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LabVIEW Based Embedded Testbed for Vehicle Speed Detection Using GPS Co-Ordinates

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ABSTRACT: PC based data acquisition has gained its importance nowadays. This work focuses on tracking and monitoring of one's vehicle regularly. It aims at designing a system for early detection and giving alert when an unusual driving pattern is witnessed in case of rash driving. The proposed testbed is developed with the help of LabVIEW and myRIO evaluation board. In this testbed real time data is obtained using GPS Module and the data is published in the web browser using myRIO Web publishing tool. This will be helpful for travel agencies who want to monitor the vehicle and can also be used to track a vehicle in case of theft detection. Its usage is further extended in smart cities.

KEYWORDS: myRIO, LabVIEW Software, GPS Module

I. INTRODUCTION

In earlier days, only passive systems were used in which the speed information of the vehicle was stored in a device. After the vehicle returns, the data can be downloaded from the device. With the development in technology, an active system that is capable of monitoring and updating the values continuously is required. LabVIEW (Laboratory Virtual Instrument Engineering Workbench) is a system design platform from National Instruments. It integrates the creation of user interfaces termed as front panels. It uses application web server to host the web services on the network. The webserver can be remotely controlled using TCP/IP (Transmission Control Protocol/Internet Protocol) services.

MyRIO (Reconfigurable Input Output) is a real-time embedded evaluation board made by National Instruments. It is used to develop applications that utilize its onboard FPGA and microprocessor. It requires LabVIEW software for implementation. myRIO has an inbuilt Wi-Fi capability in which the code can be dumped and can be made to run continuously once it is powered using a DC supply. The Wi-Fi range of MyRIO is 150m. The program can also be dumped using external Wi-Fi. The device can be made to run as a stand-alone application.

II. LITERATURE REVIEW

The vehicle's location information is determined using GPS and the information is transmitted using GSM and this data is stored in database [1]. Using GPS, location of the vehicle is determined and by subtracting the values of latitude and longitude, speed of the vehicle will be calculated and the system alerts the driver if another car is approaching in opposite direction with range of 50m [2]. Two Ultrasonic sensors interfaced with myRIO is used to find the speed of the vehicle and the LPR algorithm is used for number plate recognition [3]. The speed limit, signal status, timers, pedestrian alert is set by the traffic police which is displayed within the car [4]. The authority can lock the door and stop the motor of the vehicle in case of any theft detection. This is done using GSM and GPS technology [5]. In case of any accident, the location of the person is sent to the ambulance driver and the route maps for the nearby hospital is also provided [6]. The movement of the object is continuously tracked using a surveillance camera and the

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values are updated in the user’s system[7].The patient’s body conditions are detected using sensors and the values are continuously updated to the doctor. This is done using LabVIEW and arduino[8].The shortest path with less traffic is identified by using the GPS module and the information is sent to the driver’s mobile using the GSM module[9]. The location data is extracted using the GPS module and the location information is send using the GSM module[10]. The instructions for using the MyRIO-1900 kit was studied using the LabVIEW National Instruments manual [11].Several doubts regarding the working of myRIO , GPS interfacing with myRIO and the problems related to publishing the front panel of myRIO in the web server were clarified by the National Instruments forum[12].

III. OBJECTIVE

To develop a VI that provides information about the following:

- Vehicle's location information
- Speed at which vehicle travels
- E-Mail alerts in case the vehicle crosses the limit set by the owner of the vehicle

IV.BLOCK DIAGRAM

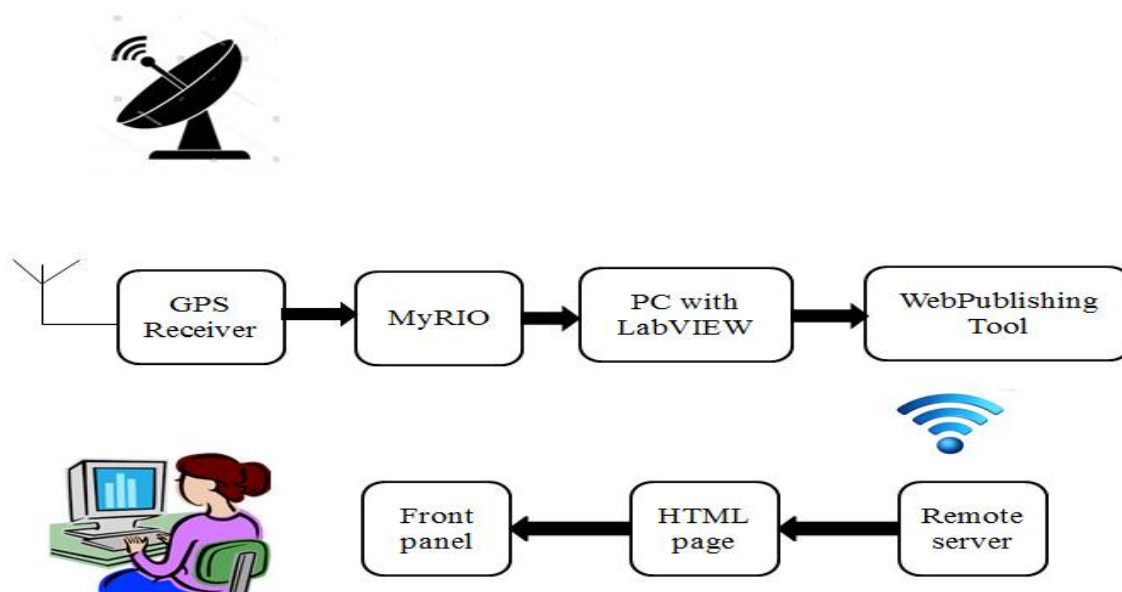


FIG. 1 Block diagram

IV.A GPS Receiver (SIM 28ML):

The block diagram of the proposed design is shown in FIG.1.The GPS receiver antenna is highly sensitive and is able to track the signals inside the buildings and even under tree cover. It is a standalone L1 frequency GPS module. The data received by the GPS module is in the form of NMEA (National Marine Electronics Association)sentence .The NI VISA(Virtual Instrument Software Architecture) is used to access the data for NMEA sentence which is further processed using the LabVIEW code and only the necessary data like speed, latitude and longitude information are extracted from the sentence.



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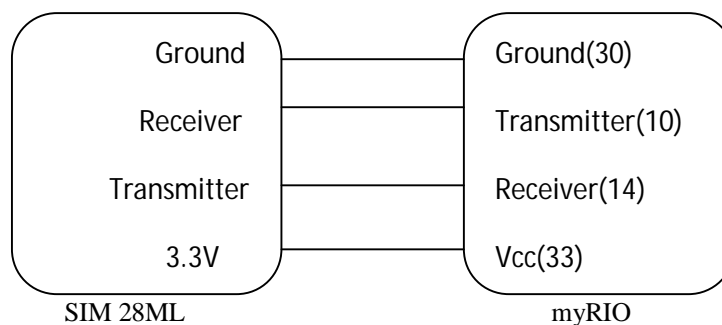


FIG. 2GPS Receiver Connection with myRIO

The GPS receiver module is connected with the UART pins of myRIO. The connection diagram is shown in FIG.2.

IV.B MyRIO:

myRIO is a compatible device embedded with real time processing capability .It has Wi-Fi capability within it. The program can be deployed either by using a cable or Wi-Fi. Wi-Fi compatibility makes it to use as a real time application. The Wi-Fi range in myRIO is 150m.The program can also be deployed using External Wi-Fi from mobile phones.This makes it more compatible compared to arduino in which once the supply is stopped, the program has to be deployed once again. myRIO is powered using DC power supply and connected to a computer.The program can be dumped within myRIO making it available as a stand-alone application. Once the input is given to run as startup, whenever the supply is on, the program runs automatically and need not be dumped each time. This functionality is provided by NI Measurement and Automation Explorer software. It has default FPGA personality that can be modified to suit a particular task. Debugging of a LabVIEW code is easier compared to arduino. It includes analog inputs & outputs, digital I/O lines, LED's, push button, onboard accelerometer, Xilinx FPGA,dual-core ARM Cortex-A9 processor.

IV.C LabVIEW:

LabVIEW is a graphical programming language which uses graphical blocks rather than lines of text to create applications. The programmer can connect the different function nodes by drawing wires. LabVIEW provides a platform for communication tools including ActiveX, TCP,UDP and Data Socket. The standard protocol HTTP is being used .LabVIEW also includes a built in support for National Instrument's hardware platforms like myRIO and myDAQ with a large number of device specific blocks like Measurement and Automation Explorer(MAX) and VISA toolsets. LabVIEW version 2014 has been used.

IV.D Web Publishing Tool:

The wireless transmission of the data has been earlier done with Zigbee, Bluetooth, Wi-Fi and Dash7.All these components have range limits. LabVIEW overcomes this complexity by means of an inbuilt feature called the Web Publishing Tool which provides the wireless transmission of data which can be accessed from anywhere using the URL typed in a web browser. The IP Address should be in the format:

http://ipaddress:portno/filename.html

The Web based configuration is usually based on the client server architecture where the transmission from machine to machine communication is usually enabled. The program is embedded within myRIO as a standalone application and the front panel running within myRIO is published in the web browser.



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V. PROPOSED METHODOLOGY

The myRIO is sent along with the GPS receiver in the vehicle whose position is to be tracked. The GPS receiver antenna collects the information in the form of NMEA sentences. NMEA stands for National Marine Electronics Association. The speed, latitude and longitude information can be obtained using the LabVIEW code which is deployed within myRIO. The front panel of myRIO which contains the information regarding speed, latitude and longitude can be viewed through the web browser operated by the remotely located user. The latitude and longitude information can be used to obtain the exact location of the vehicle by using the co-ordinates in Google maps

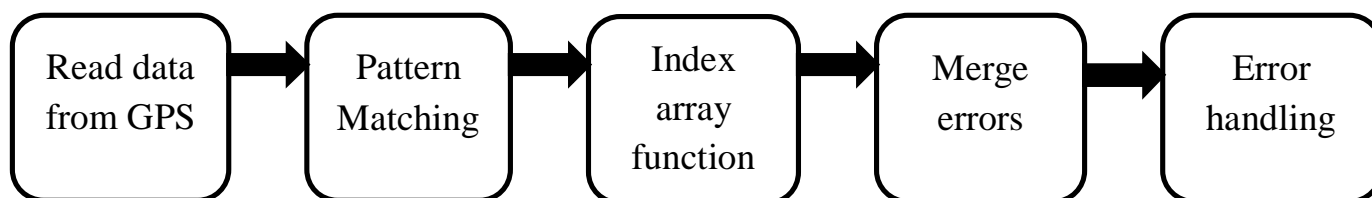


FIG. 3 Proposed methodology

The GPS data is obtained in the form of NMEA sentence. These sentences are compared with the expression. If the pattern matches, it returns the required NMEA sentence. The index array function is used to extract the speed, latitude and longitude informations. The errors are concatenated using the merge error function and finally displayed using simple error handling function. The proposed methodology is shown in the FIG.3.

V.A Steps to configure LabVIEW for remote communication:

1. Open myRIO project and connect to the target.
2. In the Project Explorer window right click on the target and choose properties.
3. Enable remote panel server in web server and set the HTTP port (default is 80).
4. Specify the list of VI's that are allowed to access by the clients.
5. Specify the list of Client's IP address who can view the Web server.

V.B Steps for Web Publishing:

1. Open Tools>>Web Publishing Tool.
2. Select the VI and choose Embedded to view and control the VI and click NEXT.
3. In this window give the proper title, header and footer information.
4. Browse the local directory to save the webpage as C:\Program Files\National Instruments\LabVIEW 2014\www.
5. Access the web server using the server IP address

V.C Mail alert system:

1. Add the send Email Express VI to the block diagram.
2. Specify your email address in the sender's email address textbox located in the user information section of the configuration block.
3. Specify the host name or the IP address of SMTP server.
4. Specify the port number of the SMTP server.
5. Click the OK button to save the configuration and close the Configure send email dialog box.

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V.D VISA Configure:

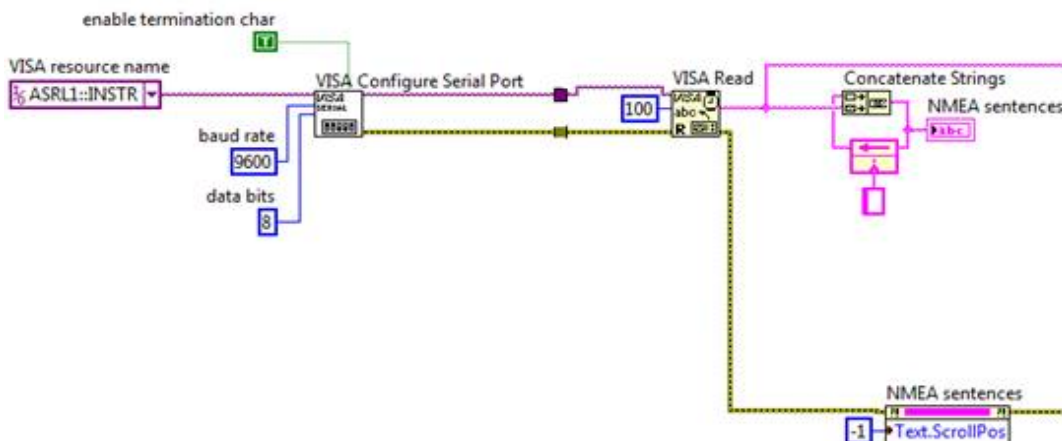


FIG.4 VISA Configure block diagram

The specification for VISA configure serial port is described in TABLE NO.1 and the front panel of the VISA configure is shown in FIG.4.

Baud rate	9600
Data bits	8
Stop bits	1.0
Parity	None
Timeout value	2000

TABLE NO.1 Specification

V.E GPRMC Block Diagram:

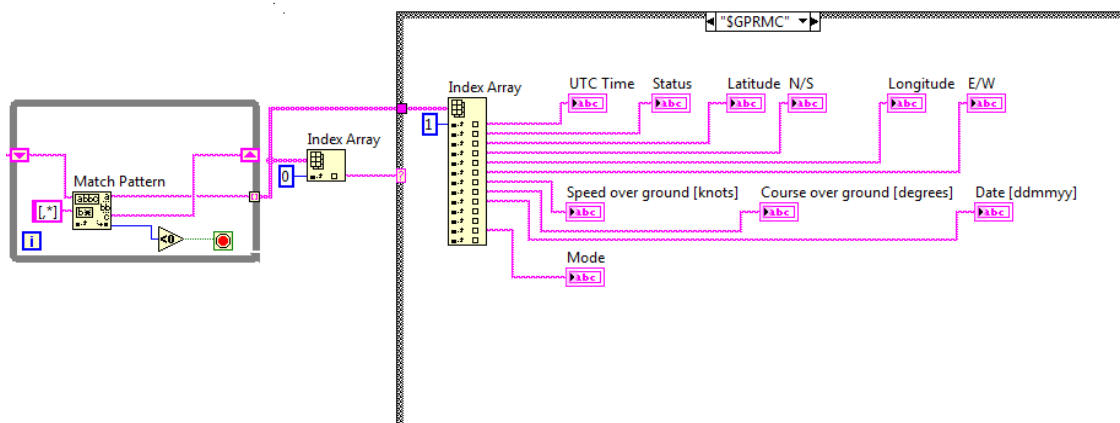


FIG.5 GPRMC Block diagram

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RMC provides the minimum sentence information. The speed of the vehicle in knots information is obtained(1knot=1.852kmph).The value of the speed in knots can be converted into kilometer per hour .From the position information that is obtained from the Google maps, the time at which the vehicle can reach our place can be calculated using :

$$SPEED = \frac{DISTANCE}{TIME} \quad (1)$$

This can be useful for the train passengers to know the arrival of the train time and can save their waiting time of the travellers. The front panel of GPRMC data is shown in FIG.5.

V.F GPGGA Block Diagram:

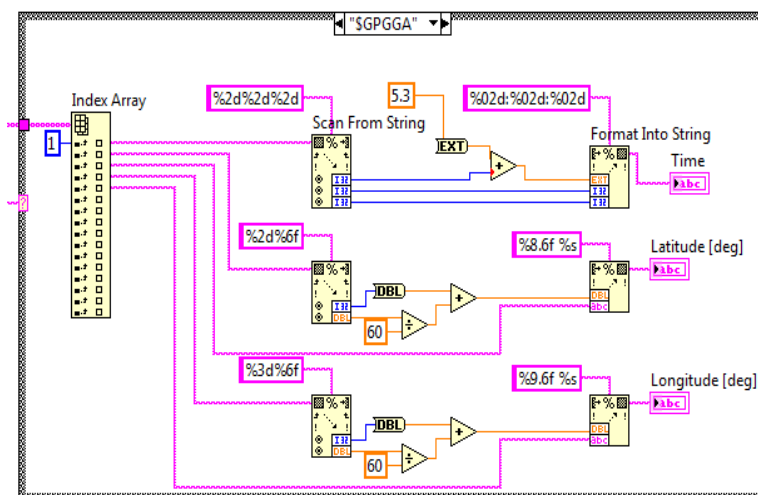


FIG.6 GPGGA Block diagram

GGA is an essential data which provides the current fix data. It provides 3D location and accuracy data. GPGGA provides the latitude and longitude data along with the direction of the latitude and longitude .The front panel diagram of GPGGA data is shown in FIG.6

VI.RESULTS AND DISCUSSION

The updated GPS values in the front panel of the program embedded within myRIO is published in the system containing the Lab VIEW Runtime Engine Software.FIG.7 shows the front panel of the program running within myRIO.



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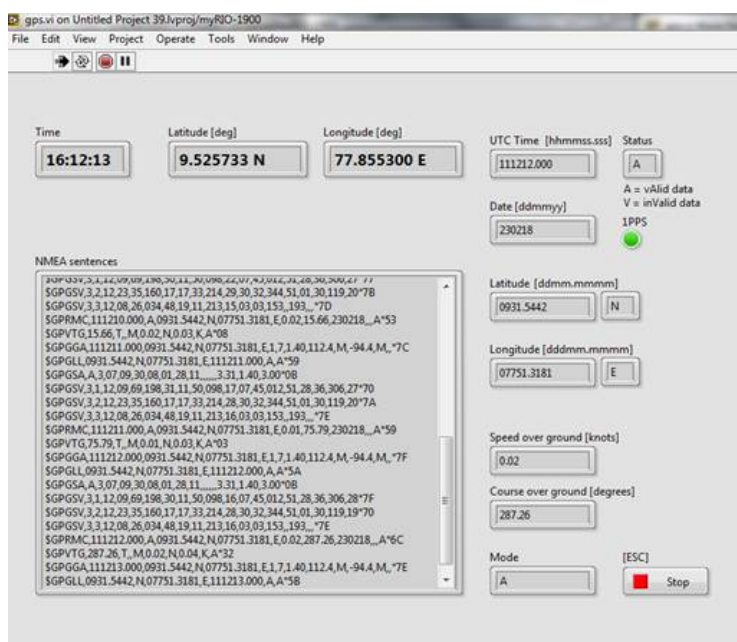


FIG.7 Output in LabVIEW Front Panel

The front panel of the GPS program running within myRIO is published in the web server of a remotely connected user. The system must contain the LabVIEW runtime engine software. FIG.8 shows the HTTP page seen by the remote user.

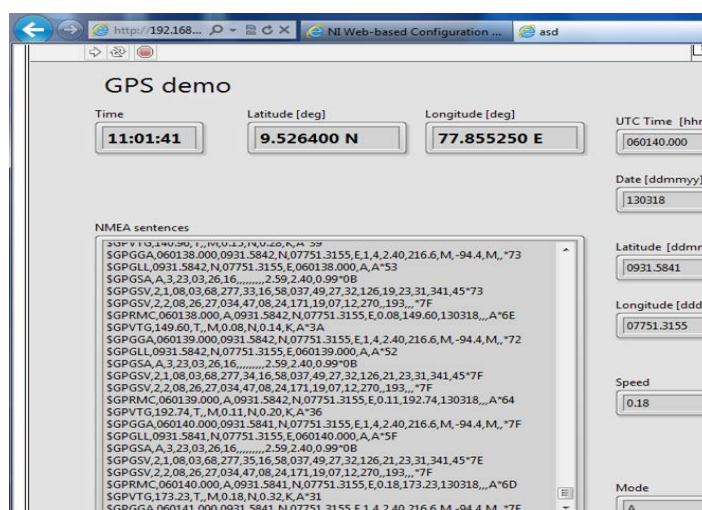


FIG. 8 Output in web browser



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VII. FUTURE SCOPE

By integrating this system with DBMS (Data Base Management System), a database can be maintained to monitor the speed and the location at which the vehicle had travelled. The alerting system can also be provided in case of any speed violation by the traveller. The speed limit can be set by the owner of the vehicle and they can receive notifications through mail in case the vehicle travels above the speed limit specified by the user.

VIII. CONCLUSION

The work mainly focus on tracking the position of the vehicle. This can be effectively used in theft and by the travel agencies to monitor the speed. This can further reduce the waiting time of the passengers in trains. From the position and the speed that is obtained, the time at which the train can reach the station can be effectively determined. Its usage is further extended in smart cities.

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