PROJECT REPORT

ECECC09: Electronic Design and Workshop

HINDI
WORD CLOCK

Submitted by:
2021UEC2661:
ANAND SHUKLA
2021UEC2667:
AVNISH UNIYAL

Submitted to:
Prof. SATYA PRAKASH

Contents

1 Synopsis **2**

2 Motivation **2**

3 Project Description **3**

4 Flow Chart **5**

5 Block Diagram **6**

6 Bill of Materials **6**

7 The *"6-Block Model"* **7**
7.1 The Input Devices 7
7.2 The Output Devices 8
7.3 The Power Supply 8
7.4 Signal Processing 8
7.5 Data Storage 9

8 The Timeline **10**
8.1 The Initiation Phase 10
8.2 The Planning Phase 10
8.3 The Execution Phase 10
8.3.1 The Interfacing 10
8.3.2 The Prototyping 10
8.3.3 The Pilot 11

9 The Circuit Schematic **12**

10 The Code **13**

11 Future Prospects **16**

12 Gantt Chart **17**

1 Synopsis

A word clock is a type of clock that displays the time using words rather than numbers. Instead of using traditional clock hands or digital numbers, a word clock uses a grid of letters that light up to spell out the current time in words.

The first word clocks were developed in the early 2000s, and they quickly gained popularity as a stylish and elegant alternative to traditional clocks. They are often appreciated for their simplicity, elegance, and the way they present time in a more intuitive and natural way.

The letter grid is typically arranged in a rectangular or square shape and is divided into different sections to represent the various components of the time, such as hours and minutes. Each section contains a set of letters that correspond to a particular word or phrase.

In this guide, we will discuss how to make a word clock with Arduino Nano and RTC module.

2 Motivation

The idea for the project was suggested by our professor Satya Prakash. We found the idea of the word clock very interesting and creative. Word Clock can be used as an impressive decorative material for houses and offices.

In doing some research, we found that all the previously made word clocks were in the English language. So to make it understandable to Indians unknown to English, we decided to make a "Hindi Word Clock".

Henceforth, the aim of the project, aka the "Hindi Word Clock" is similar to that of a regular word clock, which is to display the time in a unique and visually appealing way using words. However, the difference is that the Hindi word clock uses the Hindi language instead of English or any other language. It typically consists of a grid of Hindi words or numerals, where certain words or numerals are illuminated to indicate the current time in the 24-hour format. The overall effect is not only functional but also adds a touch of cultural significance to a room, particularly for those who speak or appreciate the Hindi language.

3 Project Description

The various components that will be used in our project are as follow:

- **Arduino Nano**:
  The heart of the design, the Arduino NANO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 8 analog inputs, a 16 MHz quartz crystal, a USB connection, and a reset button. The Arduino Nano can be programmed with the help of Arduino Software (IDE). Our programming logic governs the operation of the corresponding modules and LCD. The Nano is compatible with data logging and can perform onboard computation for machine learning applications. Its small size makes it ideal for projects where space is a constraint.

- **RTC MODULE**:
  An RTC (Real-Time Clock) module is an electronic device that keeps track of the Current time and date with high accuracy. It has a battery backup to maintain the time even when the main power supply is turned off. The module usually includes a crystal oscillator to provide a stable and precise time base. RTC modules can be used in a variety of applications, such as time-sensitive systems, data logging, and alarm systems.

  The RTC module typically has four pins, including VCC (power supply), GND (ground), SDA (serial data), and SCL (serial clock). The SDA and SCL pins are used to communicate with the module using the I2C (Inter-Integrated Circuit) protocol. The VCC and GND pins are used to provide power to the module, while the SDA and SCL pins are used to send and receive data to and from the module.

  In our project, we have used DS3231 RTC MODULE.

- **I2C MODULE:**
  The I2C (Inter-Integrated Circuit) module is a serial communication protocol used to connect microcontrollers, sensors, and other devices in embedded systems. It is a two-wire interface that uses a clock signal (SCL) and a data signal (SDA) to communicate between devices. The I2C module is widely used in embedded systems due to its simplicity, low cost, and flexibility.

  The I2C module typically has two pins, including SDA (serial data) and SCL (serial clock). The SDA pin is used to transmit and receive data between devices, while the SCL pin is used to synchronize the data transfer between devices. The I2C module uses a pull-up resistor on both the SDA and SCL lines to maintain signal integrity.

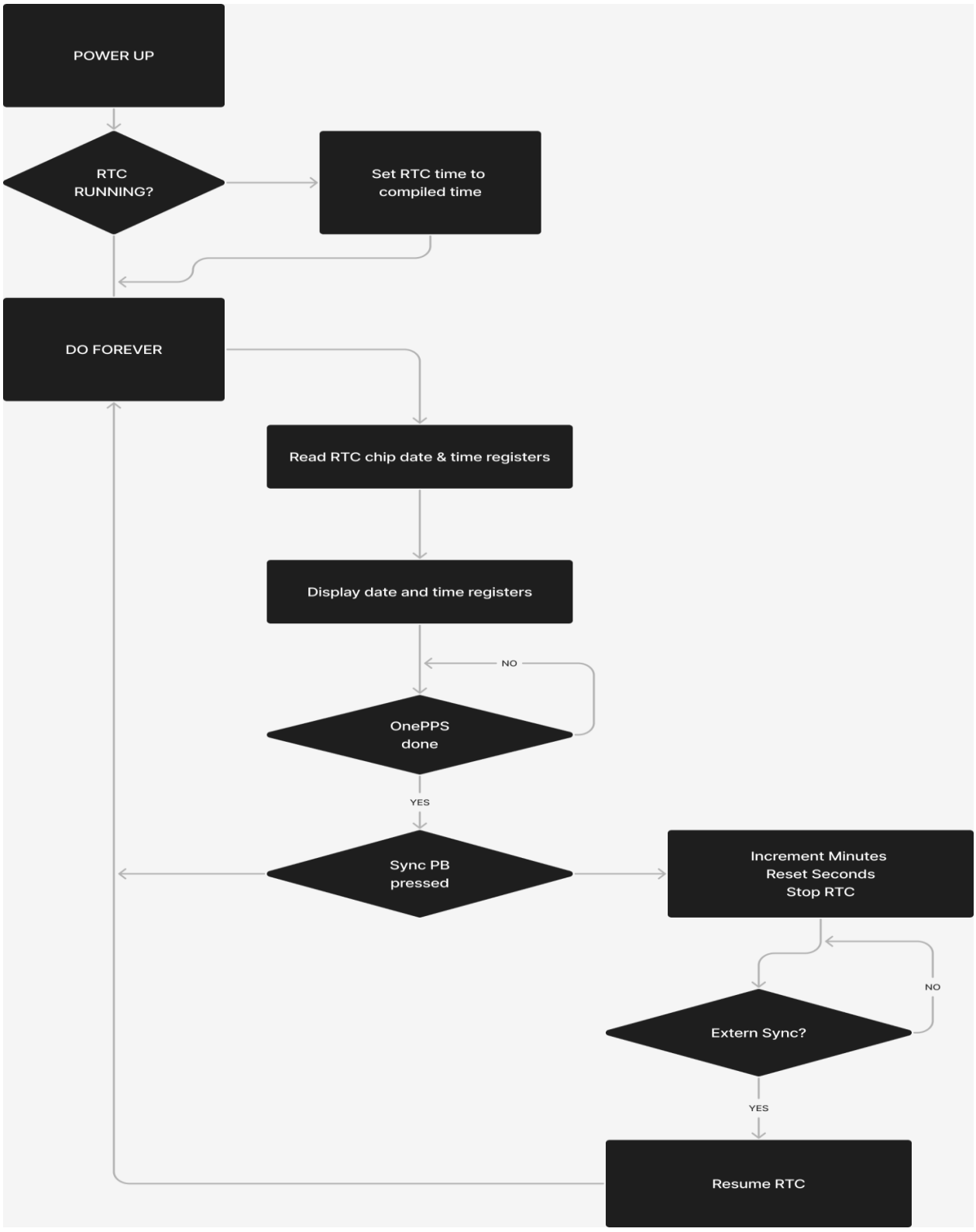
  .

- **LIQUID CRYSTAL DISPLAY(LCD):**
  An LCD (Liquid Crystal Display) is a flat panel display commonly used in embedded systems to display information. It uses a liquid crystal material to produce images by selectively blocking light. The LCD module typically includes a driver IC that controls the display.
  The LCD module typically has a set of pins for communication and control. The most common LCD module used in embedded systems is the 16x2 LCD module, which has 16 columns and 2 rows. The pins typically include VCC (power supply), GND (ground) RS (register select), RW (read/write), E (enable), and D0-D7 (data lines). The RS pin is used to select between the instruction and data registers, while the RW pin is used to read or write data to the LCD module. The E pin is used to enable the data transfer. The D0-D7 pins are used to send data to the LCD module. Additionally, some LCD modules may include backlight pins for controlling the backlight of the display.

- **PUSH BUTTONS:**
  A push button is a type of switch that is activated by pressing it down. It is commonly used in embedded systems to provide a simple interface for user input. The function of a push button is to provide a momentary connection between two points when pressed, allowing a signal to be sent to the microcontroller.
  Push buttons can be used for a variety of functions, such as selecting options from a menu, starting and stopping a process, or toggling a setting. They can also be used in combination with other components, such as LEDs, to provide visual feedback to the user.

- **LIGHT EMITTING DIODE:**
  LED (Light Emitting Diode) is a semiconductor device that emits light when a current is passed through it. It is commonly used in embedded systems to provide visual feedback to the user.
  The function of an LED is to emit light when current is passed through it in a forward direction. LEDs can be used for a variety of functions, such as indicating the status of a process, providing visual feedback to the user, or illuminating a display. They can also be used in combination with other components, such as push buttons, to provide a simple user interface. LEDs are popular in embedded systems due to their low power consumption, long life, and ease of use.

4 Flow Chart



THE RTC MODULE

5 Block Diagram

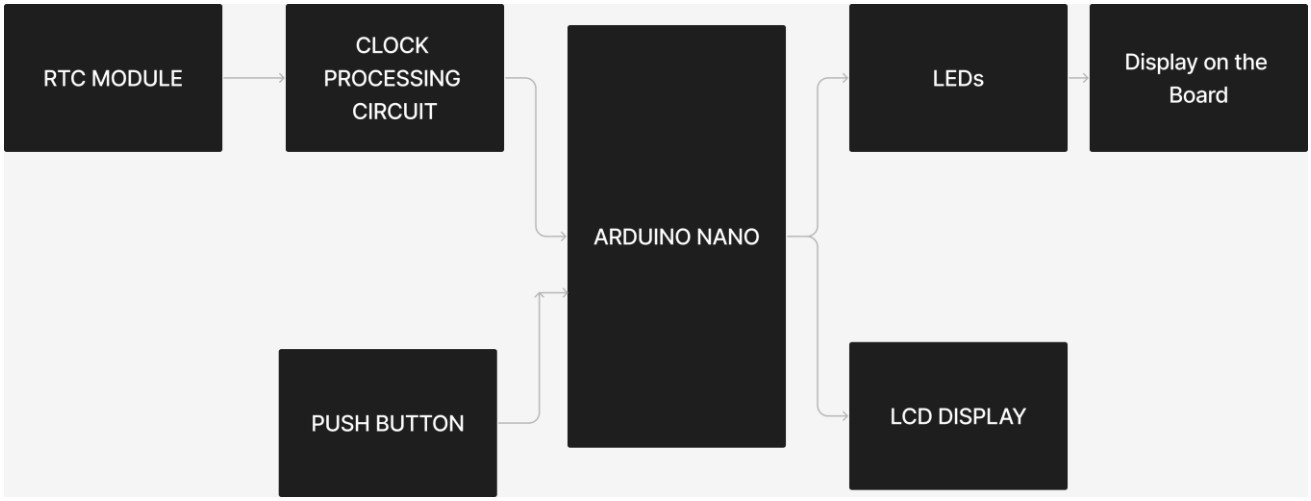


Figure 2: Schematic for Block Diagram

6 Bill of Materials

COMPONENTS	QUANTITY
Arduino Nano	1
RTC Module	1
LCD Display	1
I2C Module	1
LED	54
Push Buttons	54
Resistors	10
Molex Connectors	18

Table: Component Table

7 The *"6-Block Model"*

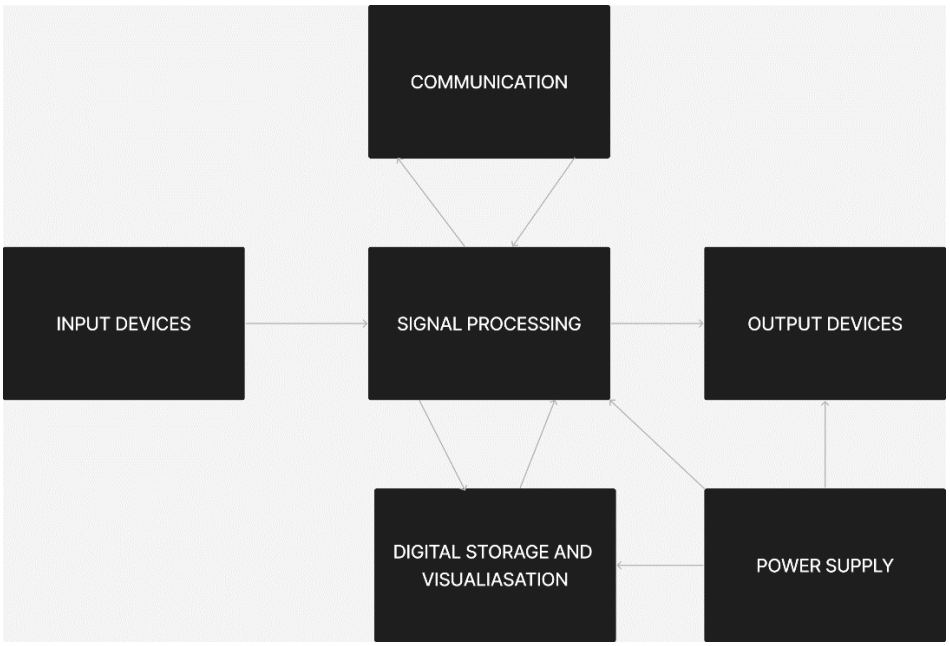


Figure 3: Schematic for The 6-Block Model representation of a system

7.1 The Input Devices

An input device is a piece of equipment used to provide data and control signals to an information processing system. The following comprises of the Input Device block for our system.

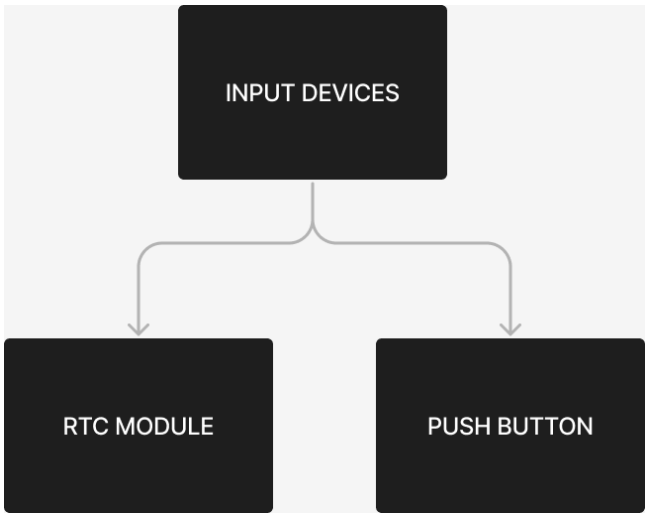


Figure 4: Schematic for Input Devices

7.2 The Output Devices

An output device converts information into a human-perceptible form or, historically, into a physical system-readable form for use with other equipment. The following comprise of the Output Device block for our system.

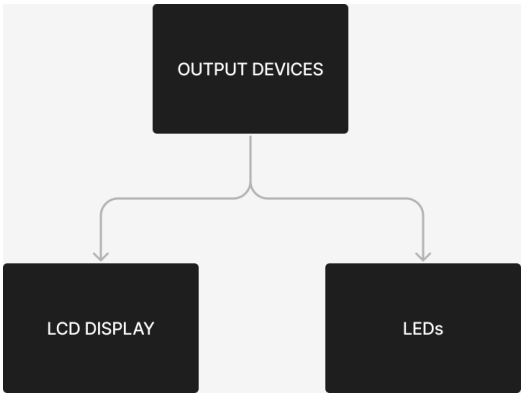


Figure 5: Schematic for Output Devices

7.3 The Power Supply

A power supply is an electrical device that supplies electric power to an electrical load. The main purpose of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. Our system is powered by the 220V mains supply through an AC/DC adaptor. We have used a 9V battery as backup for the system.

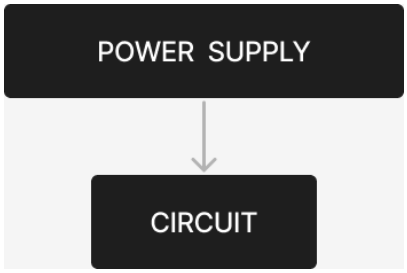


Figure 6: Schematic for Power Supply

7.4 Signal Processing

The heart of the system, the signal processing unit extracts information from the input devices, processes it, and then further translates it to the output devices. The Arduino micro-controller forms the signal processing block for our system.

7.5 Data Storage and Visualization

The purpose of Data storage in the RTC module, for our system, is to render accessibility feature for logging data in the memory, and to process the data to extract meaningful inferences and visualization of the same via LCD and LED on the MDF board.

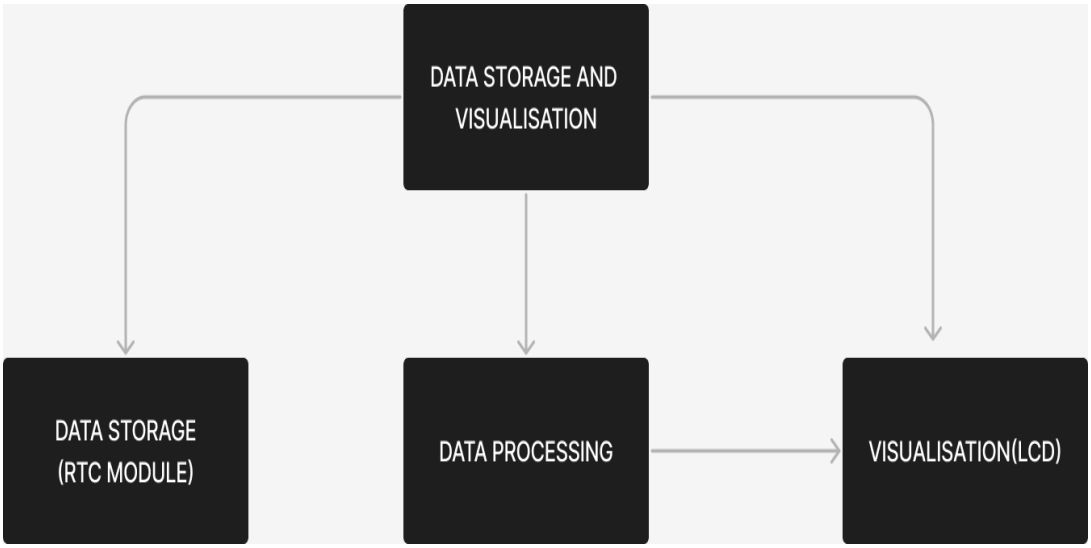


Figure 7: Schematic for Data Storage and Visualization

8 The Timeline

8.1 The Initiation Phase

The initiation phase involved framing out the block diagrams and charting out the optimal strategy with the brutest framework in mind. Following which, the scope of the project was identified and the clarification of resources was carried out, involving gathering required components and modules for the same.

8.2 The Planning Phase

The planning phase involved preparing the Gantt chart and brainstorming on the optimal milestones and the documentation resources for the project.

8.3 The Execution Phase

Putting the plan into action, the execution phase, being the primary focus, involved majorly the hands-on stuff.

8.3.1 The Interfacing

The LCD and individual modules were interfaced with the Arduino separately on breadboard in various stages, staring with the RTC module, followed by the I2C module soldered with LCD, the LEDs, and resistors, referring to the official Arduino documentation here,
https://docs.arduino.cc/hardware/nano

8.3.2 The Prototyping

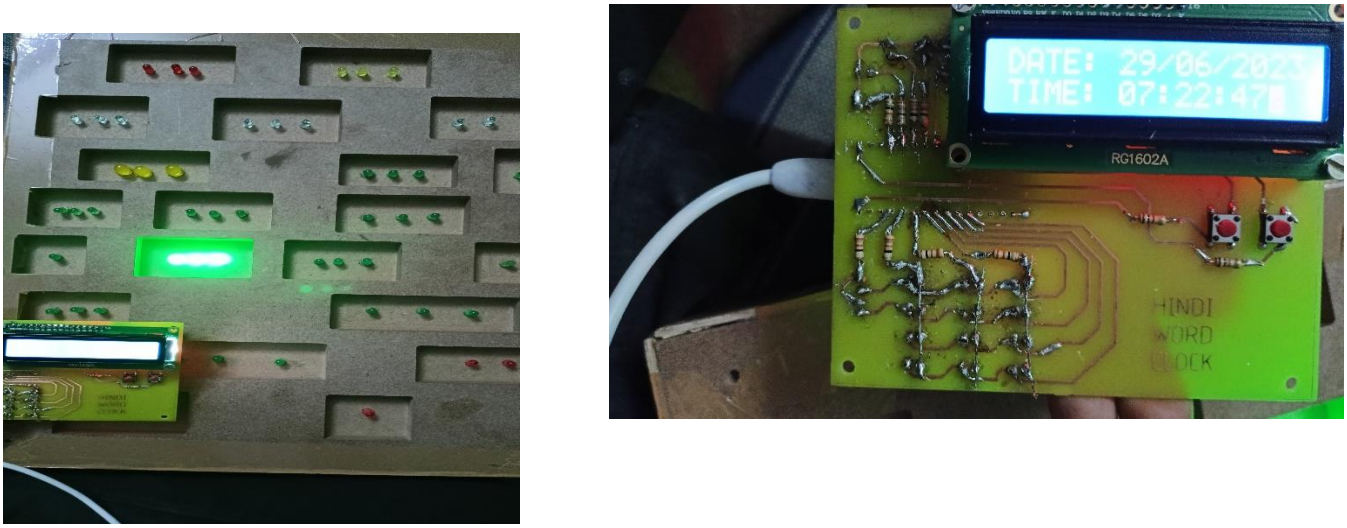
The prototyping phase involved assembling the initial integrated sketch of the circuit as shown onto the breadboard and interfacing it with the Arduino micro-controller, accompanied by an exhaustive set of dry runs of the former. Interfacing the circuit with the Arduino micro-controller board required programming using the Arduino IDE Software, and debugging to tune the circuit to tailor our requirements.

The RTC module, when powered and given an initial time, starts to increase the time count by 1 second and keeps the time stored with the help of a lithium cell when power is removed. The time output of the RTC module is made available at Analog Output A4(SDA pin) and Analog Output A5(SCL pin). I2C module, soldered to the LCD is connected to the RTC module directly to display the time on LCD. Multiplexing of LEDs is done to reduce the usage of more pins in Arduino. The output is taken from the Analog Outputs (A0, A1, A2, A3) and Digital Outputs(D2, D3, D4, D5) multiplexed with(D6, D7, D8, D9). These output pins are connected to the LEDs which light up in accordance with the current time.
There are two push buttons that are used to change the time and date and are connected to the Digital Pins D12 and D13 respectively.

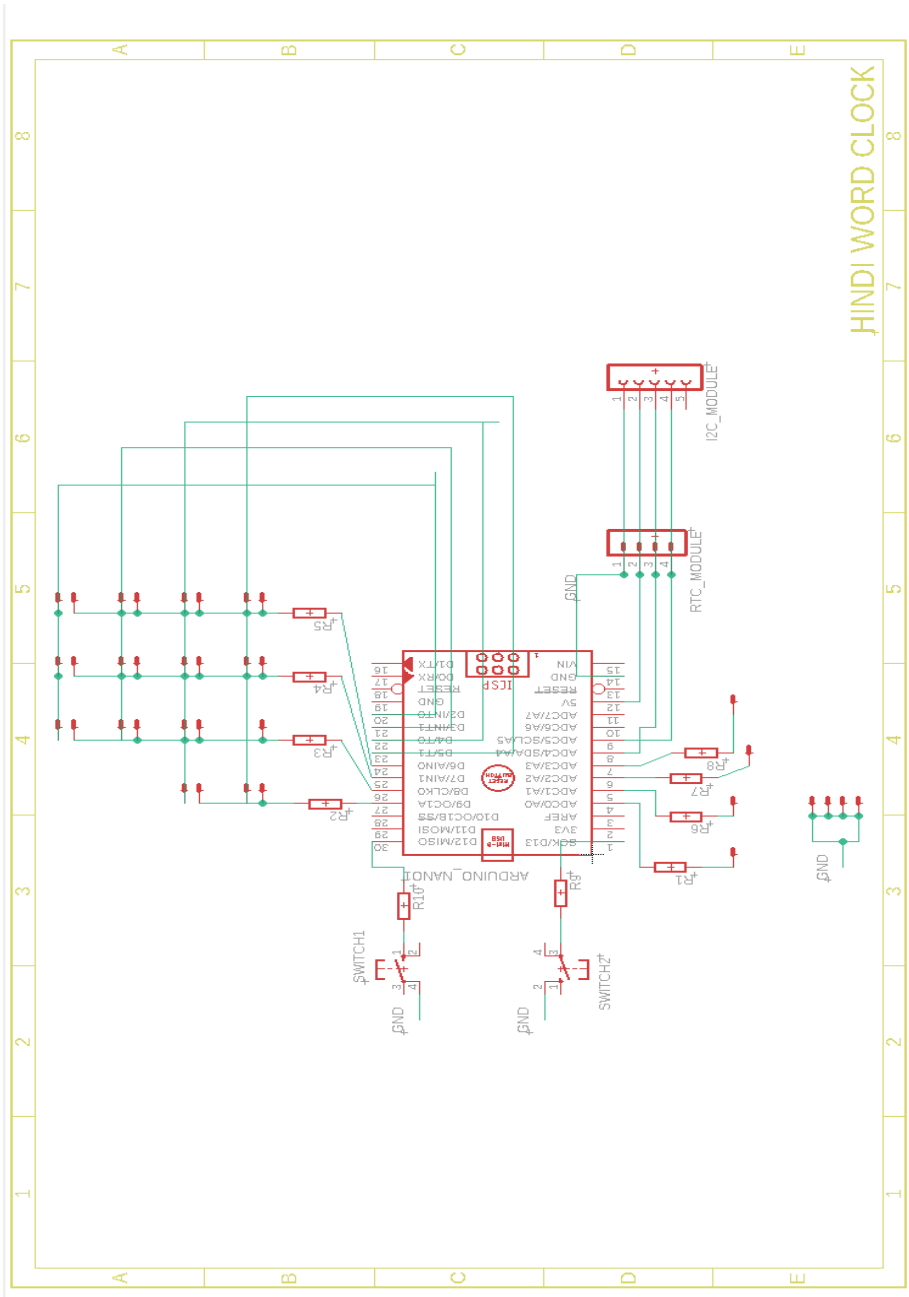
8.3.3 The Pilot

The beta prototype was prepared by connecting the circuital components onto the breadboard as per the final schematic given, accompanied by the subsequent dry run of the project, before designing of the enclosure and making concluding adjustments - The Pilot.

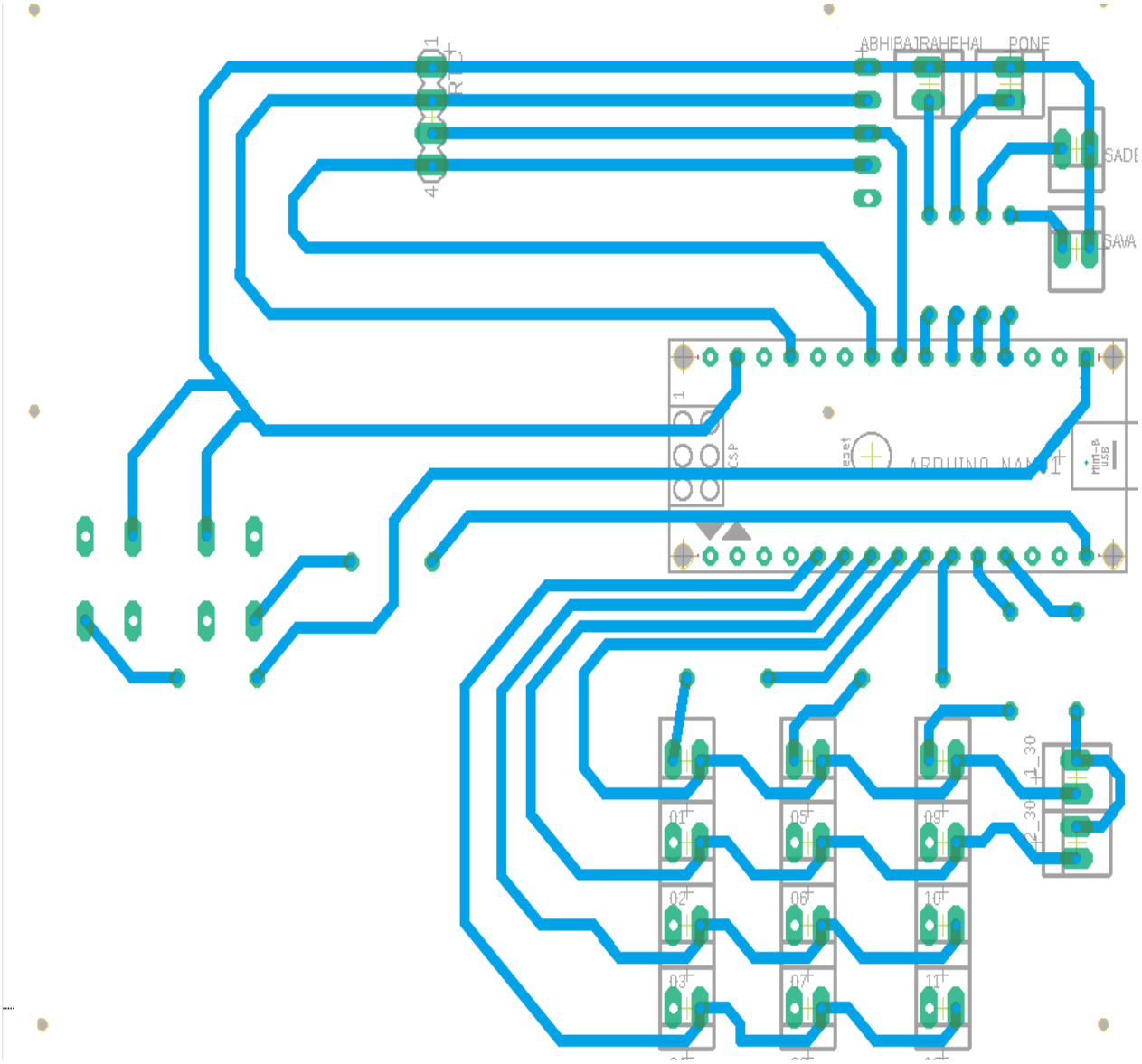
Figure 9: The Pilot



8.3.4 The Circuit Schematic



The Board Diagram

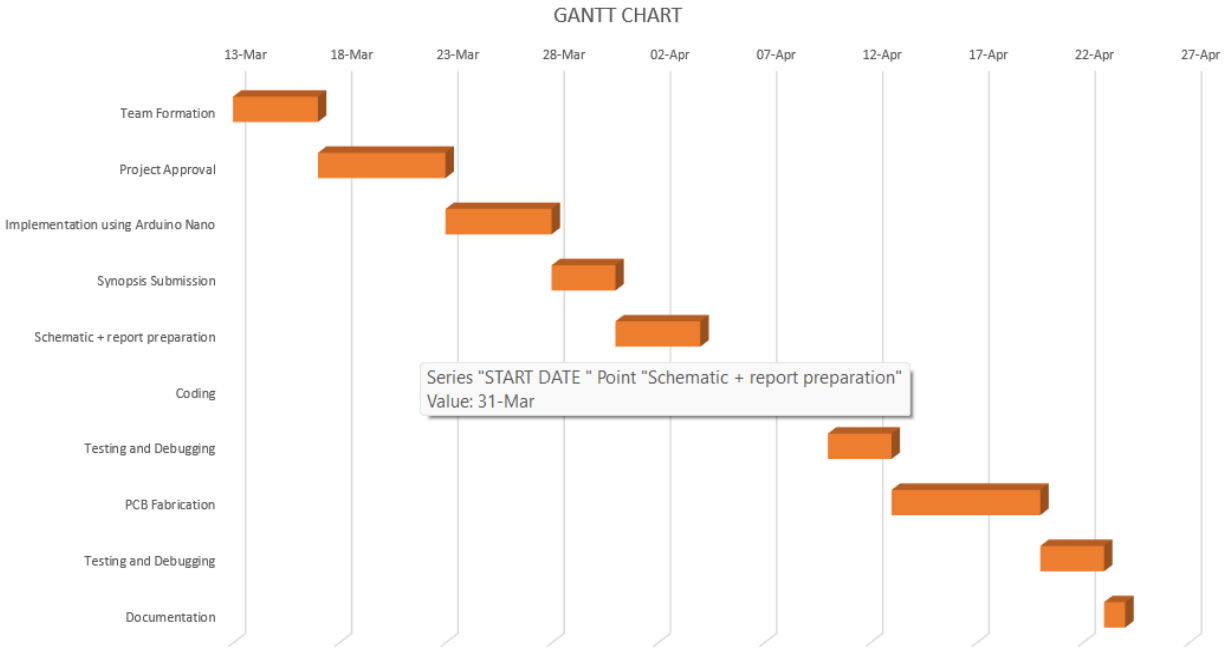


9 Future Prospects

A Hindi word clock has the potential to become a popular cultural artifact, especially among Hindi-speaking communities. It can serve as a symbol of cultural pride and identity and become a unique and valuable addition to any household or office.
For some people, a Hindi word clock may evoke nostalgia for a bygone era when traditional clocks were more prevalent. Such people may be willing to purchase a Hindi word clock for sentimental reasons, even if they use digital clocks for practical purposes.

Overall, the positive future prospects of a Hindi word clock will depend on its design, quality, and cultural significance. While it may not have mass market appeal, it has the potential to become a valued cultural artifact, a nostalgic item, a novelty item, or a collectible for certain groups of people.

10 Gantt Chart



	Documentation	Testing and Debugging	PCB Fabrication	Testing and Debugging	Coding	Schematic + report preparation	Synopsis Submission	Implementation using Arduino Nano	Project Approval	Team Formation
START DATE	23-Apr	20-Apr	13-Apr	10-Apr	04-Apr	31-Mar	28-Mar	23-Mar	17-Mar	13-Mar
DAYS TO COMPLETE	1	3	7	3	6	4	3	5	6	4

List of Figures

1 Illustration of Module Schematics 5
2 Schematic for Block Diagram 6
3 Schematic for The 6-Block Model representation of a system 7
4 Schematic for Input Devices 7
5 Schematic for Output Devices 8
6 Schematic for Power Supply 8
7 Schematic for Data Storage and Visualization 9
8 Instances from the Execution Phase 11
9 The Pilot 11
10 Schematic for the Circuit 12
11 Board diagram for Circuit 13
12 Schematic for Gantt Chart 15

List of Tables

1 Component Table 6