SENSOR MODULES ACTIVE & INTELLIGENT ENERGY SAVING SYSTEM

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ABSTRACT: Electricity is one of the most critical prerequisites of contemporary society, without which a variety of critical applications will come to a halt. As we all know, the demand for power is on the rise these days. When demand exceeds supply, electric companies favor load shedding. As a result, in a distribution system, it must be carefully monitored for a certain time period. Using embedded systems, Time Based Electricity and Load Shedding Monitoring is a stable and effective load shedding system that automates the process of turning on and off the electrical supply according to time. It uses a software-based real-time clock to communicate with the ARM CPU (RTC). The article "Time Based Electricity and Load Shedding Monitoring Using Embedded Systems" will discuss real-world load shedding techniques, such as monitoring distribution substations and load shedding for many cities from a single location.

Keywords: Load shedding, Real-time clock (RTC), and ARM processor are some of the terms used in this paper.

I. INTRODUCTION

The power generating system must be in a stable state for the whole distribution system to work properly. The stable condition is defined as the power generated by the system being fully used in operating and no losses remaining so that the equation can be valid. System = Reserved power + produced power Losses + running power However, if there is an unexpected increase in demand in the Load, the system may become unstable during peak demand periods. Load-shedding is a procedure used by the electrical authorities to deal with a shortage of electrical power utilized by society. Shedding is done through various substations that are connected to the main power station to reduce the load absorbed by society. When the power generator's frequency drops, it is unable to create the requisite power. As a result, the authority does not have the required quantity of electricity, forcing it to undertake a shedding. The main station then instructs the substations to cut some feeds for a set amount of time, and the shedding process continues. Manufacturing facilities with on-site generation typically employ some kind of load shedding to guarantee that the system remains stable and available during disruptions. Traditional underfrequency and PLC-based load shedding techniques have been combined with computerized power management systems to create a "Automated" load shedding system in recent years. By employing real operating circumstances and algorithms, it may deliver faster and more effective load alleviation and knowledge of past system disturbances. The major goal of the suggested technique is to provide a computerized mechanism for regulating the load-shedding time period in a systematic manner so that manual labor is reduced throughout the shedding management process. With a suitable user-friendly interface given with the system, this automated shedding plan would be simple to run and have less complexity. As a result, the "Load shedding time management system employing microcontroller" is a trustworthy system for monitoring the on/off of electrical equipment according to time. Atmega328 microcontrollers are used to communicate with a real-time clock system. When the specified time and real time coincide, the microcontroller instructs the relay to switch on or off the load.

II. RELATED WORKS

When weather causes an imbalance in demand and supply, load shedding is implemented. The methods used to create distributed undervoltage load shedding are addressed in [1. In order to combat voltage instability, a novel design based on load shedding is proposed. [2] proposes a novel condensed, adaptive load shedding method that makes use of voltage and frequency data from phasor measuring equipment (PMUs). The utilization of reactive as well as active power in load shedding strategies is a fundamental contribution of this innovative approach. As a result, this novel strategy concentrates the blending of voltage and frequency stability issues significantly better than previous methods. The novel technology [3] makes a significant contribution by combining reactive and In the load-shedding strategy, active power is used. To reduce power outages and the peak-to-average ratio during fast grid load variations, [4] recommends offload shedding and Smart-direct load control (S-DLC). A forecasting and shedding technique is used by the software. Stream analytics and the Internet of Things were also used in this system to provide real-time load management (IoT). An uninterruptible power supply system fueled by fuel cells is used in [5.] A grid interface inverter is connected to a fuel cell and a super capacitor through a 3-port bidirectional converter.. A system can operate in one of two modes: stand-alone or grid-connected.

III. METHODOLOGY

The main purpose of the electric power system is to recognize the power structure to consumer's loads. An electric power system consists of three parts:

1. Power generation
2. Transmission system
3. Distribution system

In a power producing plant, electric electricity is generated at 11kV, 50Hz. It is stepped up to 400kV, 220kV for sending across long distances in order to decrease power losses when transmitting power. The transmission network uses a high-voltage wire to transport power. These power lines usually run for hundreds of kilometers and transmit power to the grid. These load centers (cities) are connected to the grid through a 33kV (or occasionally 66kV) sub-transmission network. These lines terminate in a 33kV (or 66kV) substation, where the voltage is stepped down to 11kV for distribution to load points across an 11kV and lower distribution system.

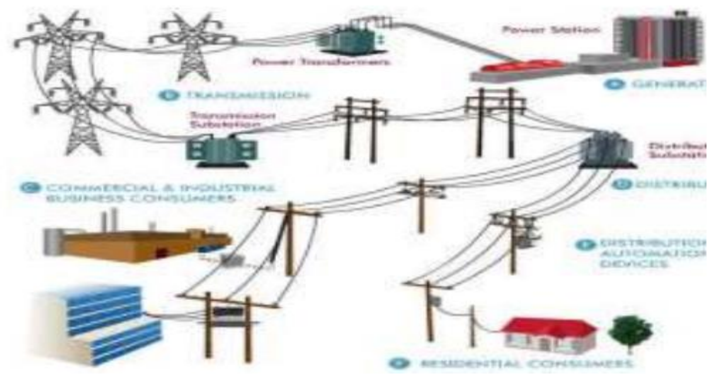

Fig. 1: Power system network

This section depicts a review of a number of effective load shedding techniques which are:

A. Manual load shedding technique

The power supply is interrupted by an electrician stationed at the substation for a set amount of time to regulate the deficit of electrical energy utilised by the locality in the manual load shedding approach. Load shedding was done manually at the substation in this way to turn off the power supply in a specific area.

B. Programmable load shedding

The demand for energy changes throughout the day, according to the data from the various chronological demand curves (Figures 2 and 3). It is quite difficult to generate enough capacity to meet such a large demand. When demand exceeds supply, the electricity system requires an effective load shedding strategy.

"Time-Based Electricity and Load Shedding Monitoring Using Embedded Systems" is a dependable technology that automates the process of turning on and off the electrical supply based on time. It works with an ARM CPU and uses a software-based real-time clock (RTC). When the specified time equals actual time, the ARM processor sends a command to the associated relay to turn on the electric load, followed by a command to turn off the load according to the programmed.

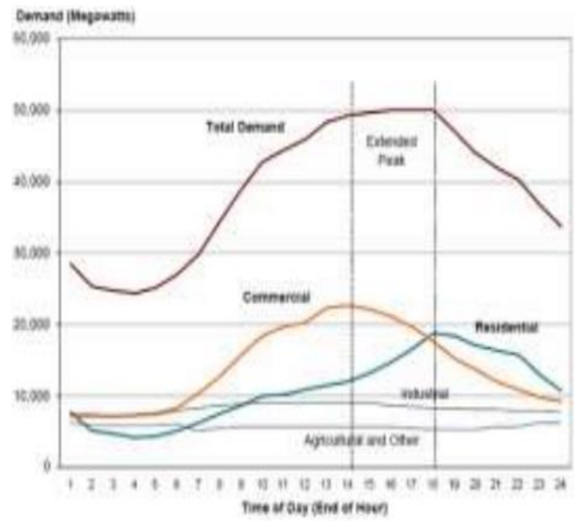

Fig. 2: Electricity Load Curve (For Demand in Megawatts)

The most significant benefit of this project is the ability to enter multiple ON/OFF time inputs. A computer-based control system aids in the overall monitoring of the operation. Information regarding the state of the load is provided through a computer-based GUI (Graphical User Interface) that is also interfaced to the ARM processor Cities where the load shedding is carried out.

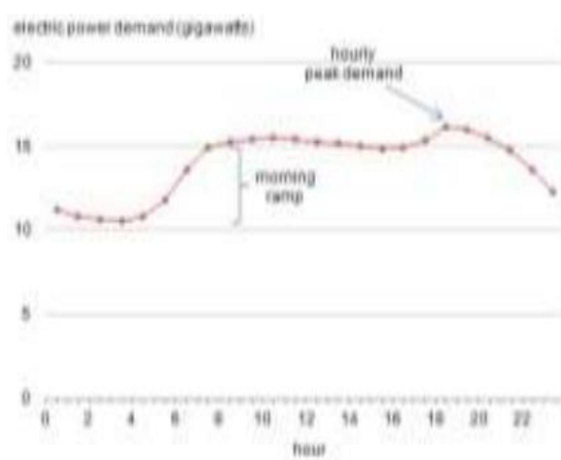

Fig. 3: Electricity Load Curve (For Demand in Gigawatts)

IV. BLOCK DIAGRAM

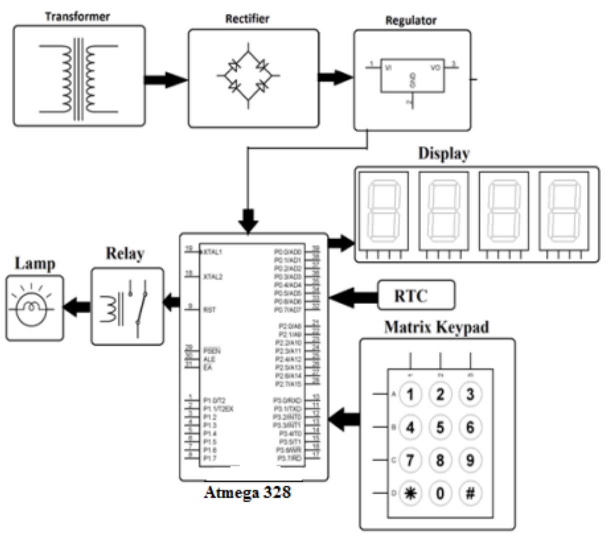

Fig 4: Block Diagram

A. Regulator

“A controller (regulator) is a device that maintains a constant voltage. The controller's blockage varies depending on the heap, resulting in a steady yield voltage. The controlling device is built to work as a variable resistor, continually changing a voltage divider system to maintain a constant yield voltage and dispersing the difference between the information and regulated voltages as waste heat. An exchange controller, on the other hand, employs a functioning device that alternates between on and off in order to maintain a consistent yield estimate. The efficacy of a straight controller is restricted because the directed voltage must always be lower than the input voltage, and the information voltage must always be high enough to allow the dynamic device to shed some voltage.”

B. RTC

“The DS1307-dependent module, in addition to 56 bytes of NV SRAM, the DS1307 serial Realtime clock (RTC) is a low-power, complete binary coded decimal (BCD) clock/schedule. An I2C bidirectional transport transports address and information in a consecutive manner. The clock/schedule shows seconds, minutes, hours, days, dates, months, and years. The month's end date is naturally balanced over a lengthy period of time, with less than 31 days, including jump year adjustments. The check features an AM/PM marker and may be used in a 24-hour or 12-hour configuration. A built-in power system of the DS1307 detects power limitations and automatically changes the force to compensate. While the portion smoothly operates from the reinforcement, the timekeeping activity continues.”

C. LCD

“LCD (Liquid Crystal Display) screens are electronic display modules that may be used in a variety of applications. A 16x2 LCD display is a common component in many devices and circuits. Seven-segment and other multi-segment LEDs are preferable to these modules. This is because of the following reasons: LCDs are inexpensive, simple to programmed, and allow for the display of distinctive and even original characters (as opposed to seven segments), animations, and other effects. A 16x2 LCD may have 16 characters per line on each of its two lines. A 5x7 pixel matrix is used to represent each character on this LCD. Command and Data are the only two registers on this LCD. A file is preserved for the LCD command instructions. LCD screens (Liquid Crystal Display) are electrical display modules that may be found in the command register. A command tells the LCD to perform a certain task, such as initialising it, cleaning its screen, setting the cursor location, managing the display, and so on. The information that will be shown on the LCD is stored in the data register. The ASCII value of the character to be shown on the LCD is the data."

D. KEYPAD

"In microcontroller-based jobs, matrix keyboards are essential as an information device. The typical technique of connecting a network console to a microcontroller is to use the MCU's many I/O pins. The MCU then uses a filtering computation to determine which keys have been crushed. The disadvantage of this method is that it necessitates the use of a large number of MCU I/O pins to connect the console. To connect a 43 console, for example, you'll need seven advanced I/O pins. It recognizes what information is by filtering each line and segment."

E. RELAY

"The output is obtained via a relay. Control is sent to the main power source from the relay's output. The entire system functions like a switch."

F. Atmega328

"The Arduino UNO is an open-source microcontroller board manufactured by Arduino and based on the Microchip ATmega328P microprocessor. The board has a number of advanced and simple data/yield (I/O) sticks that may be attached to various development sheets (shields) and circuits. The board includes 14 digital connections and 6 analogue pins, and it can be programmed with the Arduino IDE using a USB type B connection (Integrated Development Environment). It can be powered by USB or an external 9-volt battery, although it can only detect voltages between 7 to 20 volts, which is similar to the Arduino Nano and Leonardo. The system reference configuration is available on the Arduino website under a Creative Commons Attribution-Share Alike 2.5 license.. There is also design and introduction information for suitable duplicates of the equipment. The name "Uno" was selected to mark the introduction of Arduino Programming (IDE) 1.0. It means "one" in Italian. The Uno board and Arduino Software (IDE) version 1.0 were the reference versions of Arduino, and are now superior to newer releases. The Uno board, as well as the Arduino stage's reference version, are essential in the production of USB Arduino sheets. The Arduino Uno's ATmega328 chip has a boot loader that allows you to upload new code without a software developer. It delivers its message during the main STK500 conference. The Uno also differs from previous boards in that it does not have the FTDI USB-to-sequential driving force chip. Rather, it uses an Atmega16U2 (or an Atmega8U2 in the case of version R2) as a USB-to-sequential converter."

G. TRANSFORMER

"A transformer's inert coupling between its winding circuits allows it to transport energy. A changing magnetic flux in the transformer's core is caused by a changing current in the primary winding, which generates a changing magnetic flux in the secondary winding. The electromotive force changes as the magnetic flux changes (emf)".

H. LED

"A light-emitting diode (LED) produces light when electricity passes through it. Photons are produced when electrons in a semiconductor recombine with electron holes, releasing energy. Electroluminescence is a term for this phenomena."

V. CIRCUIT OPERATIONS

1) Atmega 328 microcontroller IC, 16*2 LCD module, 7805 voltage controller IC, 4*3 keypad, DS12887 RTC IC, relay, and Crystal oscillator make up the programmable burden shedding time the executives for utility division circuit.

2) The 7805-voltage controller converts the info voltage to 5V and sends it to the Atmega328 microcontrollers' VCC (pin 28). This voltage is critical for the microcontroller to function properly. A DS12887 RTC connects to the microcontroller's port0, which runs from pins 32 to 39. The RTC displays the current situation at any given time. When the RTC is adjusted, it will continue to operate even if the force is interrupted in the middle. From pins 21 to 28, the keypad is connected to port 2 of the microcontroller. The keypad is used to set the continuous, the best time for load shedding, and the time span for load shedding. From pins 1 to 8, the 16*2 LCD is connected to port 1 of the microcontroller. The precious stone oscillator assists with giving the working recurrence 16Mhz to the microcontroller.

3) We updated the microcontroller so that we could set the true time and the burden shedding time. We may monitor both continuous and burden shedding time using the application. The programmed checks for fairness on a regular basis, and if it detects a coordinated yield transfer, it turns it off. It began to check fairness with goal time and continuous, at whatever point coordinated handoff was turned on, at that point.

VI. THE ALGORITHM

STEP 1: GET STARTED.

STEP 02: Set up the RTC.

STEP 03: Turn on the LCD.

STEP 04: Activate the relay.

STEP 05: Use the LCD to show the time.

STEP 06: If pin P3.2=0, proceed to step 7; otherwise, proceed to step 8.

STEP 07: From the keypad, read the character '#'.

STEP 08: Go to step 10 if n=1.

STEP 09: Go to step 13 after updating the current time.

STEP 10: If n=2, proceed to step 11; otherwise, proceed to step 12.

STEP 11: Set the power off alarm time and interval, then go to step 13.

STEP 12: Show "try again" and go to step 13.

STEP 13: Move to step 14 if the current time matches the alarm time; otherwise, go to step 5.

STEP 14: Disconnect the relay.

STEP 15: Change the alarm time to the new value as the power on time.

STEP 16: On the LCD, display the current time and power on time.

STEP 17: Go to step 16 if the current time matches the alarm time.

STEP 18: Turn on the relay and go to step 5.

STEP 19: COMPLETE

VII. RESULTS:

Fig 5 Show the setup of hardware system for load shedding

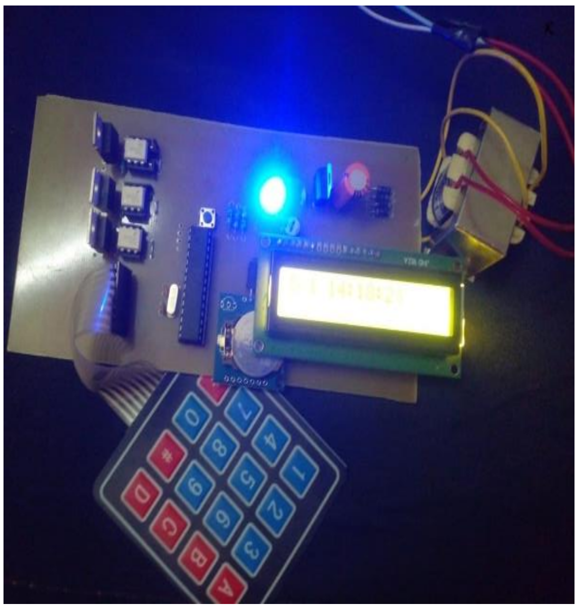

Fig 5: Hardware setup

Fig 6 Shows the Real time on lcd to show time controller read RTC data

Fig 6 RTC data display on LCD

Fig 7 shows when # is pressed in keypad controller enter time entering mode which is display in lcd.

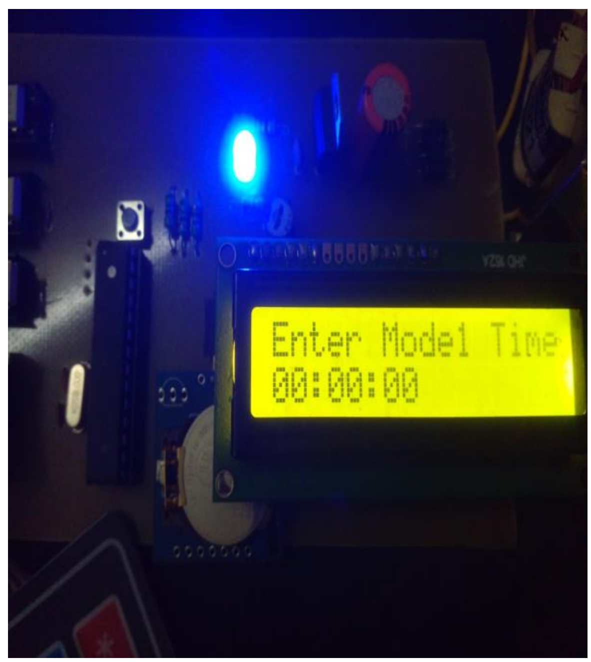

Fig 7 : Enter Mode1 time

Fig 8 Show mode2 enter time which display after entery of mode 1 time

Fig 8 : Enter Mode1 time

Fig 9 Show Off enter time which display after entery of mode 2 time

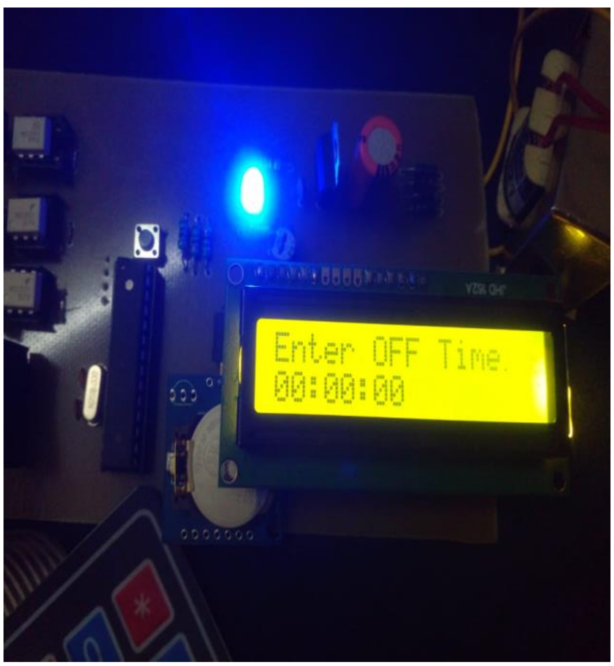

Fig 9 : Enter Off time

Fig 10 Show when system match the entered Mode 1 time it Automatically Start the load1

Fig 10 : entered in Mode 1

Fig 11 Show when system match the entered Mode 2 time it Automatically Start the load 2

Fig 11: entered in Mode 2

VIII. CONCLUSION:

It has been effectively designed and tested an Arduino energy auditing system for dynamic load shedding management. Loads with a high-power rating consume more current, resulting in an overload situation that shuts down the entire grid. These modules detect current spikes and disconnect all high-power loads while reconnecting priority low-power loads depending on a predefined threshold. Total blackouts can therefore be avoided, and work can continue, albeit at a lesser efficiency, which is preferable than no work at all.

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