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Pothole Detection System

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Abstract – *Most of the road accidents that occur are caused due to bad road conditions and potholes. It is very difficult to conduct a survey of road conditions and fix those potholes. So this cheap and robust Pothole Detection System would be very useful for road construction and maintaining authorities.*

Key Words: MQTT, Raspberry Pie, Locent IOT, Arduino.

1. INTRODUCTION

The basic idea behind making this intelligent pothole detection system is to collect the data of road condition like pothole and humps and this data is plotted on Google Map for visualization.

Our plan is to install this standalone device in public vehicles In each route to collect the pothole data which is then sent to cloud. Our device consists of a highly precise GPS module to collect the accurate location of a pothole.

2. SYSTEM COMPONENTS

Table -1: System Components

S. No.	Component Name	Quantity Used
1.	Raspberry Pi 3b+	1
2.	Arduino UNO R3	1
3.	GPS Module neo 6	1
4.	GY 61 Accelerometer	1
5	Distance Sensor array	1

3. COMPONENTS DESCRIPTION

3.1 Raspberry Pi 3b

It is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. We are using it head less so boot up it starts running a program which sends pothole coordinates to cloud if detected.

3.2 Arduino Uno R3

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino is useful microcontroller board for small code footprint. In our device Arduino is performing continuous analysis of pothole using IMU reading and various pothole detection algorithm.

Figure 1- Arduino

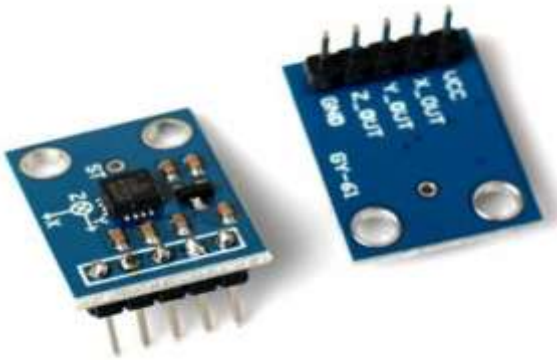
3.3 NE0 6 GPS MODULE

The NEO-6M GPS module is a well-performing complete **GPS receiver** with a built-in 25 x 25 x 4mm ceramic antenna, which provides a strong satellite search capability. With the power and signal indicators, you can monitor the status of the **module**.

Figure 2- GPS module

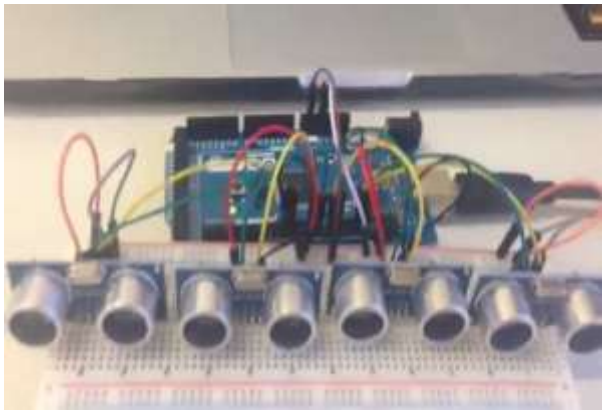
3.4 GY 61 accelerometer

GY-61 DXL335 3-Axis Accelerometer Module is a three axis **accelerometer** sensor module based on ADXL335 integrated circuit.



3.5 Ultrasonic Distance sensor array HC-SR 04

Ultrasonic distance measuring **sensor** provides precise, non-contact **distance** measurements up to 6000mm on any surface and in any environment. We are deploying an array of 10 distance sensors in front panel of vehicle between its front tires, to distinguish between humps and pothole.

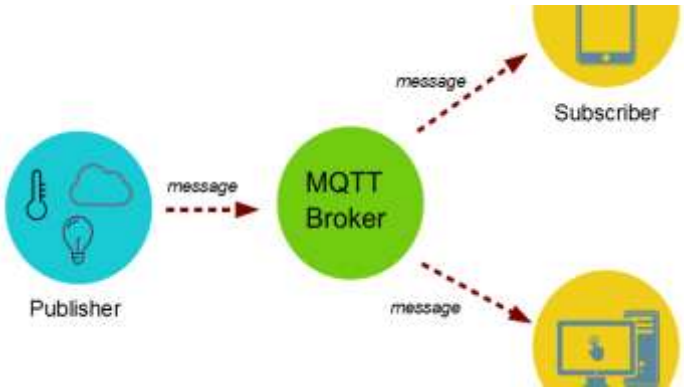


4. PROTOCOL AND ALGORITHM

4.1 MQTT

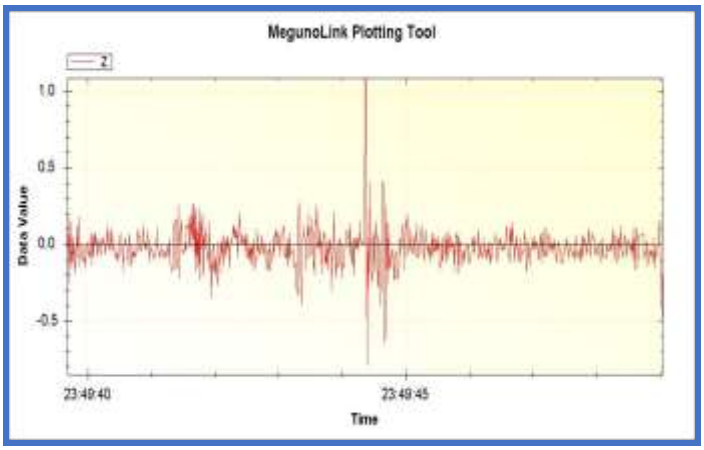
MQTT is popularly known as mosquito telemetry , which is a Lightweight **IOT** protocol used for low bandwidth. MQTT works on Publish Subscriber Architecture, whenever a device Publish on a Topic, so other device (Subscriber) can also access this data if have subscribed to same topic.

So with in this communication protocol two different device are not connected directly to each other, instead they communicates through a **Broker**.



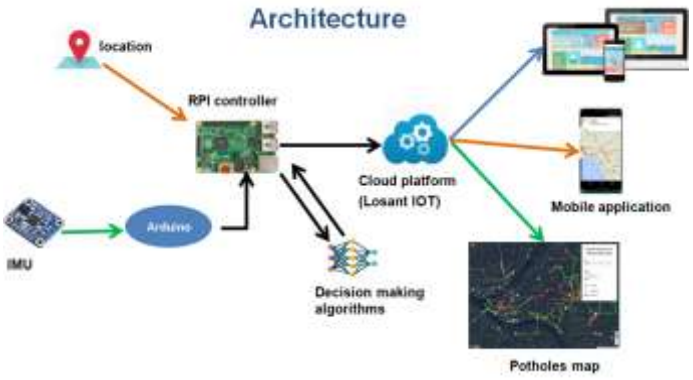
4.2 Z-DIFFERENCE METHOD

The Z-DIFF approach considers the maximum difference of two consecutive Z-axis accelerometer records as the threshold to detect pothole.



5. METHODOLOGY

1. An accelerometer is connected to arduino ,so it fetches continuous Z axis acceleration reading of accelerometer which is then analyzed using various algorithm deployed in Arduino.



2. Based on the analysis of those algorithm if a pothole is detected by Arduino. It pings Raspberry Pi by sending a low to high pulse at a GPIO of Raspberry Pi.

3. So whenever Raspberry Pi receives an interrupt on its GPIO, same time it fetches GPS location form GPS module which is connected to Raspberry Pi by UART protocol at baud rate 115200.

4. This location coordinates of pothole is then updated in a CSV file of local storage, same time it sends these location coordinate to **LOSANT IOT** cloud, which is free an open source cloud platform, supports various communication protocol like **MQTT, HTTP, COAP** etc.

5. Since our plan is to install more such devices in public buses of a city. So this data would be updated regularly based on frequency of buses plying on particular route.

6. Working Prototype

Fig. Pothole Detection System

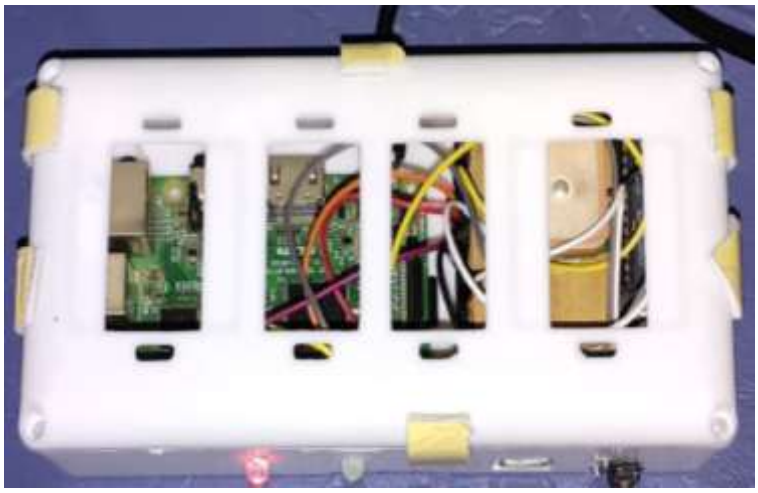


Fig. Ready Working Model

7. CONCLUSIONS

- Better way to visualize city roads condition.
- Compact, reliable.
- Accurate location data of pothole
- Local processing reduced
- Most IOT devices faces problem of power but we use power from bus.

8. FUTURE WORK

This pothole detection system can be made more handy and compact as per future requirement and could be

used in vehicles on advanced level so that people may identify comfort level of road.

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