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Automatic Detection And Notification Of Potholes And Hump To The Aid Drivers

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Abstract: ***One of the major problems in developing countries is maintenance of roads. Well maintained roads contribute a major portion to the country's economy. Identification of pavement distress such as potholes and humps not only helps drivers to avoid accidents or vehicle damages but also helps authorities to maintain roads. This paper discusses previous pothole detection methods that have been developed and proposes a cost effective solution to identify potholes and humps on roads and provide timely alerts to drivers to avoid accidents or vehicle damages. Ultrasonic sensors are used to identify potholes and humps and also to measure their depth and height respectively.***

I. INTRODUCTION

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter. "Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduno, moving forward. The Uno is the latest in a series of USB Arduino boards, and the reference model for the Arduino platform; for a comparison with previous versions, see the index of Arduino boards.

II. CHARACTERISTICS OF ARDUINO

A. MEMORY

The Arduino Uno has 32 KB memory. It comes with 2 KB of SRAM and also 1 KB of EEPROM (EEPROM library is required to read or write into this).

B. CLOCK SPEED

The performance of this controller is based on its clock speed. The Clock speed of the Arduino is 16 Mhz so it can perform a particular task faster than the other processor or controller

C. USB INTERFACE

Most important feature of Arduino Uno is USB connectivity. It means if we want to operate Arduino with PC, then we can do that and data communication between PC and Arduino become easy.

D. INPUT OUTPUT VOLTAGE

The Arduino Uno can be powered via the USB connection or with an external power supply. If we are using external power then we can supply 6 to 20 volts. Arduino works on 5 volts.

E. INPUT OUTPUT PINS

Each of the 14 digital pins on the Uno can be used as an input or output. 6 pins out of 14 can be used as PWM output. 6 pins can be used as analog pins.

F. COMMUNICATION

Arduino board supports I2C and SPI communication. The Arduino software includes wire library for I2C and SPI library for the SPI communication.

III. EXISTING SYSTEM

Presently there are many systems available with mostly in image processing methods. A low cost model for analyzing 3D pavement distress images, it use of a low cost Kinect sensor, which gives the direct depth measurements, thereby reducing computing costs. Other systems like real time monitoring using Smartphone accelerometer to detect the pot holes are proposed. As a result, the existing proposals very few have been implemented and tested in the real-world, identifying the existence of a gap between theory and real world application at scientifically accepted level.

IV. PROPOSED SYSTEM

In order to explain the entire system, the system is divided into two main units. The sensor unit which is used to gather the real time distance measurement. The controller unit which is used to formulate the gather value to actual distance and indicate the user. The sensor used here are ultrasonic sensor and temperature sensor. The ultrasonic sensor is used to detect the distance between its source and nearby object. The ultrasonic sensor works by sending sound waves and gather the echo sound from the object. From the time taken to receive the echo signal distance is calculated. The speed of the sound varies as per the temperature around it. So the temperature sensor is used to gather the air temperature around the ultrasonic sensor. By calculating the varying distance the detection of pothole or hump is found. If any variation is detected, it is notified to the user using buzzer.

BLOCK DIAGRAM

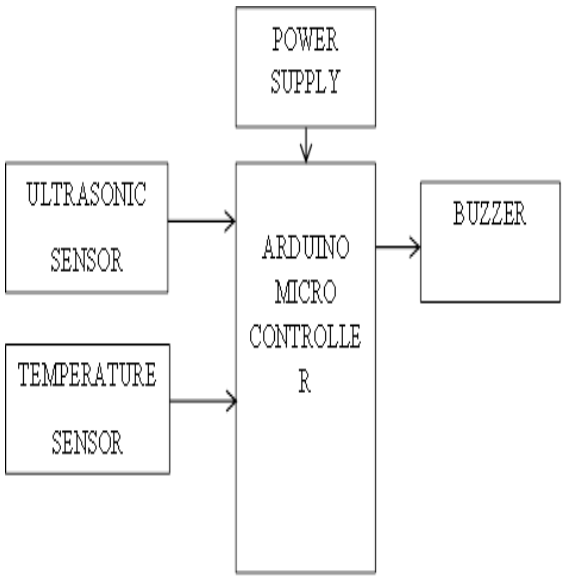

Figure 1

V. COMPONENTS OF PROPOSED SYSTEM

A. POWER

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5Vpin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

- ✓ VIN. The input voltage to the Arduino board when it's using an external power source (as opposed to5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- ✓ 5V. The regulated power supply used to power the microcontroller and other components on the
- ✓ board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.
- ✓ 3V3. A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- ✓ GND. Ground pins.

B. MEMORY

The Atmega328 has 32 KB of flash memory for storing code (of which 0,5 KB is used for the bootloader); It has also 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

C. I / O PINS

Each of the 14 digital pins on the Uno can be used as an input or output, using pinMode(), digitalWrite(), anddigitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA andhas an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

- ✓ Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. These pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip.
- ✓ External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, arising or falling edge, or a change in value. See the attachInterrupt() function for details.
- ✓ PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() function.
- ✓ SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although

provided by the underlying hardware, is not currently included in the Arduino language.

- ✓ LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

The Uno has 6 analog inputs, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analogReference() function. Additionally, some pins have specialized functionality:

- ✓ I2C: 4 (SDA) and 5 (SCL). Support I2C (TWI) communication using the Wire library.
- ✓ There are a couple of other pins on the board:
- ✓ AREF. Reference voltage for the analog inputs. Used with analogReference().
- ✓ Reset. Bring this line LOW to reset the microcontroller. Typically used to add a reset button to Shields which block the one on the board.

VI. ULTRA SONIC SENSOR

INTRODUCTION

The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like bats or dolphins do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. From 2cm to 400 cm or 1" to 13 feet. It operation is not affected by sunlight or black material like Sharp rangefinders are (although acoustically soft materials like cloth can be difficult to detect). It comes complete with ultrasonic transmitter and receiver module.

FEATURES

- ✓ Power Supply :+5V DC
- ✓ Quiescent Current : <2mA
- ✓ Working Current: 15mA
- ✓ Effectual Angle: <15°
- ✓ Ranging Distance : 2cm – 400 cm/1" - 13ft
- ✓ Resolution : 0.3 cm
- ✓ Measuring Angle: 30 degree
- ✓ Trigger Input Pulse width: 10Us
- ✓ Dimension: 45mm x 20mm x 15mm

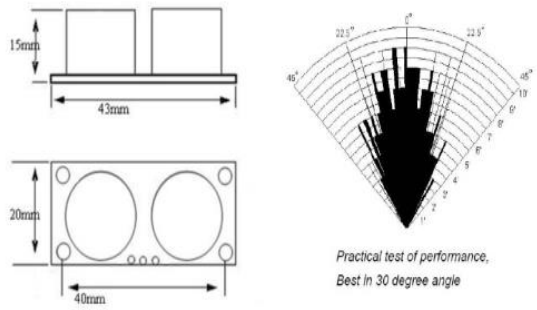

Figure 2

VII. CHARACTERISTICS OF PROPOSED SYSTEM

A. COMMUNICATION

- ✓ The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega8U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The '8U2 firmware uses the standard USBCOM drivers, and no external driver is needed. However, on Windows, an *.inf file is required.
- ✓ The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-toserial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).
- ✓ A Software Serial library allows for serial communication on any of the Uno's digital pins.
- ✓ The ATmega328 also support I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus; see the documentation for details. To use the SPI communication, please see the ATmega328 datasheet.

B. PROGRAMMING

The Arduino Uno can be programmed with the Arduino software (download). Select "Arduino Uno w/ATmega328" from the Tools > Board menu (according to the microcontroller on your board). For details, see the reference and tutorials.

The ATmega328 on the Arduino Uno comes preburned with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500protocol (reference, C header files).

You can also bypass the bootloader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header; see these instructions for details.

The ATmega8U2 firmware source code is available. The ATmega8U2 is loaded with a DFU bootloader, which can be activated by connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2. You can then use Atmel's FLIP software (Windows) or the DFU programmer (MacOS X and Linux) to load a new firmware. Or you can use the ISP header with an external programmer (overwriting the DFU bootloader).

AUTOMATIC RESET

Rather than requiring a physical press of the reset button before an upload, the Arduino Uno is designed in away that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2 is connected to the reset line of the ATmega328 via a 100 nano farad capacitor. When this line is

asserted (taken low), the reset line drops long enough to reset the chip. The Arduino software uses this capability to allow you to upload code by simply pressing the upload button in theArduino environment. This means that the bootloader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload.

This setup has other implications. When the Uno is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Uno. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data.

The Uno contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labeled "RESET-EN". You may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line.

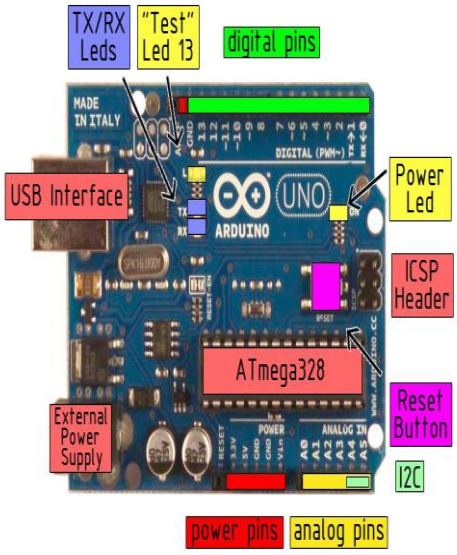

Figure 3

VIII. OPERATION

The timing diagram of HC-SR04 is shown. To start measurement, Trig of SR04 must receive a pulse of high (5V) for at least 10us, this will initiate the sensor will transmit out 8 cycle of ultrasonic burst at 40kHz and wait for the reflected ultrasonic burst. When the sensor detected ultrasonic from receiver, it will set the Echo pin to high (5V) and delay for a period (width) which proportion to distance. To obtain the distance, measure the width (Ton) of Echo pin.

Time = Width of Echo pulse, in uS (micro second)

- ✓ Distance in centimeters = Time / 58
- ✓ Distance in inches = Time / 148
- ✓ Or you can utilize the speed of sound, which is 340m/s

IX. CONCLUSION

The model proposed in this paper serves 2 important purposes; automatic detection of potholes and humps and alerting vehicle drivers to evade potential accidents. We feel that the solution provided in this paper can save many lives and ailing patients who suffer from tragic accidents.

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