POTHOLES AND PITFALLS SPOTTER

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ABSTRACT

This paper mainly aims on the idea for the pothole detection system. This paper addresses some of the key steps and some of the challenges of the detection system. It reviews various types of software and hardware of various levels currently used. We also have proposed an algorithm which could computes the working of the whole system in short. We have come up with a low-cost, road-surface-monitoring method, which employs acceleration sensors mounted on public transport buses, as a viable solution to this problem. According to this method, the sensors record vertical and horizontal accelerations experienced by the vehicle on its route while a GPS device separately logs its corresponding GPS coordinates. The collected data can be then processed to locate potholes along the path traversed earlier by the vehicle. [2] This system also takes care of alerting the government authorities about a pothole or bad road on its own. Every time a commuter passes over a pothole the government will be alerted until and unless they come and repair that road.[3] In the conclusions, questions still open and opportunities for future research are discussed.

KEYWORDS: Pothole Detection, Artificial Intelligence, Robot, Fire Bird 5, Robot Application

INTRODUCTION

Traffic, especially in a country like India, is a common word. People in such countries count the amount of time spend over traffic too. After analysis, one of the reasons for the traffic was the number of potholes on the road. Because of many reasons like rains, oil spills, road accidents or inevitable wear and tear make the road difficult to drive upon. Unexpected hurdles on road may cause more accidents. Also because of the bad road conditions, fuel consumption of the vehicle increases; causing wastage of precious fuel.[1] Thus the motivation for making a system which can detect the pothole and inform about the same. However, many countries have roads dotted with potholes, but no road monitoring system to watch the road condition before the damage to the surface due to wear and tear becomes very expensive to repair. Some of the several advantages of having such a road monitoring system can be a boon. Such a system can identify problem areas early and the relevant authorities can be alerted in time to take preventive steps. Our system can be broken into 3 modules. The first is to sensing the pothole on the surface with the amount of depth of the pothole. Secondly, to take a picture at the same moment the pothole is being detected. Thirdly, to send the picture and the location of the pothole to the concerned authority.

HARDWARE REQUIREMENTS
Fire Bird 5

The Fire Bird V robot is the 5th in the Fire Bird series of robots. All the Fire Bird V series robots share the same main board and other accessories. Different family of microcontrollers can be added by simply changing top microcontroller adapter board.

Fire Bird V supports ATMEGA2560 (AVR), P89V51RD2 (8051) and LPC2148(ARM7) microcontroller adapter boards. This modularity in changing the microcontroller adapter boards makes Fire Bird V robots very versatile.

Sharp IR Range Sensors

Sharp IR range sensors consists of IR LED and linear CCD array, both encapsulated in the housing with precision lens assembly mounted in front of them. IR LED with the help of the leans transmits a narrow IR beam. When light hits the obstacle and reflects back to the linear CCD array, depending on the distance from the obstacle, angle of the reflected light varies. This angle is measured using the CCD array to estimate distance from the obstacle. It gives same response to different coloured objects as measured distance is function of the angle of reflection and not on the reflected light intensity.

LCD Interfacing

LCD can be interfaced in 8bit or 4 bit interfacing mode. In 8 bit mode it requires 3 control line and 8 data lines. To reduce number of I/Os required, Fire Bird V robot uses 4 bit interfacing mode which requires 3 control lines and 4 data lines. In this mode upper and lower nibble of the data/command byte needs to be sent separately.

Buzzer

Robot has 3 KHz piezo buzzer. It can be used for debugging purpose or as attention seeker for a particular event. The buzzer is connected to PC3 pin of the microcontroller. Also the same buzzer is used in battery monitoring circuit to alert the battery low indication. Buzzer is driven by BC548 transistor. Resistor 100K is used to keep transistor off, if the input pin is floating. Buzzer will get turned on if input voltage is greater than 0.65V

GPS Receiver MT3318 Module

This GPS receiver gives data output in standard NMEA format with update rate of 1second at 9600 bps. Receiver has onboard battery for memory backup for quicker acquisition of GPS satellites. Module can directly work on 5V supply and can be interfaced with the 5V TTL / CMOS logic. Board has 10 pin male berg connector at the both ends for easier mounting on the PCB and comes with the two 10 pin female berg connectors which can be soldered on your PCB. This GPS module is very easy to interface and requires only Transmit, Receive pins of the serial port of the microcontroller.

SOFTWARE REQUIREMENTS

Atmel Studio

AVR studio is an Integrated Development Environment (IDE) for writing and debugging AVR applications. As a code writing environment, it supports includes AVR Assembler and any external AVR GCC compiler in a complete IDE environment.

AVR Boot Loader

All AVR microcontrollers can be programmed using In System Programming (ISP), external programmer or using boot loader. Advantage with the boot loader is that you don't need any external hardware to load. Hex file on the microcontroller. It also protects robot's hardware from possible damage due to static electricity and prevents any accidental changes in the fuse settings of the microcontroller.

TV Home Media

Output of the wireless camera's receiver module is in the composite video format. In order to acquire the image you need to set the input video format as composite video. The images captured by camera will b directly redirected to server and could be viewed using TV Home Media.

GPS Clockpit

GPS Cockpit allows a quick glance at GPS data, monitors and logs these data, displays them in a graphical way and even provides statistical information. GPS Cockpit "understands" the following NMEA sentences:

- RMC - Recommended Minimum Specific GPS Data

- GGA – Global Positioning System Fix Data

- GSV – GPS Satellites in View

- VTG – Course over Ground and Ground Speed

- GSA – GNSS DOP and Active Satellites

So in order to interpret these data, the according NMEA sentences have to be switched on within the GPS module. Of course, GPS Cockpit works best with Vin-cotech's positioning products, the GPS modules A1080-A, A1082-A, A1084-A, A1084-B, A1088-A, A1035-D, A1035-E and new ones that will be launched in the future, but can also be used with any other GPS modules providing NMEA information.

ALGORITHM

In Figure 1, we have implemented the sequence diagram and the working is explained in the below algorithm.

- Initialise all the ports and LCD device to reset state.

- Move the bot in forward direction, forward();

- Move the bot with constant velocity(150,150);

- Rotate the servo motor mounted with the IR Sharp Sensor within a range of 0-180 degrees.

- Constantly check for the value of Sharp IR Sensor

- If the value is constant or is less than or equal to threshold value, then go to step 4, Else a pothole is detected, hence stop the servo motor and move camera pod to the direction of pothole.

- Capture image, camera(); and locate the pothole using GPS module, locate(latitude, longitude);

- Send both the data to server.

- Go to step 4.
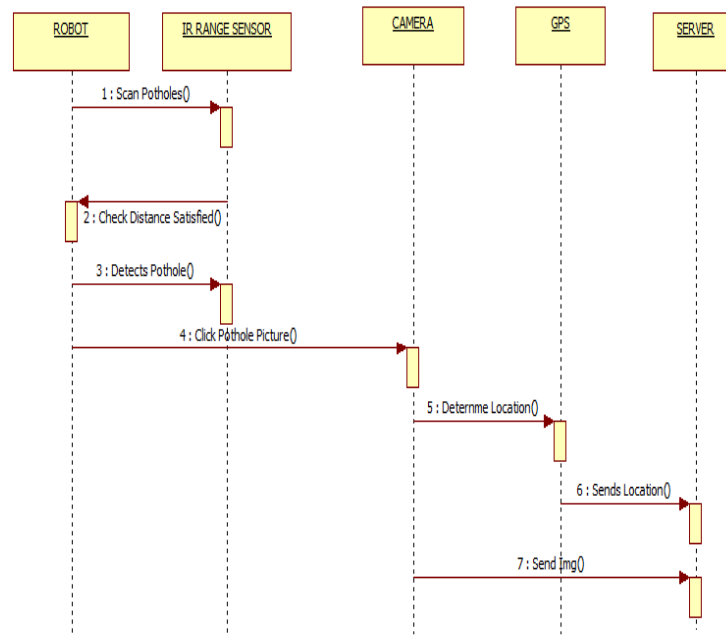
Figure 1: Sequence Diagram of the Working of Spotter

CHALLENGES

While we were able to demonstrate that it is possible to use the acceleration data gathered though a vehicle mounted sensor motes to detect potholes there are several challenges in using this technique in practice. Pothole is an extreme road surface condition. In this experiment we only concentrated on identifying this extreme condition. However, as mentioned before one of the advantages of having a road surface condition monitoring system is that it enables the road maintainers to take actions that prevent such an extreme condition. Therefore, it is essential to be able to detect and identify early signs of deteriorating road surface conditions.

These mild conditions are hard to detect since they are not much different from a good road surface.[2] However, as mentioned before one of the advantages of having a road surface condition monitoring system is that it enables the road maintainers to take actions that prevent such an extreme condition. Therefore, it is essential to be able to detect and identify early signs of deteriorating road surface conditions. These mild conditions are hard to detect since they are not much different from a good road surface.[2]

FUTURE SCOPE

In future we propose to do more experiments with variety of the scenario. Our next and immediate step is to use the Accelerometer on real vehicles and measure their response. Apply different scenarios like potholes on the slopes, turns and see how the accelerometer readings can characterize such condition. Along with that in remaining January and February we want to come up with and formalize the alternate solution for the Localization subsystem. In next months of March and April we perform simulations for given scenarios in Communication subsystem. And we plan to come up with values for the related parameters. For example Loss in throughput because of increase in number of vehicle, Loss in vehicle throughput because of the increase in speed.

In the month of May and June we perform the more experiments regarding the Localization system. If we are not

able to come up with alternate solution; then we will perform the experiments regarding integration of the rest of the system with GPS.

CONCLUSIONS

By harnessing ATMEGA 2560, we have implemented a road surface monitoring system which would continuously monitor the surface of road, detect the damaged road condition, capture image of the spot, detect the hardware's location and send the data to the server side. In this paper we have describes the working, the hardware requirements, the software requirements as well as the algorithm that it will use to run the system. The data obtained from here is being given to the higher authority for the further procedures. If such system is implemented it could result in various helps to the public as well as the governmental body for the development of the country.

ACKNOWLEDGEMENTS

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