines.In the paper [6] and [7] implementation of advanced instruments and application and communication requirements are

described. These advanced devices can be controlled through IoT .

Detaching of power is done to minimize the load being consumed by the society through several substations which are connected to the main power station and the main station instructs the sub-stations to cut some of the feeders for a certain period of time and thus the shedding procedure continues. In recent years, conventional load shedding schemes have been integrated with power management systems to provide an efficient load shedding system. It can provide faster and optimal load relief by utilizing actual operating conditions and knowledge of past system disturbances.

II. CHALLENGES TO EXISTING SYSTEM :

We know that most of the anti-social activities are take place during load shedding and it will be difficult to cope up with the emergency situations. So we have developed a system for providing minimum illumination for dealing with emergency situations and the consumers can use their appliances with in a particular load limit during the load shedding. And the street lights will not be affected by the load shedding. This system is very small so we can easily insert it into our existing system without changing house wiring. If we implement this system, we can reduce the amount of energy which we are buying from other grid.

The main theme behind the proposed method is to replace the computerized procedure for controlling the load-shedding time period by an IoT based system where the shedding management process, manual work may be minimized in a systematic way. A centralized control supply interrupter where the officials can connect or disconnect a consumer from the utility grid is also employed here.In addition to this the monthly bill and consumption will be displayed at the consumer premises itself by connecting a user interface with system. The main benefit of this project is supplying uninterrupted power supply to consumer without load shedding and displaying the consumption of electricity by the consumers at their premises.

III. OVERVIEW OF THE PROPOSED SYSTEM:

The System consists of hardware and software part. The block diagram of smart load shedding system is shown in figure 1. It consists of an Arduino controller as a main source and it receives input signals from the Wi-Fi module, where the Wi-Fi module receives the input from software part provided at the electricity provider side. The Wi-Fi module receives message from the cloud and send to the Arduino controller and it can activate or deactivate the relay circuits. Relay circuits are used to switch the circuit. Relays are controlled by relay driver, which is directly connected to the Arduino controller. Also remote connection and disconnection power supply can be done through this circuit.

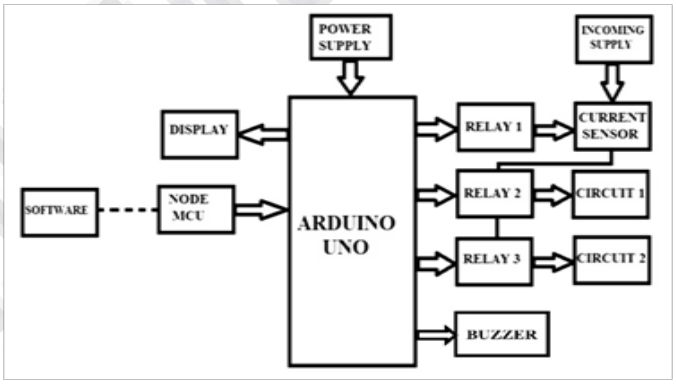

Figure 1: Block Diagram of the proposed System

IV. SYSTEM DESIGN :

HARDWARE DESIGN

ARDUINO UNO (ATMEGA 328)

Arduino board is the heart of our system. Entire functioning of system depends on this board. Arduino reacts to the 5v supply, keeps on counting the power consumption and then calculates the power consumed and also the cost. This data, is continuously displayed on the display screen, so that users can visit any time and check their consumption and cost. It even reacts accordingly as per programmed, to the situations like message sending during threshold value etc.

WI-FI MODULE

Wi-Fi stands for Wireless Fidelity. We are using Wi-Fi which acts as heart for IoT. Through Wi-Fi the authority can set changes in threshold value, and can ON and OFF the consumer supply.

CURRENT SENSOR

Current sensor in this system detects electric current in the circuit, and generates a signal proportional to that current. The generated signal could be analog voltage or current or even a digital output. The generated signal can be then used to calculate and display the value of power consumption and can be used for the purpose of relay operation.

RELAY

A relay is an electrically operated switch. In our system two circuits are controlled by relays. The circuits are load shedding circuit and disconnection and connection circuit. The relayoperates as per the commands which are provided by the Arduino board.

BUZZER

A buzzer or beeper is an audio signalling device, which maybe mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. In our system buzzer is used for the warning alarm before the load shedding period.

SOFTWARE DESIGN

In this system the software may be any type of open source platform. The term “open source” refers to something people can modify and share because its design is publicly accessible. The term originated in the context of software development to designate a specific approach to creating computer programs. This system uses a hardware-agnostic IoT platform with customizable mobile apps, private cloud, rules engine, and device management analytics dashboard. In future this software options can be added to the official software platform so as to improve the security and the system performance.

V. WORKING PRINCIPLE :

The principle behind the proposed system is to manage the available power from the utility grid in a fair manner to all consumers while avoiding complete blackout. Some loads in the consumer premises are assumed to be priority loads while others are non-priority loads. In the proposed smart load shedding system, consumer premises will always have a minimum illumination for dealing with emergency situation and all the street lights will be ON. A centralised control supply interrupter where the officials can connect or disconnect a consumer from the utility grid is also employed here. In addition to this the monthly bill and consumption will be displayed at the consumer premises itself by connecting a user interface with system. Whenever the officials send the load shedding commands to the system through cloud, it informs the consumer by a warning alarm before a particular time of load shedding. If someone uses electricity without paying their electricity bill, then there is no need of a person to go there and disconnect the consumer from the utility grid since the smart load shedding system facilitates remote disconnection and connection from the electricity authority.

VI. DISCUSSION OF RESULT :

The experimental result of the proposed system is shown in figure 2 and figure 3. Figure 2 shows the hardware circuit arrangement whereas figure 3 shows the developed software window of our proposed system. When the load shedding command sends from the software the buzzer which is attached with the hardware will make a warning beep sound for the attention of consumers about the load shedding. There are two different control buttons in the software window as show in the figure 3.The disconnect/connect option allows remote disconnection and connection of consumer supply.

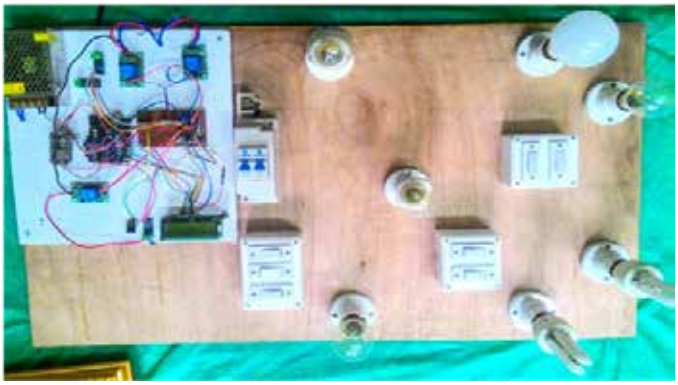

Figure 2: Developed hardware circuit of the proposed system

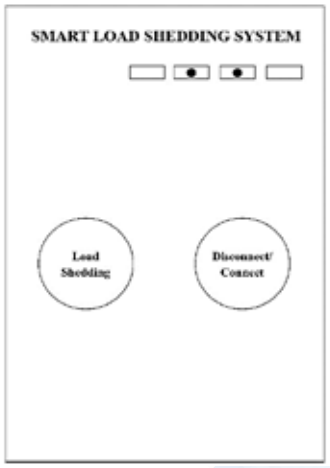

Figure 3: Developed software window of the proposed system.

VII. CONCLUSION :

This article proposed a new approach of load shedding by using Arduino UNO as microcontroller and Node MCU as interface with the users in the purpose of the flexibility of the customers to monitor their current bill, power consumptions and load shedding period can be displayed with a LCD provided at the consumer side. If the consumer does notpay the monthly electricity bill the officers can remotely disconnect the power supply without going to the consumer house.

We know that most of the anti-social activities are take place during load shedding and it will be difficult to cope up with the emergency situations. Hence, a system for providing minimum illumination for dealing with emergency situations and the consumers can use their appliances with in a particular load limit during the load shedding is developed . Moreover the street lights will not be affected by the load shedding. This system is very small and we can easily inserted into our existing system without changing house wiring.If this system is implemented,thethe amount of energy which we are buying from other grid can be reduced.

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