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SCHOOL OF ENGINEERING AND TECHNOLOGY

A Project Report

On

"GPS TRACKER"

Submitted in partial fulfillment of the requirements for the award of degree in

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE ENGINEERING

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ABSTRACT

The GPS Tracker project utilizing an Arduino UNO and NEO 6M GPS Module aims to create a portable and cost-effective solution for real-time tracking of geographical coordinates. In an era dominated by technology, the integration of GPS tracking systems has become paramount for numerous applications, ranging from navigation to location-based services.

This project aims to harness the power of Arduino UNO and the NEO 6M GPS module to develop a GPS tracker. The system not only provides real-time longitude and latitude coordinates but also offers additional functionality by displaying the date and time on the serial monitor. Furthermore, to enhance user interaction, the project incorporates an LCD display that conveniently showcases the latitude and longitude values. This GPS tracker holds significant potential for applications such as vehicle tracking, wildlife monitoring, and personal navigation.

Key components of the project include GPS data parsing, serial communication between the GPS module and Arduino, and efficient handling of data for optimal display on the LCD. The project not only provides a functional GPS tracking solution but also offers a valuable learning experience for electronics enthusiasts, allowing them to gain hands-on experience with GPS technology and Arduino programming.

The integration of Arduino and the NEO-6M GPS module offers a cost-effective and versatile solution for those seeking a customizable and DIY approach to real-time location tracking.

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1. INTRODUCTION

The GPS Tracker project, featuring the Arduino UNO and NEO 6M GPS Module, stands as a pioneering solution in the contemporary landscape of location-based technology. In an era where precision and accessibility define user expectations, this project addresses the burgeoning need for a portable, cost-effective GPS tracking system. The core objective is to seamlessly combine the capabilities of the Arduino UNO microcontroller and the NEO 6M GPS Module to provide real-time latitude and longitude coordinates, presented intuitively on a 16x2 LCD display.

The Arduino UNO serves as the project's central hub, efficiently managing communication with the NEO 6M GPS Module to extract accurate global positioning data. The output is elegantly displayed on the LCD screen, ensuring users receive immediate and comprehensible information. This synthesis of hardware components results in a versatile solution with applications ranging from personal navigation to asset tracking.

This project's significance lies in its accessibility and adaptability, allowing users to harness the power of location tracking without the complexities associated with high-cost systems. As we explore the project's intricacies, from hardware setup to programming logic, we uncover a solution that not only meets the demands of modern tracking needs but also serves as a testament to the convergence of innovation and affordability in the realm of GPS technology.

APPLICATIONS

1. Personal Navigation: Individuals can use the GPS Tracker for navigation during outdoor activities such as hiking, biking, or camping.
2. Emergency Services: Search and rescue teams can deploy the GPS Tracker to pinpoint the location of individuals in distress, streamlining rescue efforts in remote or challenging environments.
3. Vehicle Tracking: The GPS Tracker can be employed for tracking the movement of vehicles, serving as an affordable and effective solution for fleet management or personal vehicle monitoring.
4. Asset Tracking: Valuable assets can be tracked and monitored in real-time, providing an added layer of security against theft or loss.

2. Hardware and software requirements

2.1 Hardware components

(a) Arduino UNO

Fig. 2.1 Arduino Uno board

The Arduino Uno is a microcontroller board based on the ATmega328P. It provides the processing power and serves as the main control unit for a project. Arduino boards are widely used in electronics projects due to their ease of use and versatility. It has 14 digital input/output pins (of which 6 are used as PWM outputs),6 analog inputs, a 16 MHz quartz crystal a USB connection, a power jack, an ICSP header and a reset button.

(b) NEO 6M GPS Moule

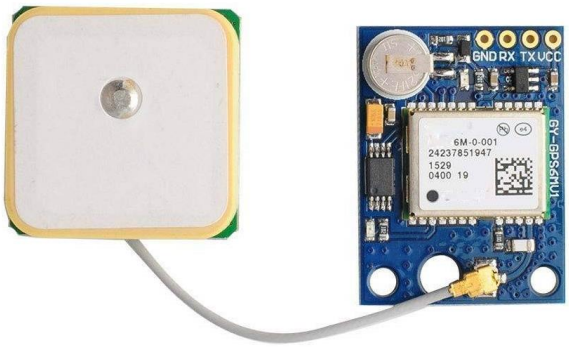

Fig. 2.2 Ublox Neo 6M GPS Module

The NEO-6M is a GPS module manufactured by U-blox. It receives signals from GPS satellites to determine its location, providing accurate latitude, longitude, altitude, and time data. The module typically communicates with the Arduino through UART (serial communication). The GPS module's antenna captures signals from orbiting satellites, enabling precise location tracking. It enhances sensitivity, ensuring accuracy in challenging conditions, and crucial for efficient GPS performance in various applications.

(c) SIM900A GSM Module

Fig. 2.3 GSM Module

The SIM900A GSM module serves as the communication gateway for sending SMS messages. In this GPS tracker project, the SIM900A GSM module plays a crucial role by enabling communication through SMS. It allows you to press a button and GSM Module receive the coordinates as an SMS reply. This functionality can be useful for real-time tracking or location-based alerts in applications such as vehicle tracking or asset monitoring.

(d) LCD (Liquid Crystal Display)

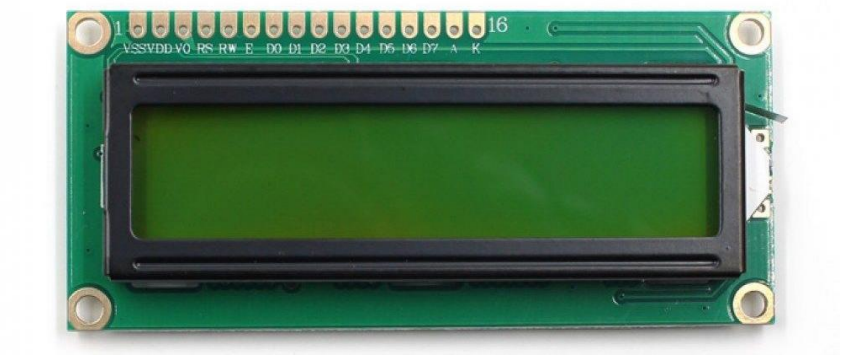

Fig. 2.4 LCD (Liquid crystal display)

The LCD (Liquid Crystal Display) in the context of the provided Arduino project serves as a user interface for displaying information related to the GPS tracking. The purpose of the LCD display in this project is to provide a visual output of the GPS coordinates (latitude and longitude) in real-time. The LCD display in this project acts as a visual feedback mechanism, providing real-time location information to the user and enhancing the user experience by moving beyond text-based output on the Serial Monitor.

(e) **Breadboard**

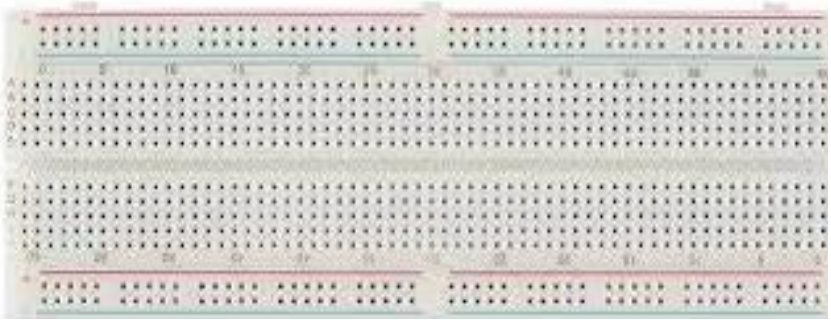

Fig. 2.5 bread board

A breadboard is a fundamental tool in electronics prototyping and experimentation. It is a device used to build and test electronic circuits without the need for soldering. Breadboards are excellent for prototyping and experimentation.

(f) Jumper Wires

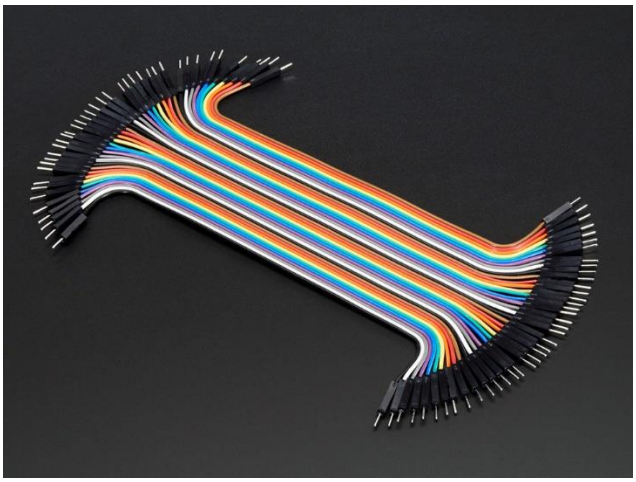

Fig. 2.6 Jumper Wires

Jumper wires are essential components in an RFID door lock system, providing a flexible and convenient means to establish electrical connections between various modules and components. These wires facilitate the seamless integration of RFID readers, servo motors, and other elements within the circuit, allowing for efficient communication and control in the door lock system.

(g) Potentiometer

Fig. 2.7 Potentiometer

A potentiometer is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. If only two terminals are used, one end and the wiper, it acts as variable resistor or rheostat. In the context of the GPS tracker, the potentiometer is used to adjust the contrast of the characters displayed on the LCD.

(h) Resistor

Fig. 2.8 Resistor

A resistor is used to limit the current flowing through the backlight of the LCD display. It helps protect the backlight and ensures proper operation. Here we use 330-ohm resistor.

(i) Push Button

Fig. 2.9 Push Button

A Push Button is used to initiate the GSM Module so that it will receive the signals to send a SMS to the registered mobile number. Whenever the push button is pressed it initiates the GSM Module and it will send the location from google maps to the mobile number.

2.2 Software requirements

(a)Arduino IDE software

Arduino IDE software is an open-source software to which a hobbyist can connect the AT mega chips. In this software the code can be written and uploaded to any AT mega chip and then the code can be executed on the chip. Many 3D printed electronics and Arduino-compatible use AT mega chip and hence the user can upload the program. Arduino can also be used firmware any electronics. Sketch is the window in which the program is to be written.

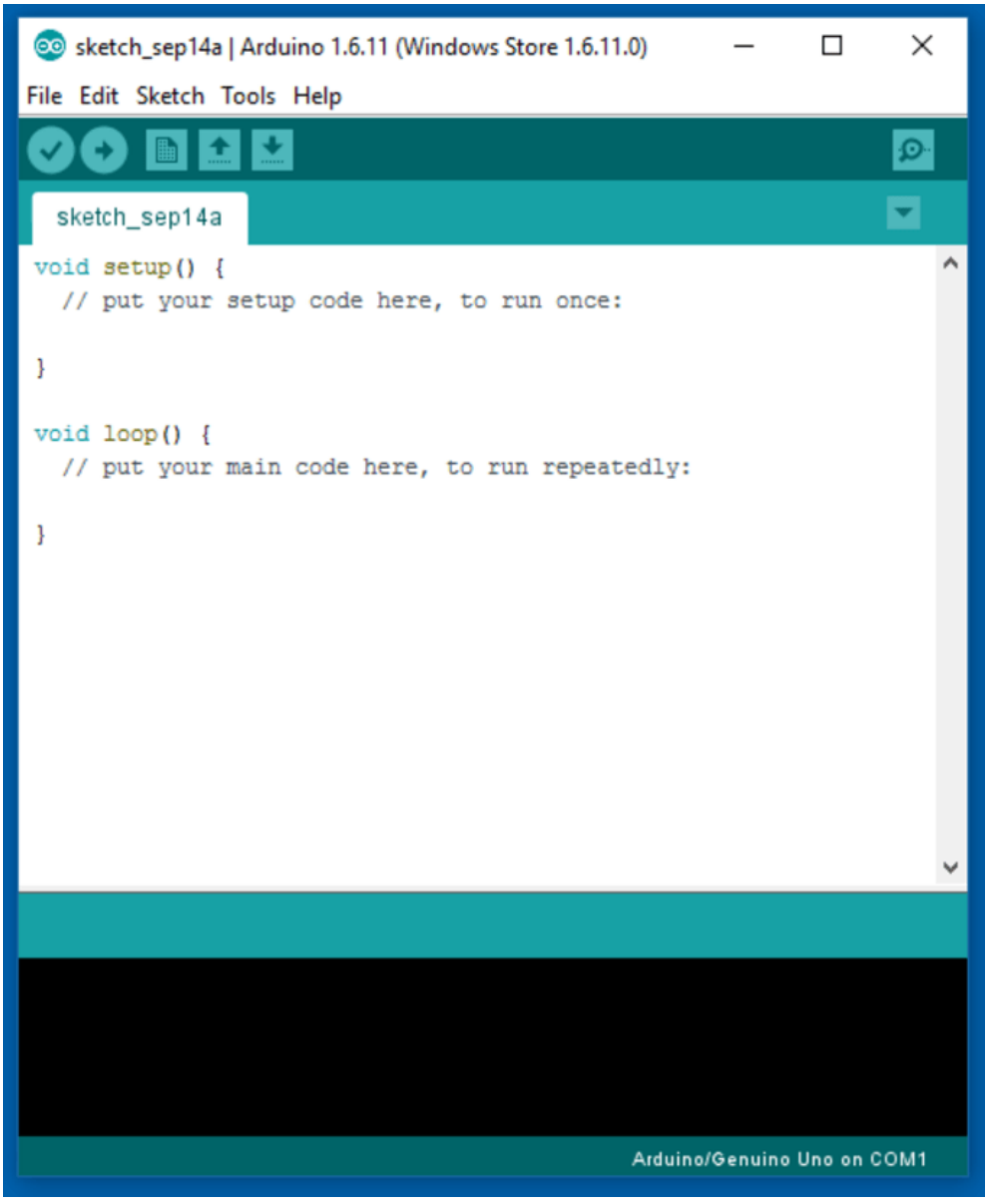

Fig. 2.10 Arduino software tool

2. METHODOLOGY

3.1 Hardware Description:

The block diagram illustrates the seamless flow of data within the system. The GPS Module communicates with the Arduino UNO, which in turn disseminates information to both the Serial Monitor and the LCD Display. This dual-output system enhances the project's versatility, catering to developers for debugging purposes while also providing a user-friendly display for real-world applications such as navigation and location tracking.

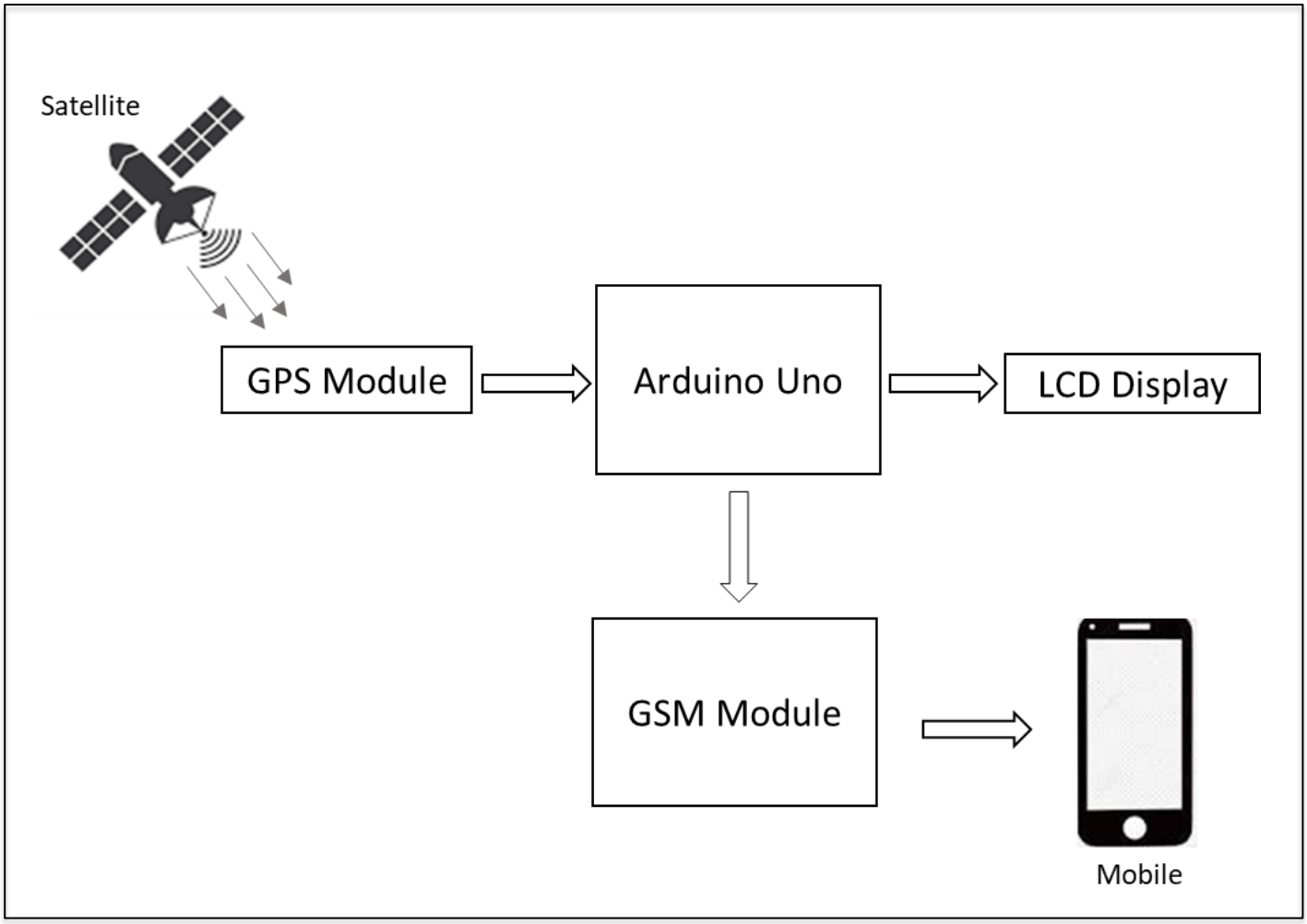

Fig. 3.1 Block diagram of automatic street light system

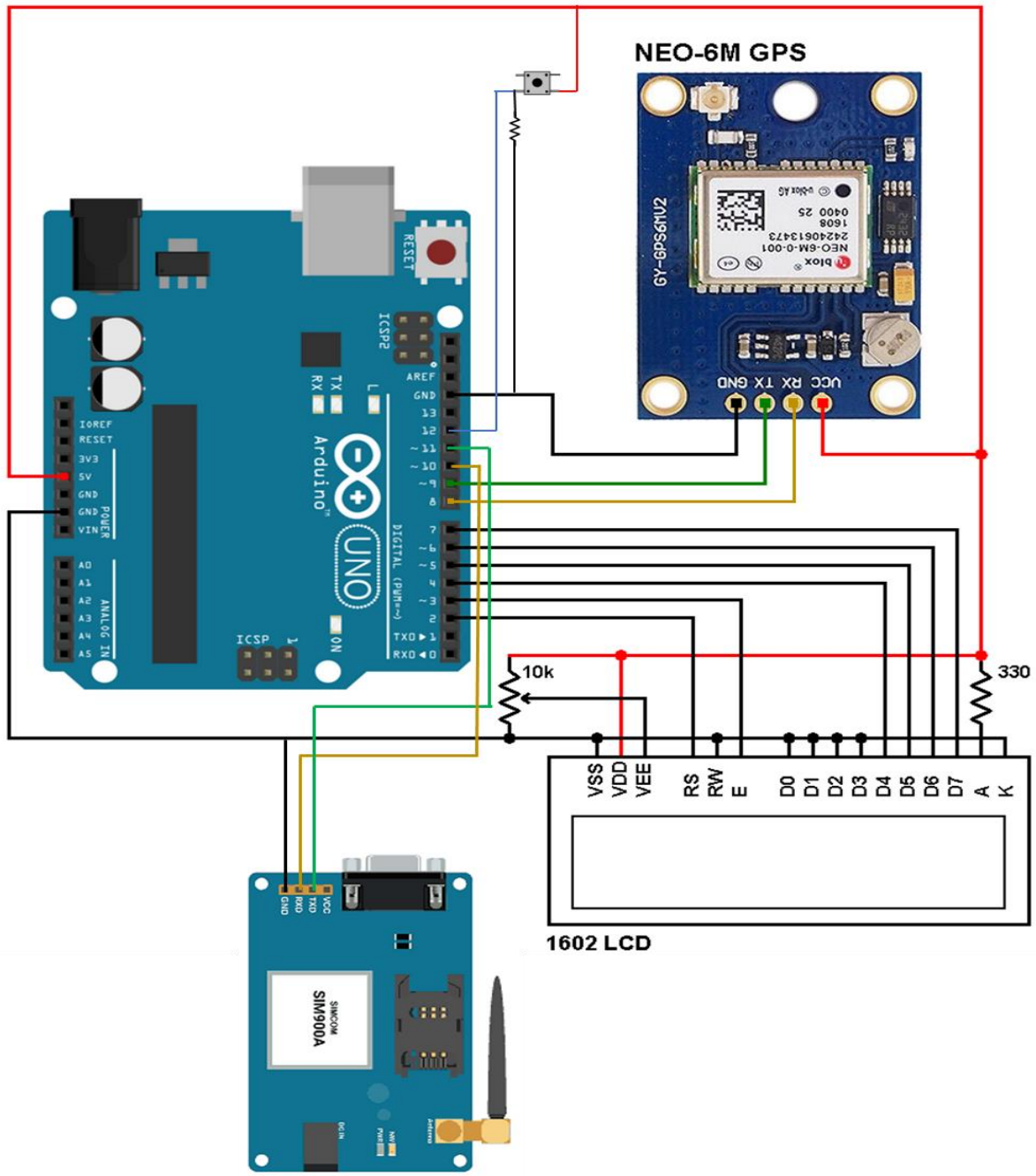

Fig. 3.2: Circuit diagram of GPS Tracker

The components are connected as shown above the circuit diagram:

- Connect the VCC and GND pins of the Neo 6M GPS Module to the 5V and GND pins on the Arduino Uno, respectively.
- Connect the TX pin of the GPS module to the RX pin on the Arduino Uno and vice versa.
- Connect GND, RX and TX pin of GSM Module to GND, D10, D11 of Arduino UNO respectively.
- Connect the VCC and GND pins of the LCD display to 5V and GND on the Arduino, respectively.
- Connect the SDA and SCL pins of the LCD display to the Analog pins on the Arduino, respectively.
- Connect one end of the potentiometer to the VCC, the other end to GND, and the middle pin to the VO (contrast) pin on the LCD.
- Connect one end of the 330-ohm resistor to the LCD and the other end to the Arduino.
- Connect pins D4 to D7 on the LCD to pins 4 to 7 on the Arduino.
- Connect one side of the push button to GND of Arduino UNO along with 10k resistor and the other side to 5V

The GPS Tracker project integrates an Arduino UNO with the NEO-6M GPS Module to create a robust location tracking system. The NEO-6M, equipped with an integrated antenna, communicates with satellites to capture precise latitude, longitude, date, and time data. This information is relayed to the Arduino UNO through UART communication, initiating the core processing stage.

The Arduino UNO, functioning as the central processing unit, receives and interprets the GPS data. Programmed logic extracts the latitude, longitude, date, and time values, facilitating two key outputs: the Serial Monitor and a 16x2 LCD Display.

The Serial Monitor output provides a comprehensive view of the real-time GPS data during the development phase. This feature aids in debugging and ensures the system is acquiring and processing information accurately. Simultaneously, the Arduino UNO interfaces with a 16x2 LCD Display using I2C communication. The LCD visually presents the latitude, longitude, date, and time information in a user-friendly format, making it easily readable and accessible.

4. SOFTWARE DESCRIPTION

4.1 Source Code

The code for the project GPS Tracker using Arduino is given below.

```
#include <LiquidCrystal.h>
#include <TinyGPS++.h>
#include <SoftwareSerial.h>

// Define the pins for the GPS module
#define GPS_RX_PIN 8
#define GPS_TX_PIN 9

// Define the pins for the GSM module
#define GSM_RX_PIN 10
#define GSM_TX_PIN 11

SoftwareSerial gpsSerial(GPS_RX_PIN, GPS_TX_PIN);
SoftwareSerial gsmSerial(GSM_RX_PIN, GSM_TX_PIN);
TinyGPSPlus gps;
LiquidCrystal lcd(2, 3, 4, 5, 6, 7);

void displayGPSData();
void sendLocationSMS();
void print2digits(int number);
void checkIncomingSMS();

void setup() {
  Serial.begin(9600);
  gpsSerial.begin(9600);
  gsmSerial.begin(9600);

  lcd.begin(16, 2);
  lcd.print("GPS Tracker");
  delay(1000);
}

void loop() {
  while (gpsSerial.available() > 0) {
    if (gps.encode(gpsSerial.read())) {
      displayGPSData();
      checkIncomingSMS();
```

```
      delay(30000); // Delay for 30 seconds before reading the
next GPS data
    }
  }

  // Print "NO SIGNALS" if no GPS Signal Found
  if (gps.charsProcessed() < 10) {
    Serial.println("NO SIGNALS");
    delay(10000);
  }
}

void displayGPSData() {
  if (gps.location.isUpdated()) {
    double latitude = gps.location.lat();
    double longitude = gps.location.lng();

    // Printing on Serial Monitor
    Serial.print(" Latitude= ");
    Serial.print(latitude, 6);
    Serial.print(" Longitude= ");
    Serial.print(longitude, 6);
    Serial.print(" Date: ");
    print2digits(gps.date.month());
    Serial.print("/");
    print2digits(gps.date.day());
    Serial.print("/");
    Serial.print(gps.date.year());
    Serial.print("  Time: ");
    print2digits(gps.time.hour());
    Serial.print(":");
    print2digits(gps.time.minute());
    Serial.print(":");
    print2digits(gps.time.second());
    Serial.println();
    // Print Google Maps location link on serial monitor
    Serial.print("Google Maps Location:
https://maps.google.com/?q=");
    Serial.print(gps.location.lat(), 6);
    Serial.print(",");
    Serial.println(gps.location.lng(), 6);

    // Number of satellites in use
    Serial.print("Number of satellites in use = ");
```

```
    Serial.println(gps.satellites.value());

    // Printing Latitude and Longitude on LCD Display
    lcd.clear();
    lcd.setCursor(0, 0);
    lcd.print("Latitude: " + String(latitude, 6));
    lcd.setCursor(0, 1);
    lcd.print("Longitude: " + String(longitude, 6));
    delay(10000); // Delay for 10 seconds before updating LCD
again
  }
}

void checkIncomingSMS() {
  if (gsmSerial.available()) {
    String incomingSMS = gsmSerial.readStringUntil('\n');
    incomingSMS.trim();

    if (incomingSMS.indexOf("location") != -1) {
      sendLocationSMS();
    }
  }
}

void sendLocationSMS() {
  gsmSerial.println("AT+CMGF=1"); // Setting SMS mode to text
  delay(1000);
  gsmSerial.println("AT+CMGS=\"+91XXXXXXXXX\""); // Phone number
  delay(1000);
  gsmSerial.print("Location: ");
  gsmSerial.print(gps.location.lat(), 6);
  gsmSerial.print(", ");
  gsmSerial.print(gps.location.lng(), 6);
  gsmSerial.write(26);
  delay(10000); // Delay for 10 seconds
}
void print2digits(int number) {
  if (number >= 0 && number < 10) {
    Serial.print("0");
  }
  Serial.print(number);
}
```

5. RESULT & DISCUSSION

6.1 Snapshot of the Project

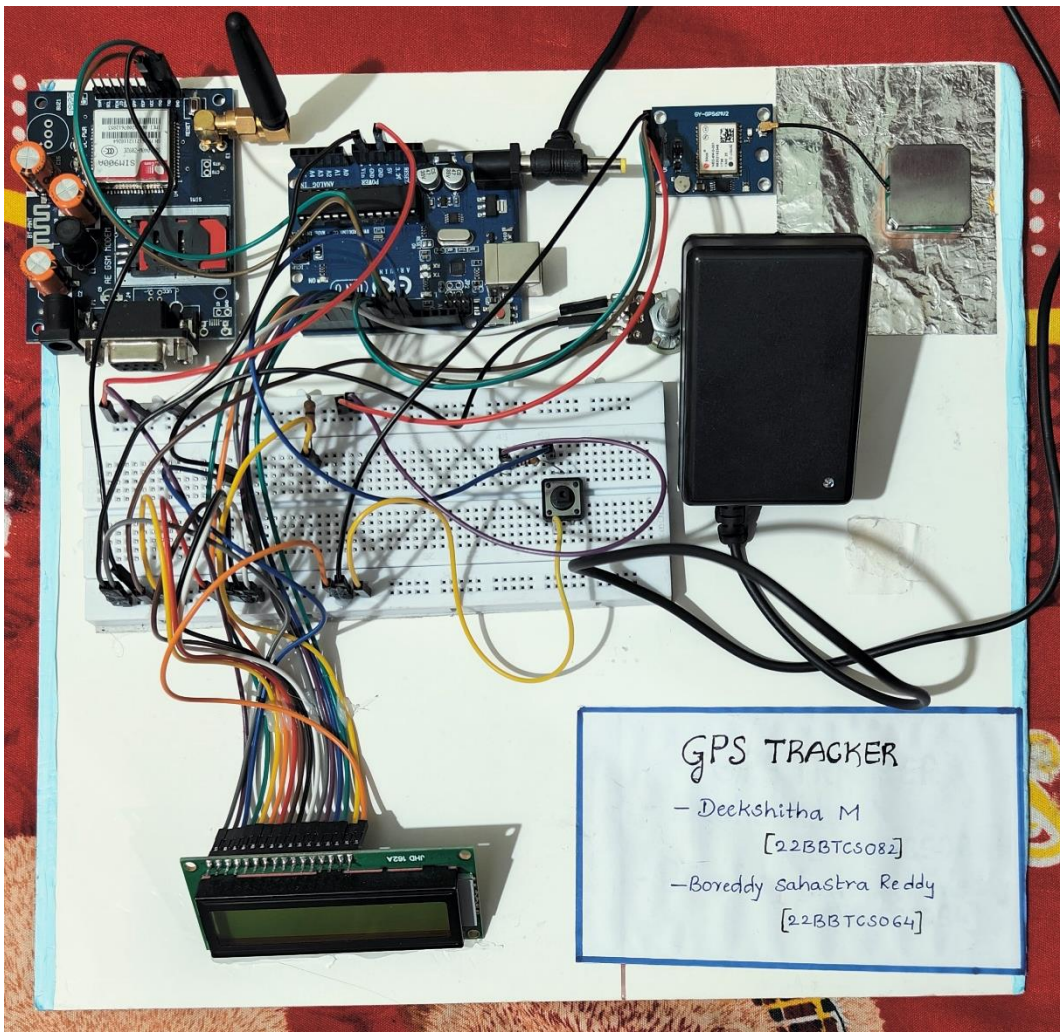

Fig. 5.1 The system setup of GPS Tracker.

The above picture encapsulates the system setup of the GPS Tracking project, offering a visual representation of interconnected components as illustrated in the accompanying circuit diagram. This meticulously designed circuit includes an Arduino UNO, NEO-6M GPS Module, LCD Display, potentiometer, and requisite resistors, all strategically connected on a breadboard. The circuit diagram serves as a guide for assembling the hardware components, depicting the precise wiring necessary for seamless functionality.

Following the circuit assembly, the next step involves uploading the carefully crafted code to the Arduino UNO. Once the code is successfully uploaded, the project is ready for activation. Turning on the power supply initiates the project, setting in motion the interaction between the Arduino UNO and the NEO-6M GPS Module. This interaction is the crux of the GPS Tracker's operational principle.

The GPS Tracker project revolves around the NEO-6M's ability to capture signals from orbiting satellites, relay them to the Arduino UNO, and process the data to extract crucial information such as latitude, longitude, date, and time. The synchronized efforts of the components, visualized in the system setup and executed in the operational stage, embody the seamless marriage of hardware and software in the pursuit of precise GPS tracking.

5.2 Result

The GPS Tracker project, implemented using an Arduino UNO, NEO 6M GPS Module, Sim900A GSM Module, and a 16*2 LCD Display, yields a functional and versatile system with various key outcomes. Firstly, the system accurately tracks and displays real-time latitude and longitude coordinates obtained from the NEO 6M GPS module. This information is visually represented on a 16*2 LCD display, providing on-site visibility of the tracked location. Additionally, the Serial Monitor output facilitates debugging and monitoring, displaying supplementary details such as the date and time of the GPS fix.

The system is designed to indicate when no GPS signals are available, enhancing user awareness in situations where the GPS fix may be compromised. On receiving an SMS command, such as "location," the system sends an SMS notification to a specified mobile number. This message includes the current latitude, longitude, and a Google Maps link for convenient visualization of the tracked location. The flexibility of the power supply, accommodating USB, external DC power, or an external power supply, adds versatility to the project.

The incorporation of a potentiometer allows users to adjust the LCD contrast, optimizing visibility under varying lighting conditions. The overall result is a user-friendly and educational project, offering practical insights into integrating GPS and GSM modules with Arduino for real-world applications. Beyond technical achievements, the GPS Tracker project has potential applications in areas such as vehicle tracking, asset monitoring, or personal location tracking, making it a valuable and accessible tool for hobbyists and enthusiasts.

6. CONCLUSION

In conclusion, the GPS Tracker project stands as a testament to the convergence of technology, precision, and user accessibility. The seamless integration of an Arduino UNO with the NEO-6M GPS Module transforms the complex science of satellite-based positioning into an accessible and user-friendly system. The project's foundation lies in the meticulous arrangement of components, as depicted in the circuit diagram and system setup, ensuring optimal connectivity and functionality.

Upon activation, the GPS Tracker project adeptly captures signals from orbiting satellites, providing real-time latitude, longitude, date, and time information. This valuable data is presented through a dual-channel output mechanism: the Serial Monitor, offering developers an insightful view during the developmental phase, and the 16x2 LCD Display, providing end-users with a clear and legible interface for immediate location insights.

Beyond the technical intricacies, this project addresses the increasing demand for compact, cost-effective, and versatile GPS tracking solutions. Whether utilized for personal navigation, asset tracking, or other location-based services, the GPS Tracker project exemplifies the synergy between hardware and software in creating a sophisticated yet accessible technology. As the digital embodiment of location awareness, this project not only captures the essence of satellite communication but transforms it into a practical tool, bridging the gap between complex technology and everyday utility.

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