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Real Time Road Inspection System with Distance Intimation Technique

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Abstract— The vibration based road condition detection device, which consists of an Arduino based sensing module, is designed. First, the Arduino based sensing module will be designed to evaluate the road conditions in real-time and send the evaluation result, through the GPS using wireless medium. While the Server receives the data from sensing module, the data will mark the position with abnormal road condition on Google Maps utilizing GPS. As a result, the driver can change their route for commute and Government can use this potholes locational data for future repairing and development.

Keywords— Accelerometer (MEMS) Sensor, Bumps, GPS, Potholes, Arduino Based System

I. INTRODUCTION

Roads have become a very important factor of our day to day life. Travelling gives us speed which we certainly cannot acquire by walking. Proper roads will lead to less time consumption for travelling and makes it less vulnerable of accidents. When road is made available to people for use after the completion of its construction it goes under various anomalies like continuous rolling of heavy vehicles, weather conditions like heavy rains, storms, snow etc. This will adversely show its effect on quality of driving. With the availability of information regarding the road conditions, road users can be cautious about or avoid the bad roads. It is desirable to have a mechanism for detecting the condition of roads and get them repaired as soon as possible. As a result, working on monitoring road conditions has gained significant attention in recent time. Dangerous road surface conditions are major distractions for safe and comfortable transportation. Both drivers and road maintainers are interested in fixing them as soon as possible. However, these conditions have to be identified first [1,2].

One approach to road damage detection is to use human reports to central authorities. While it has the highest accuracy, assuming that people are fair, it also has the most human interaction and is not comprehensive. Statistical analysis can be used to estimate damage probabilities of road segments based on their usage intensity. Integration of vibration and vehicle counting sensors in the pavement are used for statistical data collection. Surface analysis methods using Ground Penetrating Radar (GPR) have been developed and commercial products do exist. Unfortunately, this technology is using expensive equipment and therefore limits its accessibility. As an alternative, participatory sensing has the potential to increase the collected data resolution and scope. The simplest method might be to collect photos of road damage and hazards taken by the participants and to upload them to a central server. However, this requires strong participation and interaction from the users as well as manual image analysis. We believe that an automated approach for detecting potholes with little or no human interaction is more promising. This would ensure more comprehensive survey data with less error caused by human factors than generated by mere enthusiasm of the participants [3].

This method has one advantage over the other is, it can sense a pothole without experiencing it i.e. Vehicle does not actually has to pass through the pot hole to sense it. Characterization of pothole can be done on the basis of size of the pothole. In contrast to Vibration based method which employs accelerometer [4,5]; this is a device that measures total specific external force on the sensor. For example if the device is stationary, it will show some reading corresponding to earth's gravitational force. An accelerometer falling freely in the vacuum will show zero reading. The design of the accelerometer is often very simple. The simplest design can be a mass hanging by a thread and some sensor to measure its deflection for original. The device is popularly used to measure vibration or inclination. We in our pothole detection system we will be using accelerometer MMA7361 for sensing vibration caused by vehicle which embedded our sensing module passing over the pothole. Implemented system consist of two broad area Transmitter and receiver, Arduino based hardware module act as a Transmitter module which sense the potholes in real time send those vibration values (output at X, Y, Z pin of MMA7361) to the particular server, connected through GSM transmission module as soon as server receives information packets & Using this information we can easily find the location of pothole.

II. EXISTING SYSTEMS

The existing System consists of three subsystems: Sensing, Communication, Localization [6]. These three subsystems

work independent of each other, but have one center point they revolve around, that is data. Sensing system generates the data; Communication collects co-ordinates and distributes the data; lastly Localization uses the data and generates information for the driver. The overall design operations shown in fig.1.There are different ways in which these subsystems can realize and implemented. All the ways have their own pluses and minuses. We explain some of the ways in this section and mention some of their pros and cons. We try to choose the best working system and we justify the choice taken. This method uses 'Camera' as sensor to scan the road for any potholes. The camera captures the images in real time. These images are applied to image processing algorithms like edge detection [7]. This requires lot of processing time and power & i.e. time consuming process. Hardware based methods like use of special Digital Signal Processors or Application Specific Integrated Circuits improve the performance over software based method. But still the response time of the operations required like windowing convolution for the image processing algorithm is still large. Some other vision based method for obstacle detection is RADAR but they have little use in pothole detection [8].

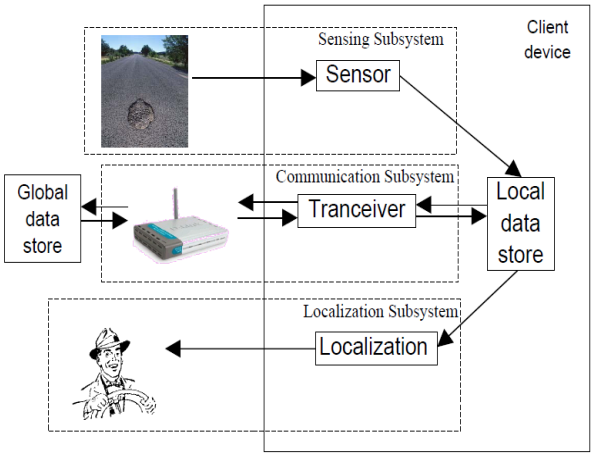


Fig 1.Existing system

Below table shows existing system with their technology used to implement the system.

Table 1.Existining System

System	Sensors	Incorporation of Machine Learning
CarTel [1]	802.11x, Camera	No
	and ODB	
Pathole Patrol [2]	Accelerometer, GPS	Yes
RCM - TAGPS [3]	Accelerometer, GPS	No
Nericell [4]	Accelerometer, GPS,	No
	GSM Antenna, Microphone	
Wolverine [6]	Accelerometer, GPS	Yes
	Magnetometer	

III. IMPLEMENTED SYSTEM

System consists of two major components i.e. hardware side which consist of supporting hardware component and second is software side. Hardware part consists of accelerometer (MEMS sensor), GPS, GSM module, LCD display, buzzer & power supply unit. While software part based on Arduino IDE software. Hardware side of system consist of Arduino Atmega328 a low power microcontroller.Adxl335 3-axis accelerometer selected from wide range of accelerometer. It is consist of three output pins X, Y, Z which gives out 3 dimensional vibration reading. We can take value from z pin and output of z pin directly given to arduino. Arduino have inbuilt ADC it convert analog value into digital value.GPS track the real-time position of the system.GSM module maintained real-time wireless connection between system & server [9].

Software side system: Software side is a dedicated IOT Thing speak server, consisting of Google Map which shows the potholes as soon as detected by the sensing hardware, Thing speak server not only pin the position in the Google map, but also create a log file which stores the latitude and longitude of detected potholes in real-time.

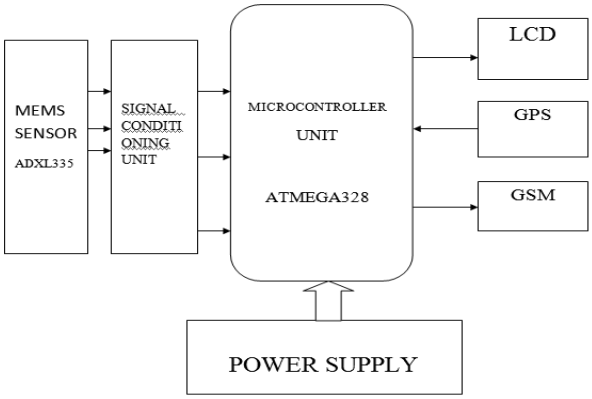


Fig.2 Block diagram

For the real time road inspection system with distance intimation technique, the sensor senses the pathole which can be based on z-axis value. This value directly given to arduino & that time GPS send real time latitude & longitude data. The communication between system & server handled by GSM module. When pathole detected that time buzzer on & value of Z-axis display on LCD display .At server side public can also access the pathole information

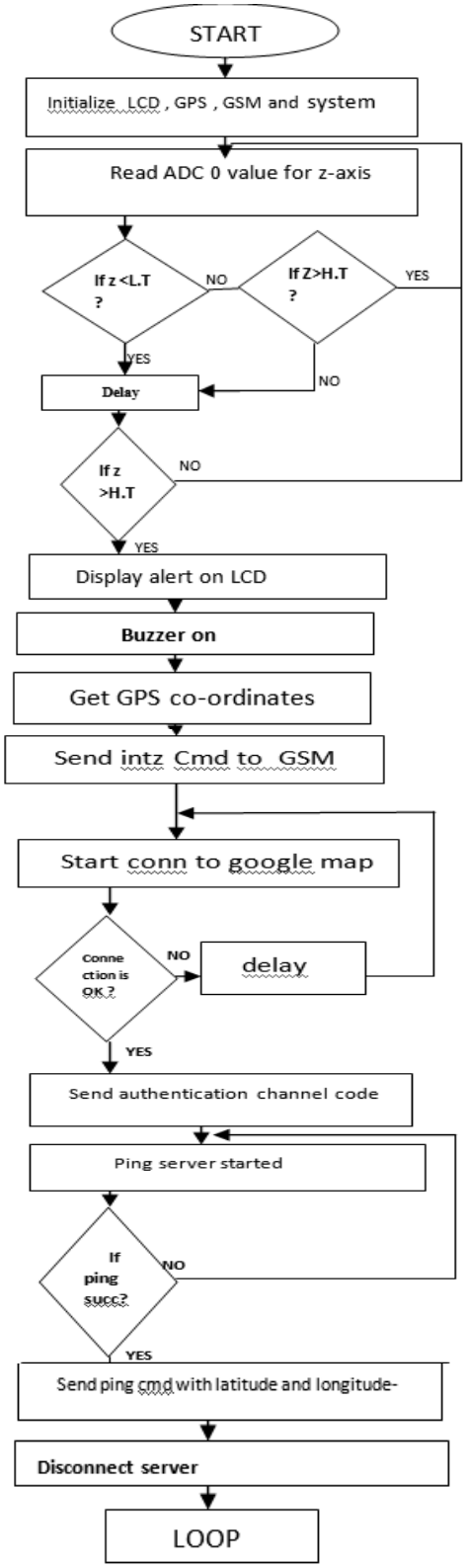
-Hardware Module:-

1. Arduino Atmega328
2. 3-D Accelerometer (ADXL335)
3. GPS
4. GSM module
5. LCD display
6. Buzzer

--Software Module:-

1. Arduino IDE
2. Proteus

IV.FLOW CHART OF SYSTEM



V. RESULTS ANALYSIS

The experimentations are preceded on the partial section of the road under the Ambernath-Badlapur west flyover. In the experimentation, the vehicle travelled the road with constant velocity 30 km/hour and the all three-axis acceleration is measured in real-time. When the sensing module detects this abnormal road condition, the system will immediately connect to GPS, show its position on Google Maps as shown in the fig.3 & those co-ordinates send to IOT Thing speak server. Therefore, if all or most vehicles running on the roads install our Arduino based sensing modules, the complete road information can be collected or using our pathole data they can easily change their route to avoid pathole.

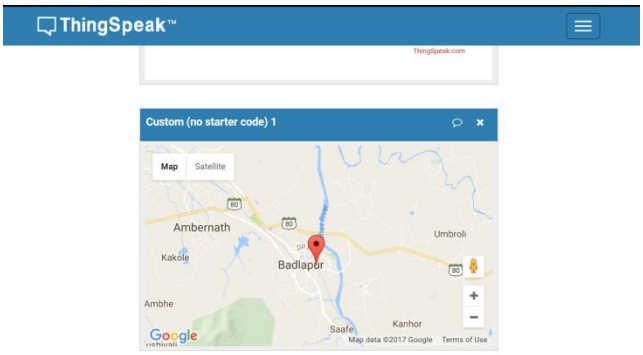


Fig.3 Detected potholes during experiment

VI. CONCLUSION

In this project model is, Automatic detection of pothole and humps and alerting vehicle drivers, to reduce the vehicle speed and then avoid potential accidents. Well maintained roads contribute a major portion of the country's economy. In our project we are using single node. In future it may require one data base server. If we are using n number of nodes we have to make a cloud. It can be integrated in the proposed system to improve user experience.Arduino based sensing module system is developed for vehicle who has to go ordeal of driving on uneven roads are successfully tested and designed. According to the real-time potholes detection, the location of abnormal road condition can be detected and saved in open source Thing speak data center. Thus, the drivers of the vehicles can obtain nearby road condition information from the open source server, highlighting Google Maps for showing road condition to change their driving routes or driving behaviours for improving driving safety, comfort and efficiency.

VII. FUTURE SCOPE

Our project is implemented by keeping future in mind. As of today, such a system which can do all three things i.e. Pothole Detection and Reporting, Accident Detection and Reporting and anti-theft system is not available. We dream about a future where this project would be implemented in each and every vehicle. Further, it could be given Wi-Fi or Bluetooth connectivity to create a network of vehicles. This network would intelligently notify other vehicles present inside it about road conditions and traffic analysis. Also, our aim is to make security systems affordable as currently only high-end vehicles boast this technology.

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