NITTE (Deemed to be University) | NMAM INSTITUTE OF TECHNOLOGY

AUTOMOTIVE ELECTRONICS (20ECE32)

Mini Project Report on

"GPS Based Position Monitoring using Ri-Pi"

Submitted by

Preethish K R	4NM20EC074
Rakshith	4NM20EC083
Ujwal N Nayak	4NM20EC135

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INTRODUCTION

Thousands of automobiles are lost every year and the theft of vehicles has become a social real time problem now a days. Hence it is necessary to monitor the vehicles regularly. With the emerging technological innovations, users are looking for automotive system than the manually operated system. An In-vehicle monitoring system are any electronic device that is used to track or report the vehicle position at any instant of time. Vehicle tracking systems is very useful for transport companies and government bus services. But still, we don't have any bus tracking system for government buses and school buses. Real time tracking of many vehicles has been made easier with the help of GPS technology. GPS positioning technology plays an important role in positioning, monitoring, and navigation.

The project primarily focusses on finding the GPS parameters such as latitude and longitude of the current location continuously and displaying it in OLED display with the help of Raspberry Pi pico and a GPS module. By combining the GPS parameters such as latitude and longitude any location can be pinpointed.

BLOCK DIAGRAM

Below figure .1 is the block diagram of the GPS interfacing with Ri-Pi Pico. It consists of GPS module, Ri-Pi Pico and an LCD display.

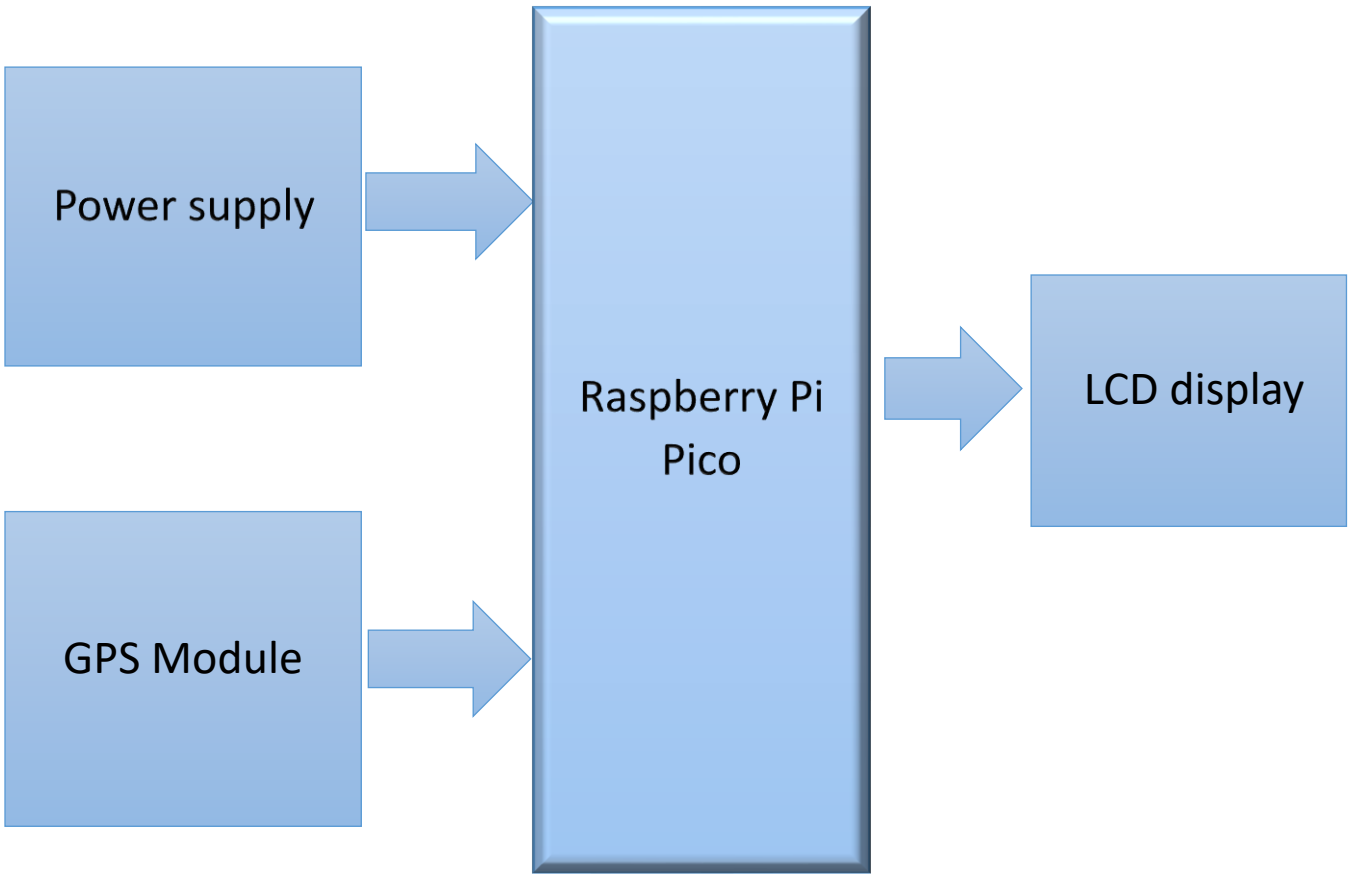


Fig. 1 shows the block diagram of the GPS based position monitoring using Ri-Pi Pico

The GPS antenna simply receives the electromagnetic signals from the satellites. To convert the electromagnetic signals to digital values GPS receiver unit is used. A GPS receiver collects information from the satellite and generates output in the form of different strings. It gives these strings as input to Raspberry Pi pico . The Raspberry Pi pico receives all the strings from GPS receiver but extracts only one string. It extracts latitude and longitude values of the current location from string and displays them on OLED display in proper format. The information like location, speed, Date &Time are also displayed in the OLED display.

HARDWARE AND SOFTWARE

THE HARDWARE SYSTEM

1) Microcontroller: This section forms the control unit of the whole project. The microcontroller used is Raspberry Pi Pico which forms the heart of the project because it controls the devices being interfaced and communicates with the devices according to the program being written. Raspberry Pi Pico is the low cost and small size microcontroller board that is equipped with RP2040 Microcontroller chip developed by Raspberry Pi Foundation itself. The RP2040 is supported with c/ c++ and micro python programming language.

Specifications:

- RP2040 microcontroller chip with 26 multifunctional GPIO pins
- A wide range of flexible I/O options include I2C, SPI, &uniquely programmable I/O pins.
- 264KB internal ram
- Operating voltage (VDC) is 1.8V~5.5V but Input /Output voltage is fixed at 3.3V

2) GPS Module: Neo-6M GPS module consists of GPS antenna with a UART TTL socket. It consists of a battery for power back up and EEPROM for storing configuration settings. The antenna is connected to the module through a ufl cable which allows for flexibility in mounting the GPS such that the antenna will always see the sky for best performance. The GPS module has 4 pins: TX, RX, VCC, and GND.

A GPS antenna is a device that boosts the received signal to a GPS unit, whether it is a standalone unit or an embedded unit. GPS antenna can transmit and receive signals. It can contact the positioning satellites in the sky through the transmitting signals so that the satellites will be able to know the situation of the user. Often a GPS antenna is used in a

situation where the GPS unit itself is somehow removed from a line of sight to the sky. The GPS antenna simply receives the electromagnetic signals from the satellites. To convert the electromagnetic signals to digital values we need a GPS receiver unit.

Specifications:

- Supply voltage:3.3V
- Baud rate: Configurable from 4800 to 115200 baud rates(default 9600)
- Rechargeable battery for back up and EEPROM to save configuration settings

3)LCD Display: A 0.96 Inch OLED display consists of I2C interface module. It consists of 4 pins such as VSS, VDD, SCL, SDA pins.

Specifications:

- Require 3.3 V power supply
- Display Size: 0.96 inch
- Resolution :128 x 64 pixels

SOFTWARE SYSTEM (DESIGN)

THONNY IDE: It is an integrated development environment for python that is designed for beginners. It is a free Operating system for Raspberry Pi board. The program works on Windows, macOS and Linux Operating systems. Thonny has support for installing micro python packages from python package index (PyPI) directly on to the Raspberry pi pico.

SYSTEM IMPLEMENTATION

1) Gather the necessary components: It requires a Neo-6M GPS module, a Raspberry Pi Pico, a breadboard, and some jumper wires.

2) Connect the Neo-6M GPS module to the Raspberry Pi Pico using UART based Communication. Connect the Neo-6M GPS module to the Raspberry Pi Pico using jumper wires. Connect VCC pin of the GPS module to 3.3V pin of the Raspberry Pi Pico, GND pin of the GPS module to GND pin of the Raspberry Pi Pico, TX pin of the GPS module to GP0 pin of the Raspberry Pi Pico, and RX pin of the GPS module remain unconnected.

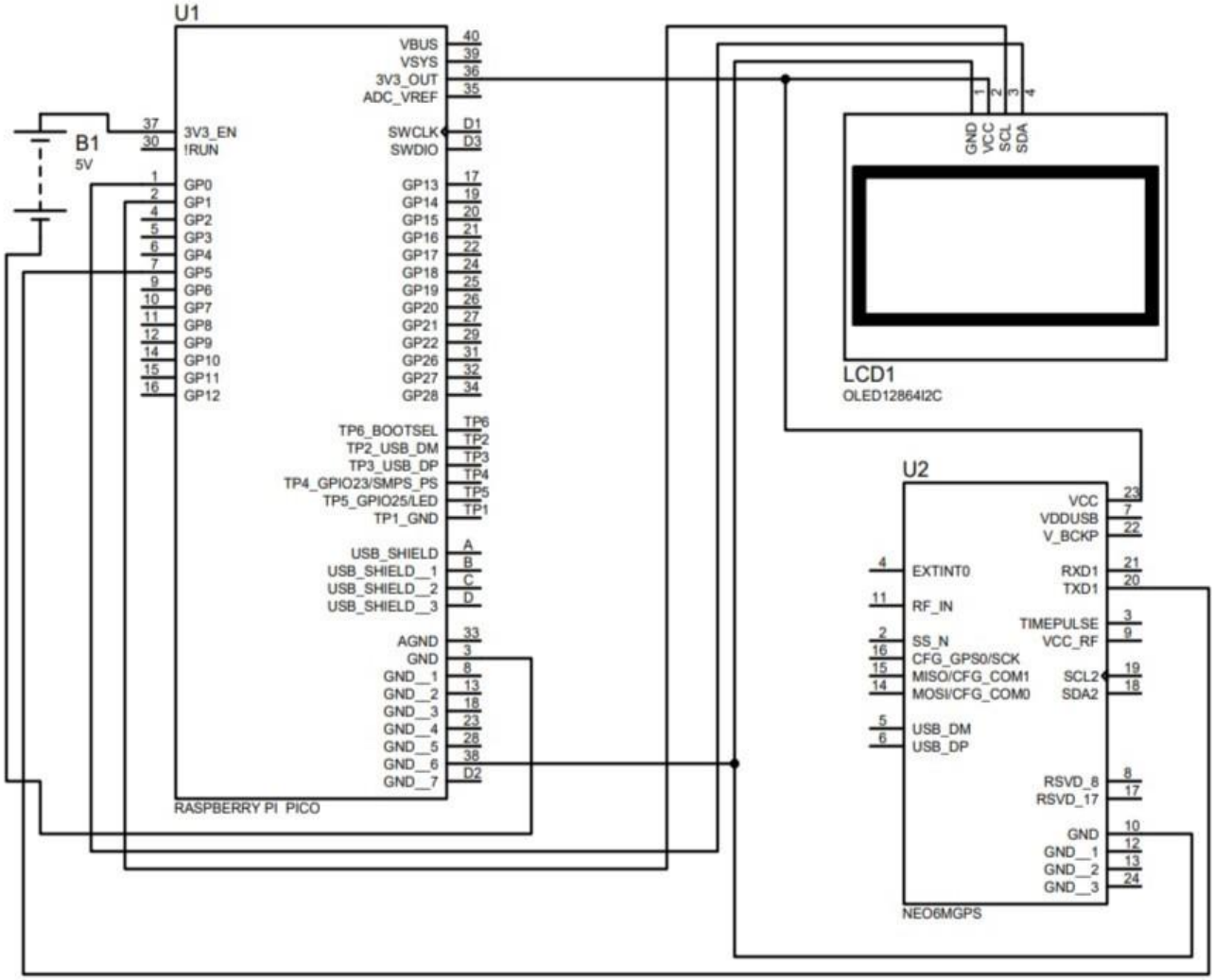
3) Install the necessary libraries: Install the necessary libraries in Thonny IDE for interfacing the Neo-6M GPS module with the Raspberry Pi Pico.

4) Next step involves Writing the code using micropython to read the NMEA data from the Neo-6M GPS module and extract the latitude and longitude information.

5) Save the code: Save the Python code as a ".py" file on the Raspberry Pi Pico.

6) Run the code: Run the Micropython code , which displays lattitude and longitude information on the console . This data is displayed on the LCD display using I2C communication with Raspberry Pi Pico.

Proteus based circuit diagram



ADVANTAGES AND DISADVANTAGES

Advantages:

1. Accurate positioning: GPS-based positioning is highly accurate and can provide real-time location information, making it useful for a wide range of applications such as navigation, tracking, and geofencing.

2. Global coverage: GPS-based positioning is available worldwide, as long as there is a clear line of sight to GPS satellites, making it useful for tracking and monitoring assets and vehicles across multiple locations.

3. Low cost: Raspberry Pi Pico boards are relatively inexpensive, making them accessible to a wide range of users.

4. Customizable: Raspberry Pi Pico boards are highly customizable, which allows for flexibility in designing and implementing GPS-based position monitoring systems to meet specific needs.

Disadvantages:

1. Power consumption: GPS receivers require power to operate, which can be a concern for battery-powered devices or applications where power consumption is a critical factor.

2. Signal loss: GPS signals can be disrupted by physical obstructions such as buildings or trees, and can be completely lost in areas with poor satellite coverage, such as indoors or in tunnels.

3. Security concerns: GPS signals can be jammed or spoofed, which can pose security risks for applications such as military or aviation.

4. Limited sensor range: GPS receivers have a limited range and may not work in areas where the view of the sky is obstructed, such as urban canyons or heavily wooded areas.

5. Complex implementation: Implementing GPS-based position monitoring using a Raspberry Pi Pico can be complex and may require specialized skills and expertise, including knowledge of programming languages and electronic circuits.

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