

Pothole Detector and Filler

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Abstract— This project aims at proposing a versatile Pothole Detection and Filler System which assists the driver in detecting and filling the potholes on the roads. The basic idea of the system is to detect the pothole using Ultra sound sensor and alert the driver, sensor measure the depth of the pothole and accordingly fill the using help of Mechanical Control system. This project presents the detailed description of the system based on PIC Microcontroller, ultrasonic sensors, and Bluetooth communication with operator to process and analyze the depth of the pothole. This system operates in Manual mode and Auto Mode.

Key words: Pothole Filler, Pothole Detector

I. INTRODUCTION

With the increase in worlds population, there has been increasing load on the infrastructure. Road have been flooded with the vehicular traffic. It has become increasingly difficult to manage this traffic. This is the prime motivation behind making a vehicle intelligent enough to aid driver in various aspects.

One of the increasing problems the world is facing is worsened road conditions. Because of many reasons like rains, oil spills, road accidents or inevitable rear and tear make the road difficult to ride upon. Unexpected hurdles on roads may cause many accidents. Also because of the bad road conditions, fuel consumption of the vehicle increases; causing wastage of precious fuel.

Because of these reasons it's very important to get information of such road bad conditions, collect this information and distribute it to the other vehicles, which in turn can warn the driver. But there are various challenges involved in this. First of all there are various methods to get the information about the road conditions. Then this information must be collected and distributed to all he vehicles that might need this information. Lastly, the information can be conveyed in the manner which can be understood and used by the driver. We in this project try to design and build such a system. In this system the access point collects the information about the pothole in the vicinity of a wireless accesss point and distributes to other vehicles using a wireless broadcaster. Here 'vicinity' is a user defined term. Ideally the vicinity is every rout till the next access point.

Pothole detection system is a system that aims at warning a driver about the uneven roads and potholes in its path. We study the different ways in which the goal of the system can be achieved. We justify the methods we have chosen in this project and then we give details about the working of the different subsystems.

II. SYSTEM ARCHITECTURE

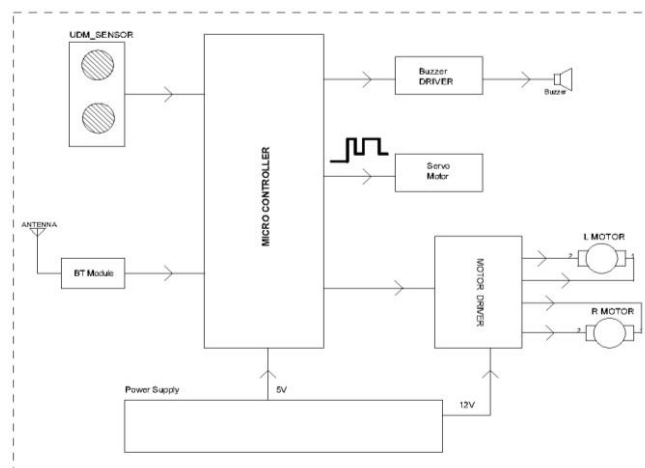


Fig. 1: Architecture

Bot is kept on road and power button is on. Bot starts moving in forward direction. If sensor finds pothole buzzer starts ringing. Sensor calculates the depth of pothole and sends it to the microcontroller. Now microcontrollers compare this input from sensor with the pre calculated depths. According to depth calculated the amount of cement to be filled into pothole is decided by controller. For certain amount of cement to be poured from cement tank preprogrammed pwm pulse is sent to the servo motor so that servo motor will open the shutter for certain time period. As cement is poured into the pothole bot will go forward and again comes reversed so that poured cement is levelled and further process will go on as above. Even if certain depth remains in this process then again that depth is detected by pot because bot is coming backward again.

The motor driver is used to drive the motors. A motor driver is a little current amplifier; the function of motor drivers is to take a low-current control signal and then turn it into a higher-current signal that can drive a motor. The driver moves the motor in clockwise and anticlockwise direction. Servo motor is used for switching purpose, like making shutter on and off when needed. In Power supply unit, a 5v and 12v supply is used. Microcontroller, sensors, Bluetooth are given 5v supply and motors, buzzer and servo motor are given 12v supply.

III. TECHNICAL SPECIFICATION

A. Servo Motor

A Servo is a small device that has an output shaft. This shaft can be positioned to specific angular positions by sending the servo a coded signal. As long as the coded signal exists on the input line, the servo will maintain the angular position of the shaft. As the coded signal changes, the angular position of the shaft changes. In practice, servos are used in signal control the flipper of cement tank.

The Servo Motors come with three wires or leads. Two of these wires are to provide ground and positive supply to the servo DC motor. The third wire is for the control signal. These wires of a servo motor are colour coded. The red wire is the DC supply lead and must be connected to a DC voltage supply in the range of 4.8 V to 6V. The black wire is to provide ground. The colour for the third wire (to provide control signal) varies for different manufacturers. It can be yellow (in case of Hi tec), white (in case of Futaba), brown etc.

B. Infrared Sensor

An Infrared (IR) sensor is used to detect depth. The sensor emits IR light and gives signal when it detects the reflected light.

An IR sensor consists of an emitter, detector circuitry. The circuit is having two parts one of them is the emitter circuit and another is receiver circuit. The emitter is an IR LED. The detector is an IR photodiode. This photodiode is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, its resistance and correspondingly, its output voltage, change in proportion to the magnitude of the IR light received. This is the underlying principle of working of the IR sensor.

C. Roller

Rollers are heavy in weight. Road rollers use the weight of the vehicle to compress the surface being rolled (static) or use mechanical advantage (vibrating). Initial of the substrate on a road project is done using a padfoot drum roller, which achieves higher compaction density due to the pads having less surface area. On large freeways a four wheel compactor with padfoot drum and a blade, such as a Caterpillar 815/825 series machine, would be used due to its high weight, speed and the powerful pushing force to spread bulk material. On regional roads a smaller single padfoot drum machine may be used. The next machine is usually a single smooth drum compactor that compacts the high spots down until the soil is smooth, and this is usually done in combination with a motor grader to get a level surface.

D. Bluetooth Module

The HC-05 Bluetooth Module has 6 pins- Vcc, GND, TX, RX, Key, and LED. It comes pre-programmed as a slave, so there is no need to connect the Key pin, unless you need it change it to Master Mode. The major difference between Master and Slave modes is that, in Slave mode the Bluetooth module cannot initiate a connection, it can however accept incoming connections. After the connection is established the Bluetooth module can transmit and receive data regardless of the mode it is running in. If you are using a phone to connect to the Bluetooth module, you can simply use it in the Slave mode. The default data transmission rate is 9600kbps. The range for Bluetooth communication is usually 30m or less. The module has a factory set pin of "1234" which is used while pairing the module to a phone.

E. Piezo Buzzer

Piezo buzzer is an electronic device commonly used to produce sound. Light weight, simple construction and low price make it usable in various applications like car/truck reversing indicator, computers, call bells etc. Piezo buzzer is based on the inverse principle of piezo electricity discovered in 1880 by Jacques and Pierre Curie. It is the phenomena of generating electricity when mechanical pressure is applied to certain materials and the vice versa is also true. Such materials are called piezo electric materials. Piezo electric materials are either naturally available or manmade. Piezoceramic is class of manmade material, which poses piezo electric effect and is widely used to make disc, the heart of piezo buzzer. When subjected to an alternating electric field they stretch or compress, in accordance with the frequency of the signal thereby producing sound.

F. Microcontroller Pic16f873:

PIC16F873 is a high performance RISC CPU. It uses only 35 single word instructions. All are single cycle instructions except for program branches which are two-cycle. Its operating speed is DC - 20 MHz clock input, DC - 200 ns instruction cycle. It has up to 8K x 14 words of FLASH Program Memory and up to 368 x 8 bytes of Data Memory (RAM). It has 8 level deep hardware stack. It has Direct, Indirect and Relative Addressing modes. It will control the sensors, motors, zigbee module and other components.

G. DC Motor

DC Motor has two leads. It has bidirectional motion. If we apply +ve to one lead and ground to another motor will rotate in one direction, if we reverse the connection the motor will rotate in opposite direction. If we keep both leads open or both leads ground it will not rotate (but some inertia will be there). If we apply +ve voltage to both leads then braking will occur.

H. H-BRIDGE

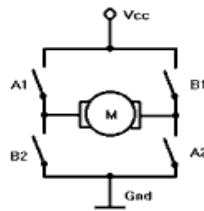


Fig. 2: H-Bridge

This circuit is known as H-Bridge because it looks like 'H'. The H bridge works in the follows- If switch (A1 and A2) are on and switch (B1 and B2) are off then motor rotates in clockwise direction

I. H-Bridge I.C (L293D)

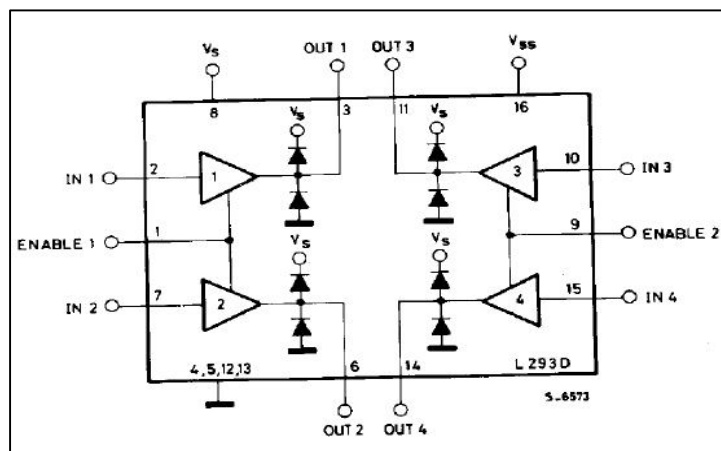


Fig. 3: L293D is an H-Bridge I.C. It contains two H- Bridge pair.

1) Truth Table:

Input 1	Input 2	Result
0	0	No rotation
0	1	Clockwise rotation
1	0	Anti clockwise rotation
1	1	break

Fig. 4: Truth table

Connect motor pins on output 1 and output 2 and control signal at input 1 and input 2 will control the motion. Connect another motor pins on output 3 and output 4 and control signal at input 3 and input 4. Truth table for i/p 3 and i/p 4 is same as above shown. 0 means 0 V or Low. 1 means High or +5V.

In Enable 1 and Enable 2 if you give high then you observe hard stop in condition 0 0 and 11. Unless slow stop of motor on low signal. Required Motor voltage has given on pin 8 (Vs) i.e. 12V DC – 24V DC.

IV. SOFTWARE SPECIFICATIONS

A. Eagle CAD

EAGLE is a powerful and flexible PCB design software offers high level functionality of expensive commercial circuit board design software. EAGLE is easy for learning and for using. It runs on Linux, Mac and Windows. It allows feature enhancement, like simulation, data import and export and self defined commands, through User Language Programs (ULPs). These are partly integrated on EAGLE.

B. Android SDK Tools

The Android software development kit (SDK) includes a comprehensive set of development tools. These include a debugger, libraries, a handset emulator based on QEMU, documentation and tutorials. As of March 2015, the SDK is not available on Android itself, but the software development is possible by using specialized Android applications. Until around the end of 2014, the officially supported integrated development environment (IDE) was Eclipse using the Android

Development Tools (ADT) Plugin, though IntelliJ IDEA IDE (all editions) fully supports Android development out of the box, and NetBeans IDE also supports Android development via a plugin. As of 2015, Android Studio, made by Google and powered by IntelliJ, is the official IDE; however, developers are free to use others. Additionally, developers may use any text editor to edit Java and XML files, then use command line tools (Java Development Kit and Apache Ant are required) to create, build and debug Android applications as well as control attached Android devices. Enhancements to Android's SDK go hand in hand with the overall Android platform development. The SDK also supports older versions of the Android platform in case developers wish to target their applications at older devices. Development tools are downloadable components, so after one has downloaded the latest version and platform, older platforms and tools can also be downloaded for compatibility testing. Android applications are packaged in .apk format and stored under folder on the Android OS (the folder is accessible only to the root user for security reasons). APK package contains .dex files (compiled byte code files called Dalvik executables), resource files, etc

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