Implementation of portable GPS receiver as early tool in the Covid-19 incidence

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Abstract— The way in which the various variables of health events such as the environment and the socioeconomic conditions of the populations interact has led to geo satellite reception systems (GPS) being incorporated into the health sector progressively, providing the opportunity to explore the spatial distribution of events and serve as support for medical decision-making, and monitoring of epidemiological surveillance. This article exposes the implementation a portable GPS receiver that allows determining the geographical position of longitude and latitude using the NEO 6M GPS receiver module and its communication to a PIC16F877 trying to contextualize its use in the analysis of data that includes spatial information. Related to geographic reference points and distribution of vectors in the occurrence of new coronavirus SARS-COV2 that causes the disease called COVID-19 in the South the Valley of Mexico with special emphasis on its epidemiology application

Keywords: GPS, IOT, COVID19, Epidemiology, Public Health.

I. Introduction

Global Positioning System the global positioning system (GPS) consists of a handheld device that is coordinated with a global system of man-made satellites and, depending on the accuracy and coordination, provides quite accurate readings of the coordinates of the position of the device. GPS enables one to pin point an individual person or a specific area or areas of the field that are affected by a pathogen, which then can be visited and examined again periodically for incremental advance of the symptoms. Similarly, the selected areas could be treated with the appropriate vaccines or other treatment wherever the pathogen is present without the need to treat the entire field. GPS can also be used to apply sanitary measures. A reduction of the covid-19 from the field by early detection and treatment is often effective in not allowing the virus to cause an epidemic.

The geographic information system (GIS) is a computer system that can be installed on any recent model desktop computer and is capable of assembling, storing, manipulating, and displaying data that are referenced by geographic coordinates. GIS is adaptable to operations of any size, and data can be used at any scale from a single field to and/or populations region. It is used to better understand and manage the society demographic, including the understanding and management of human disease epidemics. GIS techniques allow one to make connections between events based on geographic proximity, connections that are essential to the understanding and management of epidemics but which often go unrecognized without GIS. GIS techniques can even incorporate disease forecasting systems, although the time and cost for it may be prohibitive. However, as high-resolution weather forecast data are often available, the development of human disease epidemics can be predicted by knowing their dependency on some critical variable and from estimated geographic distribution of the pathogen inoculum within a GIS framework. GIS is often used for the spatial and temporal analysis of disease development over relatively large geographic areas and helps determine the role and relative importance of various parts of these areas in the initiation and development of the epidemic

Geostatistics consist of various “geostatistical” techniques that are applied in human disease epidemiology to characterize quantitatively spatial patterns of disease development or the development of pathogen populations in space and over time. These techniques have the capability to take into account the characteristics of spatially distributed variables whether they are random or systematic. In addition to being able to detect spatial connections, geostatistical techniques can also be used for studying continuous and discrete variables. Geostatistical techniques do not require as exacting assumptions of stationarity as do other spatial autocorrelation techniques. The spatial dependence or connection can be analyzed with semivariograms. The latter quantify spatial dependence by determining the variation between samples

This paper shows how to interface the PIC16F877A microcontroller with GPS module in order to receive data from satellites where the GPS module used in this project is NEO-6M. With the NEO-6M GPS module we can measure position latitude, longitude and altitude, time (UTC), date, speed and some other data.

In this project send information of latitude, longitude, altitude, time (UTC), the using serial port. The Data are sent to the laptop after receiving it from the GPS module. The 20x4 LCD and laptop displays all data with serial monitor software such as Windows hyper terminal, before with creation tools the Google maps program can draw on the map, customize your view.

II. Methodology

He shows how to build a GPS receiver using PIC16F877A microcontroller and NEO-6M GPS module, other modules should also work. The microcontroller reads time (UTC), latitude and longitude date from the GPS module and display it on a 20×4 LCD screen.

Generally the NEO-6M GPS module has 4 pins: VCC, RX, TX and GND. It uses serial communication (UART protocol) to communicate with the microcontroller where RX/TX pins are for receiving/transmitting data from/to the microcontroller.

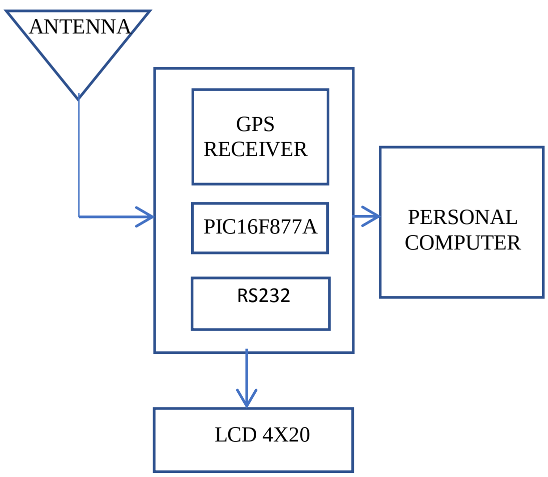


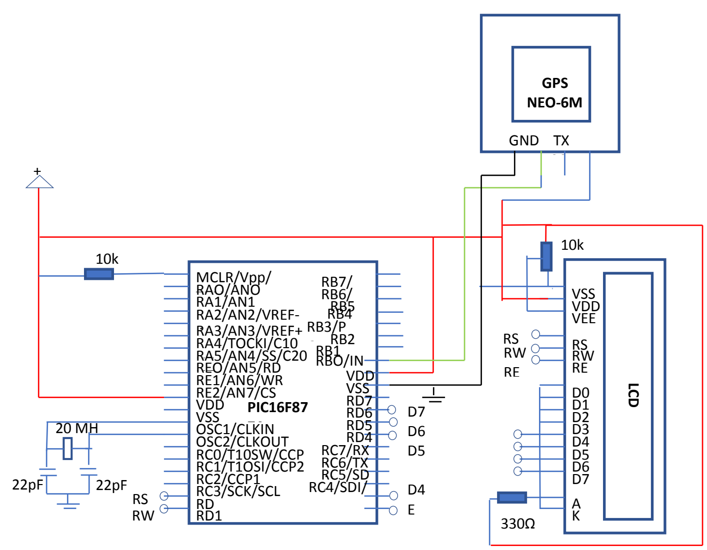
Figure. 1. NEO-6M GPS module with EEPROM included GPS antenna. It is compatible with various microcontrollers that need GPS positioning.

The GPS receiver module gives output in standard (National Marine Electronics Association) NMEA string format. It provides output serially on Tx pin with default 9600 Baud rate. This NMEA string output from GPS receiver contains different parameters separated by commas like longitude, latitude, altitude, time etc. Each string starts with '$' and ends with carriage return/line feed sequence.

$GPRMC,**184237.000**,A,**1829.9639,N,07347.6174,E**,0.05,180.19,230514,,,A*64

Figure.2. GPS receiver module gives output in standard (National Marine Electronics Association) NMEA string format. It provides output serially on Tx pin with default 9600 Baud rate. This NMEA string output from GPS receiver contains different parameters separated by commas like longitude, latitude, altitude, time etc. Each string starts with '$' and ends with carriage return/line feed sequence

To be able to send data from the microcontroller to the laptop computer we need a USB-to-Serial converter module. In this project I used the Belkin module. The GND pin of the USB-to-Serial converter is connected to circuit ground and RX pin is connected to PIC16F877A TX (RC6), in this project the PIC16F877A microcontroller used 20 MHz crystal oscillator, the Interfacing PIC16F877A with NEO-6M GPS module C code below for CCS C compiler, to assemble GPS receiver. The entire firmware is written in Embedded C language in CCS developed the first C compiler for Microchip microcontroller. The diagram electronic of our system is as shown Figure.3



igure.3. NEO-6M GPS module has 4 pins connected as follows: GND (Ground) pin connected to circuit GND, TX pin goes to PIC16F877A, RX (RB0), and RX pin is not connected, VCC pin 5Volts. The uBlox-G7020 has color code for the pins. The Positive or 5V pin is in red color, the Negative or GND pin is in black color and the Transmit pin is in green color.

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III. Results

It is systems which provide accurate Latitude, Longitude, and UTC time, to read data from GPS, we need some microcontroller and we already interfaced GPS with PIC16F877A. To select NEO-6M GPS will receive Longitude and latitude of a particular position from satellite and will display the same on a 20x4 Character LCD. The figure 4 show **Interface GPS** NEO-6M **with PIC16F877A microcontroller.**

The Figure 4 show NEO-6M GPS receive and transmit data using UART. PIC16F877A consists one USART driver inside the chip, we will receive data from GPS module by USART, so a cross connection will be made from the microcontroller Rx pin to GPS's Tx pin and USART Receive pin connected across GPS's Transmit pin.

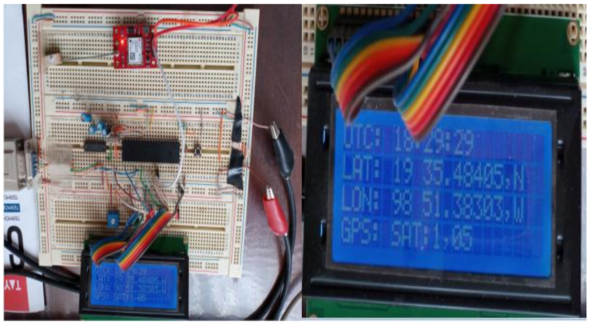

Figure.4. NEO-6M GPS receive and transmit data using UART. PIC16F877A. Receive pin connected across GPS's transmit pin.

3.1. Use latitude and longitude in Google Maps.

To find a location using its latitude and longitude on any device, just open Google Maps. On your phone or tablet, start the Google Maps app. On a computer, go to Google Maps in a browser. Then enter the latitude and longitude values in the search field the same one you would ordinarily use to enter an address.

A. Enter coordinates to find a place

1. On your computer, open [Google Maps](https://www.google.com/maps).
2. In the search box, enter your coordinates. Here are examples of formats that work:
   - **Decimal degrees (DD)**: 41.40338, 2.17403

No	Latitude	Longitude	Mark
1	19.3581	-99.0936	IZTAPALAPA 1
2	19.37092	-99.08988	IZTAPALAPA 2
3	19.3444	-99.10153	IZTAPALAPA 3
4	19.37207	-99.06831	IZTAPALAPA 4
5	19.38094	-99.0871	IZTAPALAPA 5
6	19.35618	-99.05582	IZTAPALAPA 6
7	19.35381	-99.06682	IZTAPALAPA 7

Table.1. To find the GPS coordinates of an address or a place, simply use Google Maps our latitude and longitude finder. Fill the address field and click to display its latitude and longitude.

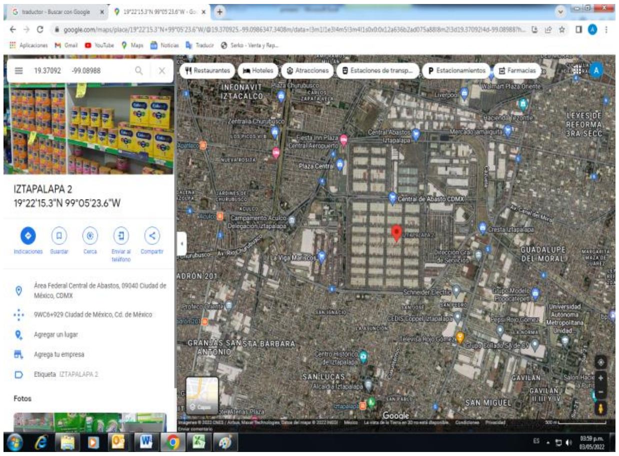

Figure.5. Table with coordinates in the south of the valley of Mexico stands Market on "La Viga Canal", México City, México, DD format: 19.37092 -99.08988.

IV. Conclusion

A. Here, we introduced the primary development phase of a telemedicine system to support the tracking of possible COVID-19 spread. We showed the hardware design of the footpath devices and collection points and introduced the basic concept of the Google Map end system.

B. The hardware design and primary testing were successful. The tracking devices worked reliably and met all requirements. The actual device can detect other trackers at a mutual distance of 4.5 ± 1.5 m. Although this specification may seem inaccurate, it is based on long-term testing in real-life situations and gives an average distance limit of 2 m. It is necessary to realize that in real life, people do not stand side-by-side passively, and their positions also change.

C. This study has demonstrated a quick and best possible solution for home quarantine and containment clusters for the affected people. The solution helps minimize the disease spread. The web service integrated on Google geo-platform also enables the solution to operate 24×7 covering the South of Mexico Valley.

D. Google Map-based application can be developed and provided along the GPS. Instead of getting location longitude and latitude coordinates, which are difficult to understand by common user, looking at the LCD display, the location can easily be viewed on a Map. Work needs to be done to improve accuracy of position fix and improving performance in indoor environment.

E. The design of GPS receiver solution for COVID-19 is important for health sector dealing with the pandemic. The solution is designed using space technology derived inputs, open-source software technologies, freeware tools and API's. The solution, addressing the systematic data capture of COVID-19 symptoms with geospatial parameters, helps in building the hotspot clusters of home quarantine layer that is dynamically generated in the web or mobile app.

F. Google maps satellite data map service as a background base map, GIS layer generation in mobile using disseminated COVID-19 data information in near real time can be termed as Geo-ICT service to the citizens, affected people and a tool for government department to effectively manage the pandemic.

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