ROAD QUALITY MONITORING SYSTEM

Valentin BELII

Technical University of Moldova

Abstract: In this project I created a system which allows road quality to be controlled in automatic mode without spending human resources and expensive equipment. Project involves using SoC computer, Android smartphone and any vehicle which can use public roads. As a result Road Administration and people with have an ability to see the situation on the roads in a live and accessible mode using simple web browser.

Keywords: Road, Quality, SoC– system on chip computer, Accelerometer, API - application programming interface,Google Maps.

Content

The development of road infrastructure is one of the most important parts of the development of the country as a whole. Transport is necessary for both large and small businesses, as well as ordinary citizens.

The state of the road infrastructure is an important aspect of transport functioning, and role of the road quality in the life of the country is the key to its successful functioning and development. Therefore, the quality of the road surface should be regularly checked and repaired if necessary. To do this, it is necessary to develop an optimal system that will collect data on the state of the road, and process them.
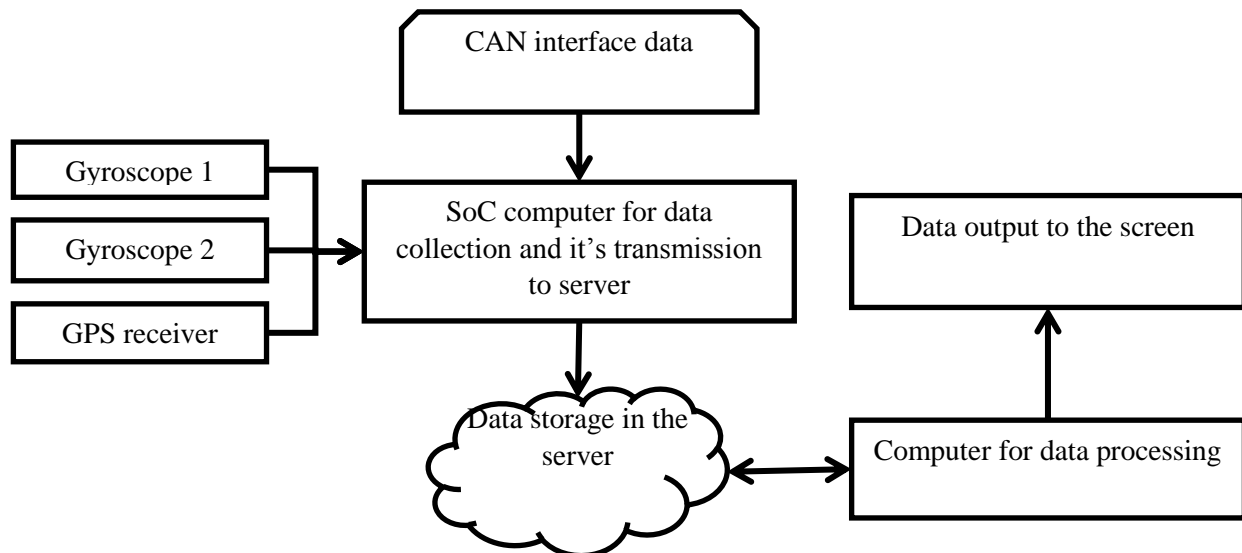

Fig. 1. System functioning scheme.

The system is intended to be installed on a portable device which will be installed in the vehicle suspension.

After completing the specified route, the analysis of the accelerometer data will be performed. The first graph from the accelerometer is analyzed, where areas with a large number of vibrations are sections with low-quality roads. To improve measurement accuracy, we can use a variety of devices, for example, 4 - one for each wheel of a car.

A magnetometer can measure the degree of curvature of the road at a given location, as well as analyze the quality of the coating according to the number of corrections of the trajectory of movement needed by the driver.

By collecting data from the CAN interface we can obtain data on the speed of the car, and the state of its engine. This data can help us in analyzing the road conditions for workload and determining the optimal switching phases of traffic lights.

Diagnosis and assessment of the condition of roads still have to be performed by specialized organizations. They will continue to give the most accurate judgement, having the appropriate mobile

laboratories, instruments and equipment. The use of new technology and its implementation are intended only to simplify the work of these organizations, and to improve the condition of the roads in general.

How does it work?

The project performs the following steps when doing its tasks

1. Generating acceleration graph in 3 axis over time
2. Getting vehicle data from CAN interface
3. Sending data to server
4. Data analysis
5. Receiving road quality results
6. Saving data with with location reference
7. Displaying results using Google Maps

Why did I choose these systems?

For an operating system, it is best to use a Linux family system; this system is free and is highly customizable and stable.

I chose to use programming language Python, as modern and one of the most reliable programming language.

For development in Python, we use the standard Python compiler and the Python 3 development environment.

What is in the code?

Javascript Code sample

```
<script type="text/javascript">
google.charts.load('current', {'packages':['line']});
google.charts.setOnLoadCallback(drawChart);
        var data1 = new google.visualization.DataTable();
   data1.addColumn('number', 'Time');
   data1.addColumn('number', 'X-axis');
   data1.addColumn('number', 'Y-axis');
   data1.addColumn('number', 'Z-axis');
   data1.addRows(data11);
var chart1 = new google.charts.Line(document.getElementById('accelera_material'));
chart1.draw(data1, google.charts.Line.convertOptions(options1));
</script>
```

Python Code

```
  def readAccel(self):
     data = bus.read_i2c_block_data(self.address, ACCEL_OUT, 6)
     x = self.dataConv(data[1], data[0])
     y = self.dataConv(data[3], data[2])
     z = self.dataConv(data[5], data[4])
```
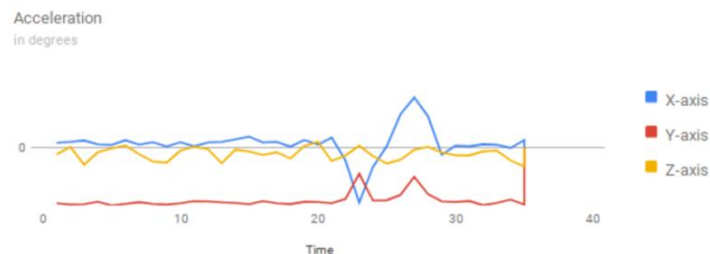

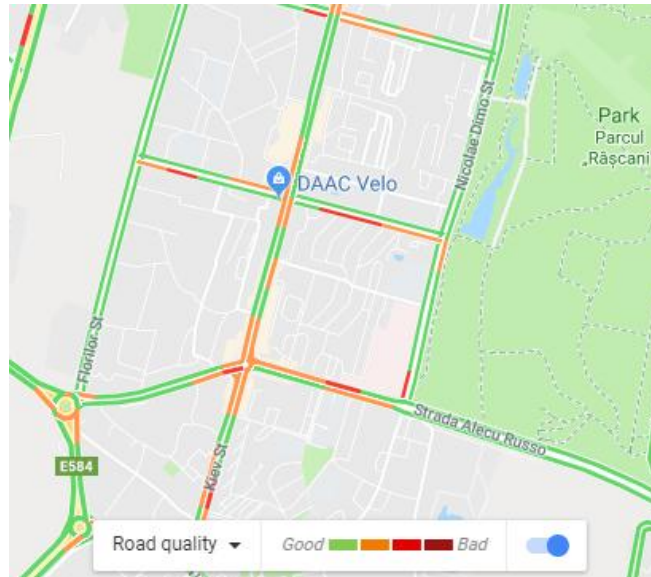Fig. 2. Accelerometer functioning scheme.

Fig. 3 Example of a map with road quality applied on it
(data are simulated).

What are the advantages of using it?

The script – which allows users to find out road quality, does a great job of saving time. Data can be accessed by everyone using an accessible interface, and different methods of data displaying. It can demonstrate a great accuracy based on massive data collection, and work great for drivers who spend a lot of time in the unknown areas.

Where is script kept and how to modify it?

The script is launched from a private server. Files are locates on Amazon AWS and can be updated any time by FTP protocol or through GIT system.

Conclusions

Project "ROAD QUALITY MONITORING SYSTEM" is a great application of modern technologies. This system will benefit not only road services, but also automakers. If the vehicle has adjustable suspension stiffness, then in areas with poor coverage, passengers will be provided with greater comfort.

Drivers of international traffic will be able to better plan their route based on the timing of delivery and the estimated wear and tear of the transport vehicle.

Bibliography

1. https://www.invensense.com/download-pdf/mpu-9250-datasheet/ - Listing and diagram of the device MPU-9250 sensor
2. https://components101.com/microcontrollers/raspberry-pi-3-pinout-features-datasheet - Listing and layout of the Raspberry Pi 3 model B microprocessor devicehttps://developers.google.com/chart/interactive/docs/gallery/linechart - Library display information in the form of graphs and charts
3. https://docs.python.org/3/ - Python 3 documentation