Visvesvaraya Technological University

Belgaum, Karnataka-590 018

A Project Report on

"Load shedding time management with Programmable Interface"

Project Report submitted in partial fulfillment of the requirement for the award of the degree of

Bachelor of Engineering
In
Electrical & Electronics Engineering

Submitted by

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CMR INSTITUTE OF TECHNOLOGY
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Certificate

Certified that the project work entitled **"Load shedding time management with programmable interface"** carried out by Mr. Prafulkumar Kharade, USN 1CR17EE044; Mr. Pruthvi S Reddy, USN 1CR17EE050; Mr. Vivek M G, USN 1CR17EE085; Mr. Prajwal B, USN 1CR17EE046 are bonafied students of CMR Institute of Technology, Bengaluru, in partial fulfillment for the award of Bachelor of Engineering in Electrical & Electronics Engineering of the Visvesvaraya Technological University, Belgaum, during the year 2020 - 2021. It is certified that all corrections/suggestions indicated for Internal Assessment have been incorporated in the Report deposited in the departmental library.

The project report has been approved as it satisfies the academic requirements in respect of Project work prescribed for the said Degree.

Signature of the Guide	***Signature of the HOD***	***Signature of the Principal***
Mrs. Priyanka Priyadarshini, Assistant Professor EEE Department CMRIT, Bengaluru	Dr. K. Chitra Professor & HOD EEE Department CMRIT, Bengaluru	Dr. Sanjay Jain Principal, CMRIT, Bengaluru

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DECLARATION

We, Mr. **PrafulKumar Kharade (1CR17EE044),** Mr. **Pruthvi S Reddy (1CR17EE050),** Mr. **Vivek M G (1CR17EE085),** Mr. **Prajwal B (1CR17EE046),** hereby declare that the report entitled **"Load shedding time management with programmable interface "** has been carried out by us under the guidance of **Mrs. Priyanka Priyadarshini,** Assistant professor, Department of Electrical & Electronics Engineering, CMR Institute of Technology, Bengaluru, in partial fulfillment of the requirement for the degree of **BACHELOR OF ENGINEERING in ELECTRICAL & ELECTRONICS ENGINEERING**, of Visveswaraya Technological University, Belgaum during the academic year 2020-21. The work done in this report is original and it has not been submitted for any other degree in any university.

Place: Bengaluru
Date:

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ABSTRACT

As we all know the electricity is basic necessity for each and every appliance for modern machines. There are varieties of applications that are totally dependent on electricity without which they are of no use. In day-to-day life electricity is continuously modernizing and improving in market. Necessity of load shedding comes when the demand capacity is more than that of power generation capacity.

As the technologies are moving towards automation and automatic machines, here comes the necessity of meeting the load demands. Industries and companies are manufacturing modern circuits that might simplify lifestyle.

We have designed our project in such a way that it provides stability and efficient load shedding technique that takes over the manual operation of ON/OFF with respect to real time. We have used Real time clock (RTC DS1302) interfacing it with micro-controller (Atmega328P).

In this design, our motto is to plan and execute the operation of an electrical load numerous times according to the program. By implementing our design one can overcome the challenges of manual action and operation of ON/OFF.

Acknowledgement

The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of people, who are responsible for the completion of the project and who made it possible, because success is outcome of hard work and perseverance, but stead fast of all is encouraging guidance. So with gratitude we acknowledge all those whose guidance and encouragement served us to motivate towards the success of the project work.

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We are thankful to all the faculties and laboratory staffs of ***Electrical and Electronics Engineering Department, CMR Institute of Technology****,* ***Bengaluru*** *for helping us in all possible manners during the entire period.*

Finally, we acknowledge the people who mean a lot to us, our parents, for their inspiration, unconditional love, support, and faith for carrying out this work to the finishing line . We want to give special thanks to all our friends who went through hard times together, cheered us on, helped us a lot, and celebrated each accomplishment.

Lastly, to the ***Almighty,*** *for showering His Blessings and to many more, whom we didn't mention here.*

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CHAPTER 1:

INTRODUCTION

1.1 Brief background to the Research

India's total capacity for electricity is much greater to that of consumption and demand. When it comes to electricity consumption and power generation, India comes in the 3rd place. Power generation is capacity in India is adequate. Although, when it comes to distribution of this power supply the distribution systems aren't much advanced.

If In-case the demand is more than that of power generation there comes the necessity of load shedding. These load shedding units can be located at specific points or locations and can be interfaced with our proposed model.

Usually, the distribution centers use a different set of wires for switching ON/OFF purpose and this extra cost can be eliminated by implementing our model.

Load shedding can also be defined as a mechanism of temporary shutdown of the electricity supply in order to satisfy the equilibrium between unpredictable supply demand and the avoidance of a power delivery system collapse. The main distinction is that the load shedding is carried out in order to keep the power delivery grid from collapsing in a situation of unavailability in order to meet the strong demand for power, which is not the case for power saving strategies.

Load shedding is a means of distributing energy demand across several sources of power. Load shedding is used to relieve stress on a primary energy source when demand for electricity exceeds the capacity of the primary power source.

Most buildings, including data centres, buy electricity from a supplier. A building company may negotiate an arrangement with the power supplier on voluntary loading of shuttles on a pre-programmed or on-demand basis to decrease power costs while assuring ongoing functioning. The building draws electricity from its secondary source(s) rather than the utility during load shedding occurrences.

On-site diesel generators, as well as on-site or contracted solar photovoltaics or wind-based renewable power, are common secondary sources.

Many utilities' load management programs provide financial incentives for building operators to voluntarily load shed during peak usage periods. Load management programs are an excellent choice for energy-intensive building operations that also have high-quality power distribution control and secondary power sources, such as a data center. To avoid disruptions to the building's systems, the operator can rely on uninterruptible power supply systems and power distribution units, which moderate the flow of electricity to sensitive equipment.

When a utility electrical provider lowers or ceases energy distribution over the coverage area for a short period of time, power customers may suffer involuntary load shedding; this sort of load shedding is frequently referred to as a rolling blackout. Brownouts, another sort of involuntary load shedding, occur when the power supplier reduces voltage distribution during peak consumption times to balance supply and demand.

1.2 Objective of Research Work

The Objective of our B.E final year project work that is entitled "**Load shedding time management with Programmable interference**" are as given below:

1. As we all know the importance of load shedding in the field of power generation and Distribution. We are taking off the manual task of switching or turning OFF/ON of loads

2. To control loads from substation, it is necessary to carry out different cables or wires in order to turn them ON/OFF. But, by implementing our project the cost of Wires and cables can be reduced. Thus, making it a very cost-effective in all terms.
3. There could be possibility of Human errors while Turning OFF/ON of loads that can be minimized or even overcome with ease with this model. These errors can cause drastic loss to factories and other important institutions like hospitals, Airports, etc.
4. When working with electricity safety is the utmost priority we should be considering and due to this reason manual operation could be harmful as it may cause accidents and electric shocks. But this risk can be prevented with our proposed model.
5. As we are using RTC module in our setup the time management and operation is very accurate that saves power and turns the load OFF/ON as per the entered time details by the power man.

CHAPTER 2:

LITERATURE REVIEW

We have gone through several research papers and found that load shedding is being done in most parts of India to meet the consumer demands. Although, there are various other technologies that are implemented in various parts of the world.

The most common way load shedding is done in India is by manual operation of the circuits and this might cause human errors and less safety to the operator.

Anticipated All India Power Supply Position for the year 2016-17

State / Region	Energy				Peak			
	Requirement	Availability	Surplus (+)/ Deficit (-)		Demand	Met	Surplus (+)/ Deficit (-)	
	(MU)	(MU)	(MU)	(%)	(MW)	(MW)	(MW)	(%)
Northern	357,459	351,009	-6,450	-1.8	55,800	54,900	-900	-1.6
Western	379,087	405,370	26,283	6.9	51,436	56,715	5,279	10.3
Southern	310,564	320,944	10,381	3.3	44,604	40,145	-4,459	-10.0
Eastern	151,336	135,713	-15,622	-10.3	21,387	22,440	1,053	4.9
North-Eastern	16,197	14,858	-1,339	-8.3	2,801	2,695	-106	-3.8
All India	**1,214,642**	**1,227,895**	**13,252**	**1.1**	**165,253**	**169,503**	**4,250**	**2.6**

Figure 1: Load generation Balance report

The above-mentioned figure describes the Load generation report by Central Electricity authority for the year 2016-17. Power generation at some places is higher or equal to that of demand. But, at some parts in India there is still a shortage of power to meet the demand and here comes the necessity of rolling blackouts.

As per our research the most common way used to develop and achieve this type of design is by using of Proteus design suit software that enables to design electronic design automation.

Micro-controllers are cost-effective, user friendly and comes with inbuilt memories in some models making them a perfect choice at the current scenario.
Micro-controller can be programmed using Keil software development program. Keil comes with inbuilt libraries, compilers and many other plugins.

“From 45 to 50 million units of load shedding per day, the figures have fallen to 15 to 10 million units. We have even had a few days without any load shedding,” said an official from the Tamil Nadu Electricity Board (TNEB).

“We used to have power cuts in shifts of four hours till about two weeks. But, for the last two weeks, the maximum power cuts we’ve faced has been for not more than 10 minutes,” said M. Chandrasekaran, secretary of the Nagari Industries Association.

In Western Region, Gujarat, Goa and Madhya Pradesh faced negligible energy shortage whereas, Maharashtra faced shortage of 0.3%.

In Northern Region Chandigarh, Punjab, Delhi, Rajasthan and Haryana faced negligible energy shortage in the range of 0.1-0.3%. Himachal Pradesh and Uttarakhand experienced energy shortages in the range of 0.7-1.7%, whereas the shortage in Uttar Pradesh was -12.5%. In Eastern Region, Sikkim faced negligible energy shortage whereas West Bengal, Odisha, Chhattisgarh and Bihar faced energy shortages in the range of 0.3-1.3%. The maximum energy shortage of 2.3% was faced by Jharkhand.

In North-Eastern Region, Arunachal Pradesh, Manipur, Mizoram, Nagaland and Tripura faced energy shortages in the range of 2.2-5.5%.

CHAPTER 3:

DESIGNED MODEL

BLOCK DIAGRAM:

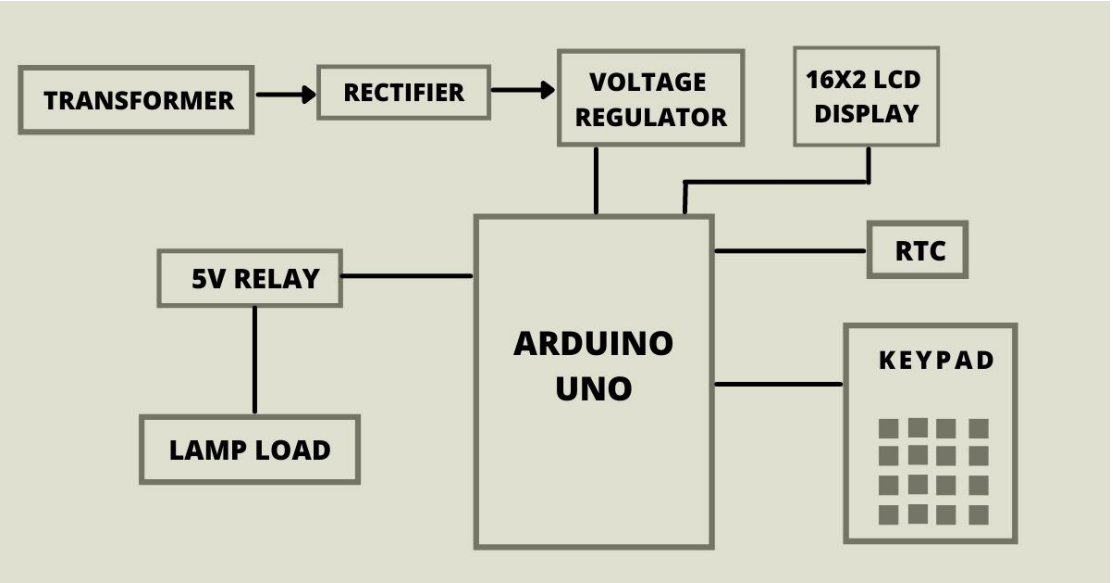

Figure 2: Designed Model

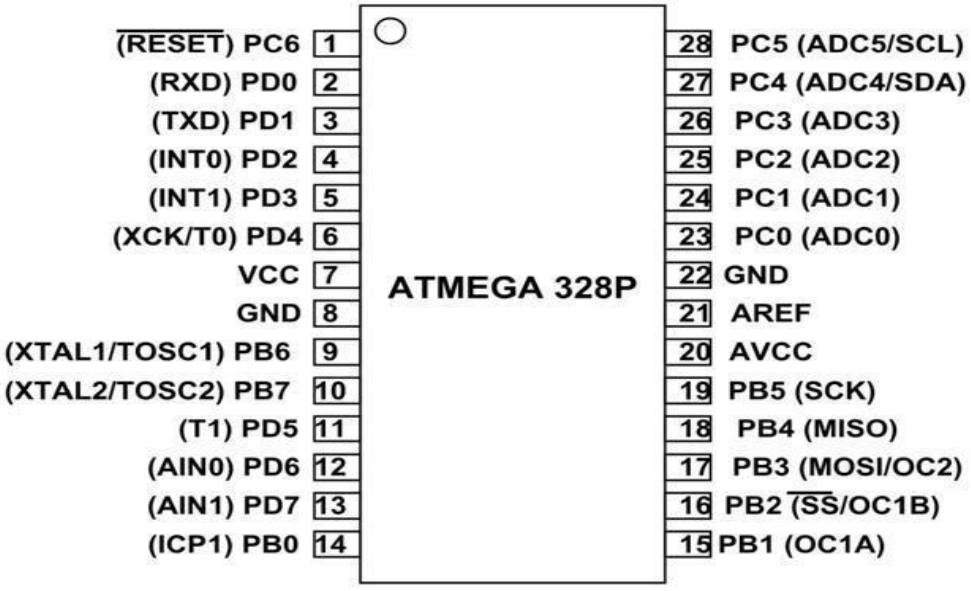

Figure 3: Pin Diagram of Atmega328P

COMPONENTS REQUIRED:

- Atmega328P
- 5-volt Relay
- RTC DS1302 Module
- LCD Display
- Hex Keypad
- Arduino
- 10k Trim pot
- Resistors & Capacitors

Hardware Description

1. **ATMEGA328P:**

   The Atmel 8-bit AVR RISC-based microcontroller has 32 KB ISP flash memory with read-while-write capabilities, 1 KB EEPROM, 2 KB SRAM, 23 general-purpose I/O lines, 32 general-purpose working registers, 3 flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, and a 6-channel 10-bit A/D The device operates on a voltage range of 1.8 to 5.5 volts. The device has a throughput of around 1 MIPS/MHz.

2. **RTC DS1302 Module:**

- The Precise Real-Time Clock module DS3231 RTC is a low-cost, very accurate real-time clock (RTC) featuring a TCXO and crystal oscillator.
- The gadget includes an input battery and keeps precise time when the power supply is stopped. The incorporation of the crystal resonator improves device long-term precision and decreases part count in a production line. ds3231 Arduino comes with 16-pin, 300-military SO packaging, in commercial or industrial temperature ranges.

Features:

- There are two time-of-day alarms.
- Output of a Digital Temperature Sensor
- Sign up for Aging Trim.
- RTC DS 3231 with 2032 Battery Holder
- RTC is highly accurate and manages all timekeeping functions completely.
- Clock in Real Time Seconds, Minutes, Hours, Date of the Month, Month, Day of the Week, and Year are all counted, with Leap-Year Compensation valid up to 2100.
- Using SMD jumpers on the PCB, you may configure the I2C device address for the AT24C32 (A0, A1, A2).
- Output signal with programmable square wave.
- Input from a battery for continuous timekeeping.
- Extends Low-Power Operation Time it takes for the battery to charge.

3. 5-volt relay

- The SRD-05VDC-SL-C relay is connected to the device you wish to operate via three high voltage connections, NC, C and NO. The opposite side is connected to the Arduino via three low voltage pins (ground, vcc and signal).
- NC: Closed usually Terminal 120-240V
- NO: Open 120-240V terminal usually
- C: Terminal Common
- Ground: The Arduino 5V Vcc connects the ground pin: The Arduino 5V pin is connected
- Signal: Carries the Arduino trigger signal activating the relay.
- The 120-240V switch is linked to a magnet in the relay. If the relay gets the HIGH signal at the signal pin, the electromagnet is loaded and the switch contacts are opened or closed.
- A HIGH signal opens the switch and disconnects the 120-240V current in the usually closed arrangement. The LOW signal shuts the switch and lets the C terminal flow to the NC terminal. Therefore, utilize the usually closed terminal, when you wish to switch the HIGH signal OFF on the 120-240V current.

Features:

- Relay board with one channel
- 5V Operating Voltage
- 20mA maximum current
- At 250V AC, the relay contact current capacity is 10A.
- At DC5V, the relay contact current capacity is 10A.
- One contact that is typically closed and one contact that is normally open

- Increased relay coil due to triode driving
- Controller pin with a high impedance
- Pull-down circuit to prevent malfunction
- Lamp that indicates the status of the power supply
- Lamp for the control indication
- Relay output status indicator.
- With a large current, it is possible to control numerous appliances and equipment.
- Controlled using standard TTL logic (AVR, Arduino, 8051, PIC, ARM)
- International safety requirements, as well as control and load area isolation trenches, are all met by the module.

4. LCD Display

- This display addresses the disadvantage of the LCD1602 Parallel LCD Display in that it requires around 8 pins on your Arduino to get it to operate. Fortunately, an I2C adaptor is connected directly to the display pins in this device. So, all you have to do is connect the I2C pins, which indicates that you have a solid library and just need to code a bit.
- Philips invented the I2C serial bus, which consists of two bidirectional lines named SDA (Serial Data Line) and SCL (Serial Control Line) (Serial Clock Line). Pull-up resistors are required to link the two. 5V and 3.3V are the common operating voltages.
- The wiring is fairly simple if the I2C adaptor is already soldered into the board, as it is with this product. Only four pins should be used in most cases. Obviously, VCC and GND. The LCD screen requires 5 volts to operate. As a result, the 5V Pin is chosen.

Features:

- The Arduino IIC/I2C interface was created to minimize the number of IO ports on the Arduino board.
- The I2C adaptor provides for greater flexibility in connection options.
- I2C reduces the amount of wire required.
- rows of white text on a blue backdrop, 16 characters wide
- The supplied single LED backlight may be dimmed easily using a resistor or PWM.

5. Hex Keypad

- This DC 12V 4X4 16 Key Matrix Membrane Switch Keypad Keyboard is a high-quality soft-touch feeling button keypad with a lifetime of 100 million life-strokes and strong environmental resistance.
- This 16-button keypad may be used in microcontroller applications as a human interface component. The keypad can be easily mounted in a number of situations thanks to its handy adhesive backing.
- The Keypad 44 has 16 Matrix-style buttons. There are no moving parts in this membrane keypad. To connect it to your device, you'll need a female 8-pin berg connection for microcontroller circuits.

Features:

- The ultra-thin design and adhesive backing make it simple to incorporate into any project.
- Any microcontroller may communicate easily with it.

- 4x 4type 16 keys on a 5 pin 2.54mm pitch connection
- For sticky installation, the sticker may be peeled away.
- Used widely in industrial and home electronic equipment, instrument, etc.
- This allows a microcontroller to ‘scan’ the 8 output pins to see which of the 16 buttons is being pressed.

6. Arduino

- Arduino is an open-source hardware and software business, initiative, and user community that creates single-board microcontrollers and microcontroller kits for the creation of digital devices.
- Its hardware products are licensed under a CC-BY-SA license, while software is licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL), allowing anybody to make and distribute Arduino boards and software. Commercial Arduino boards are available through approved distributors or the official website.
- Different microprocessors and controllers are used in Arduino board designs. The boards have digital and analogue input/output (I/O) pins that may be connected to other expansion boards ('shields') or breadboards (for prototyping) and other circuits.
- Serial communications ports, including USB on some versions, are available on the boards and are used to load applications. The microcontrollers may be programmed in C and C++ using a common API dubbed the "Arduino language."
- Arduino is a hardware platform that is free and accessible to the public. The hardware reference designs are freely accessible on the Arduino website and are licensed under a Creative Commons Attribution Share-Alike 2.5 license. Some versions of the hardware also come with layout and manufacturing files.

Features:

- ATmega328 is a microcontroller.
- The operating voltage is 5 volts.
- 7-12V is the suggested input voltage.
- 6-20V Input Voltage (Limits)
- I/O Digital 14 pinning's (of which 6 provide PWM output)
- 6 DC analogue input pins I/O current 40 mA DC Current for 3.3V Pin 50 mA at the pin
- 32 KB flash memory, of which 0.5 KB is utilized by the bootloader.
- 2 KB of SRAM (ATmega328)
- EEPROM (Electronic Programmable Read-Only Memory): 1 KB (ATmega328)
- 16 MHz Clock Speed

7. 10K Trim Pot

- Trim pots are a high-accuracy variable resistor with three terminal pins that may be mounted on a PCB. As the trim pot is turned, the voltage between the terminal's changes. Variable resistors are used in circuits to vary voltage according to the requirements. A single turn on this potentiometer may be used to set a value.

Features:

- Rotary, also known as a Radio POT.
- Resistance values include 500, 1K, 2K, 5K, 10K, 22K, 47K, 50K, 100K, 220K, 470K, 500K, and 1 M.

- Power Consumption: 0.3W
- Input Voltage Maximum: 200Vdc
- 2000K cycles of rotational life

METHODOLOGY:

As mentioned above we will be using Atmega328P Micro-controller in our designed model. This micro-controller will be interfaced with Real-time clock, Hex keypad, LCD display, 5-volt Relay. Micro-controller requires a stable DC power supply in order to function and this can be achieved with the help of Voltage regulators and rectifier circuit.

Firstly, the AC 230 volts, 50Hz power supply is stepped down to 12 volts AC power supply with the help of step-down transformer and then this voltage is converted to unregulated DC power supply using a rectifier circuit.

Next, this unregulated DC power supply is stabilized using a voltage regulator 7805, or 7812 and some of the capacitors are used as to reduce AC noise to ground and also reduce AC ripple.

Next, this supply is fed to 7812 voltage regulators for stable voltage. We will be using Embedded C for coding the controller. RTC 1307 is used as a Real time clock.

The Real-time clock used in our proposed model is RTC DS1302 which is a time-keeping module that comes with 31 bytes of static RAM.

This RTC DS1302 module comes with inbuilt battery for a backup power supply as an alternative if in-case there is a power failure to this time-keeping module.

An input is fed through using Hex Keypad and the microcontroller is programmed in such a way that we can set the actual time and load shedding time. Using the LCD Display we can monitor both real time and load shedding time.

Program always check the equality and whenever it gets matched output relay turn off. Then it began to check equality with target time and real time, whenever it gets matched relay turns on.

SIMULATION:

1. Setting of Load Shedding Time

Simulation of designed model is made using proteus. In the first case, load shedding start timing is set using a 24 hours format. Here in this test case, the load shedding set time is set to 12:09 and the load shedding stop time is 12:10. As you can observe the load is still in-tact with the real time.

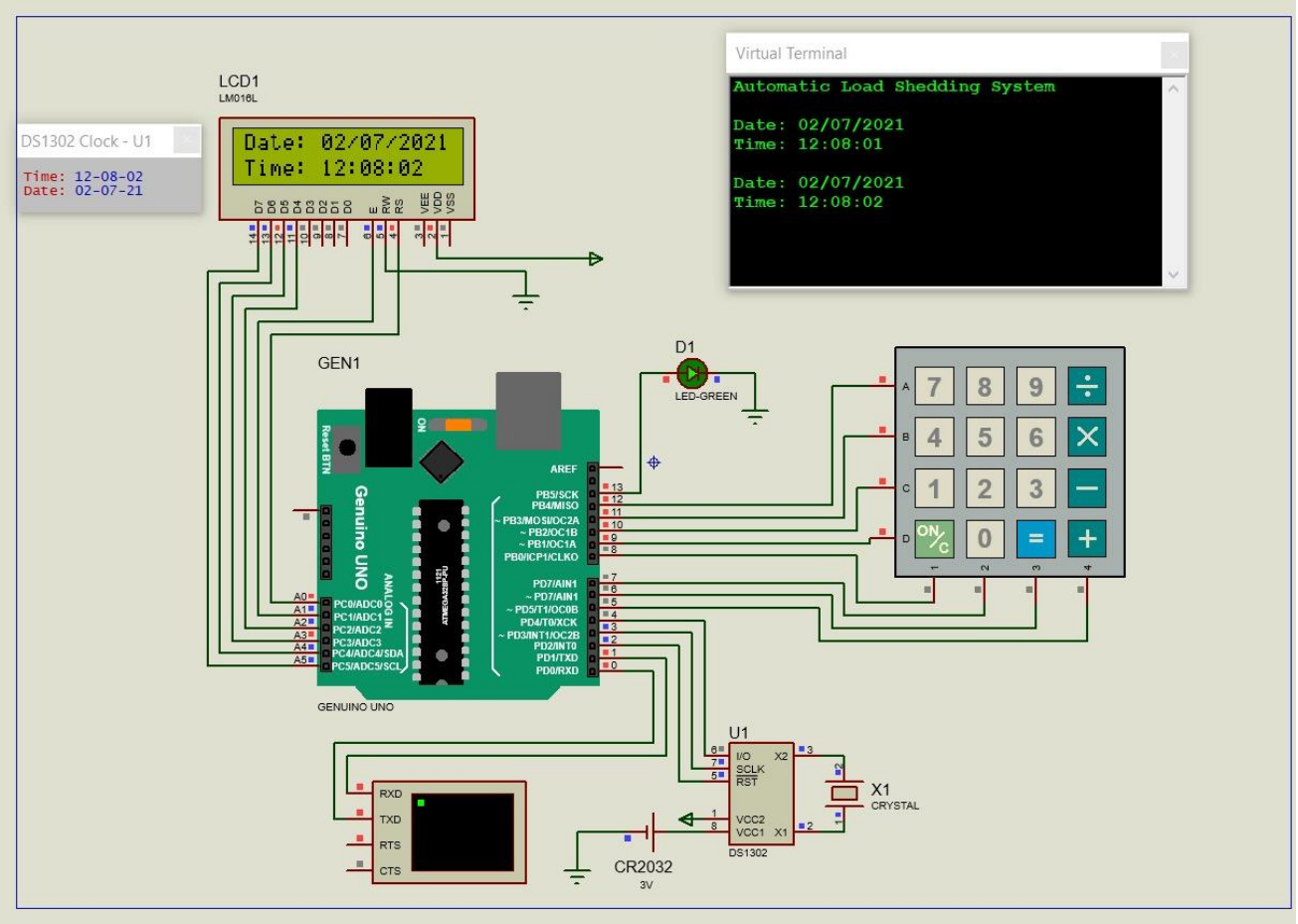

Figure 4: Setting of Load shedding time

2. In Load Shedding

When the real time matches the Load shedding start time, it is observed that the load shedding is started and this can be observed with LED indication that is turned off. The LED that is turned off indicates that the load shedding has been started and the power is being cut.

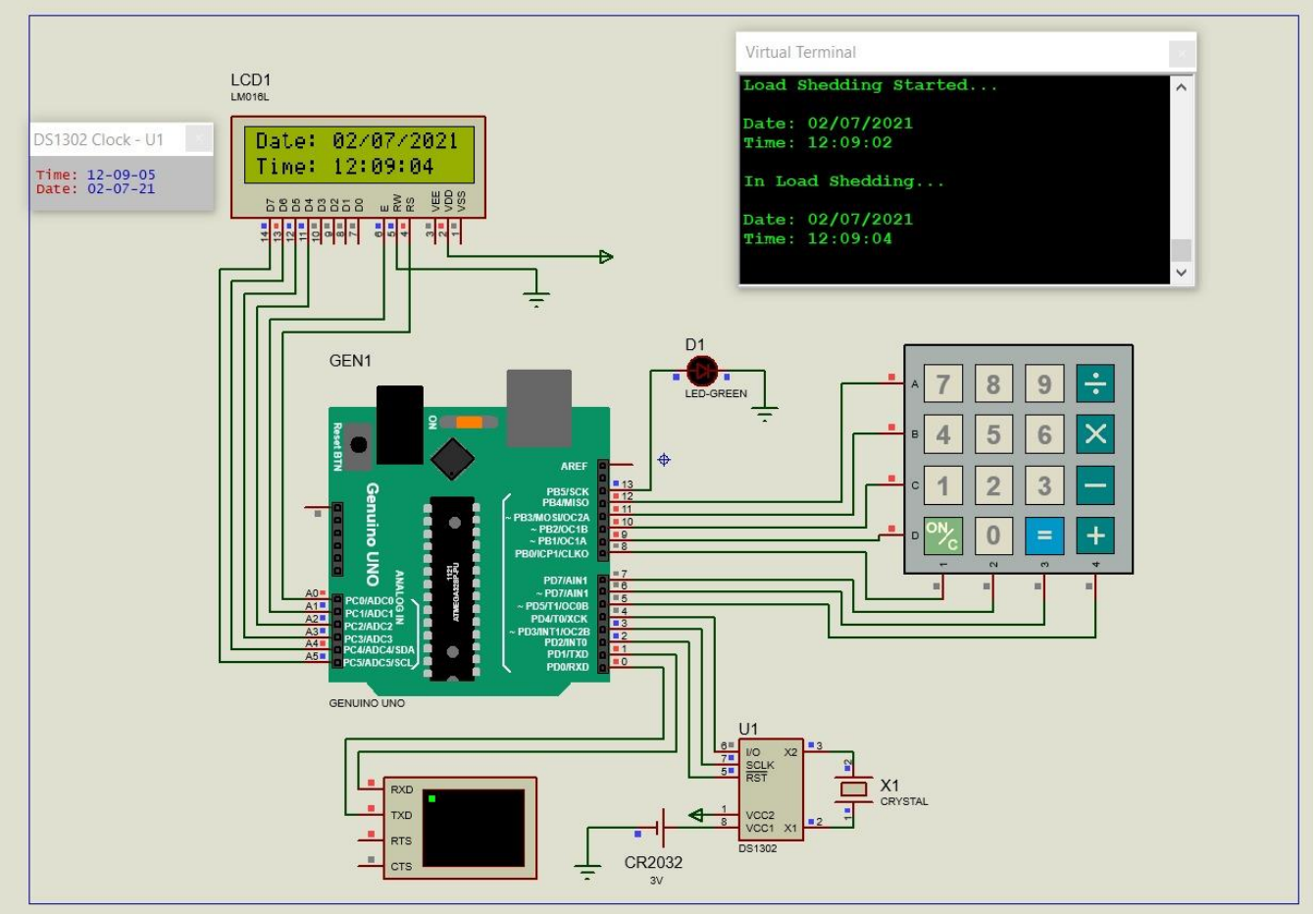

Figure 5: In Load shedding

3. Load Shedding Stopped

Here in this case, It is observed that the load shedding is being turned off when the real time matches the load shedding stop time. The load is reconnected that can be observed with the glowing LED from the figure 6.

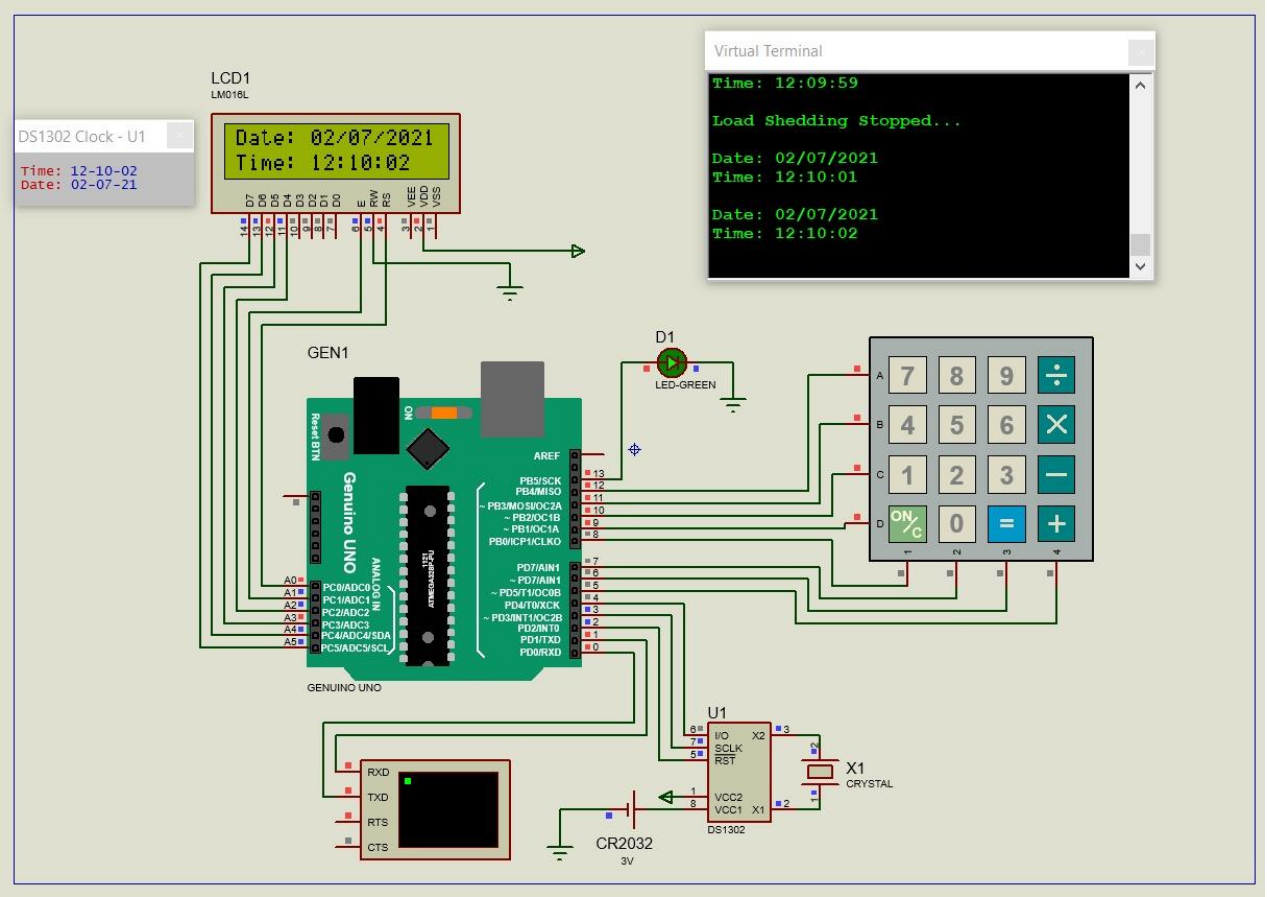

Figure 6: Load shedding stopped

CHAPTER 4:

CONCLUSION

When it comes to time management, Real-time clocks plays a major role as it continuously keeps time up to date. In simple words, Real-time clock is very similar to your wrist watch. You will have to set the time at first and the machinery inside the watch keeps running for you with the help of battery.

Real-time clocks use a battery as a backup source if in-case there is a power failure.
It consumes very less power that makes it more efficient and convenient when compared to other time-measuring substitutes. Using of Real-time clock becomes necessary when it comes to time management-based circuit designs. As we have a necessity of time management in our set up Real-time clock helps us to monitor current time. Program checks for both the set time and real time and then functions as per the given instructions.

As the program execution takes place gradually the steps go on reducing in the system. In projects like time management most of them use RTC module in their designs as a real time monitoring device. As, micro-controllers are very efficient, convenient and comes with in inbuilt memory (In-some models) they can be used extensively keeping the cost of design as low as possible.

All the Power distribution departments rely on rolling blackout if they fail to meet the consumer demands. To reduce or terminate load shedding power generation should be more than that of consumer demands. By implementation of our designed model one can manage or control rolling blackout without manual operation task of switching ON and OFF. If in case the power generation is less than that of consumer demands, load shedding comes into picture. However, rolling blackouts is the last choice the in order to meet the power demands.

In the world of power generation and distribution, one can eradicate the need of load shedding by generating power more or equal power than the requirement or consumer needs.

FUTURE SCOPE

As we have Designed our Project that is Entitled “Load shedding Time management with Programmable Interface” by using Atmega328P interfacing it with C++ with some domain-specific libraries. It is totally possible to Advance by further making changes in the design.

Implementation of this project can be done at a power distribution centre. Installation of this designed is possible in a central distribution point and a service man can easily set the load shedding time in much easier way prior to the actual load shedding time.

It can be designed to send SMS Alerts when the relay trips or when the load turns ON/OFF. With further work Interfacing Atmega328P with a Wi-fi Module and then connecting this to cloud based Network or any other 3rd Party Website that can log Data of Load tripping time and duration. With usage of different Electrical parameters measuring Instruments this device may periodically log electrical data like active power, reactive power, voltage, current, frequency, etc in the form of a normal SMS to your GSM Sim-card in real time world.

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