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Auto Detection of Path Hole Using WSN

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Abstract: This project aims to propose design of 'Pothole detection System' which assists the driver in avoiding pot-holes on the roads, by giving warnings beforehand. Warnings like buzzer if the vehicle is approaching a pothole, or vehicle may be warned in beforehand about which road has more potholes. When vehicle gets this information user sees if it has sensed any discontinuities which access point does not have data about; if that is the scenario then the information about those discontinuities is transmitted to server as a feedback. Access Point updates its database with the new entries of potholes. And finally the localization subsystem which reads the data given by Access points and warns the driver regarding the occurrence of pothole.

Keywords: Potholes, detection, roads, warning.

I. INTRODUCTION

The ever increasing apathy of the road development authorities is one of the major reasons for the increasing road mishaps. Potholes trigger majority of such mishaps. While driving in the night just the headlights might not suffice in assisting the driver to detect the presence of the pothole. Many other unexpected hurdles on road apart from potholes may cause severe consequences. Abysmal road conditions cause wastage of precious fuel, wear and tear of the tyre and damage to the vehicle. All these reasons demand that it is important to collect information of such bad road conditions and through a series of processing and analyzing the obtained information, appropriate conclusions are derived which in turn, warn the driver. In the information gathering phase, a vehicle with a camera mounted on its front end travels along the road, thereby capturing images of the road. Henceforth in the analyzing phase, this data will be processed by an algorithm to detect potholes along the path travelled earlier by the vehicle. It is this algorithm which will determine the reliability of the pothole detection by the system in place. For this purpose, the algorithm has to identify edges that are caused exclusively by potholes on the road. However, unwanted disturbances that are treated by the system as noise would affect the ultimate outcome. To overcome this problem, the system would then evaluate an index which would clearly differentiate the pothole and the non-pothole road.

II. LITERATURE SURVEY

With the rise in world's population, there has been increasing load on the infrastructure. Roads are flooded with the vehicle traffic. It's become progressively tough to manage this traffic this can be the prime motivation behind creating a vehicle intelligent enough to assist drive in numerous aspects. One in all the increasing issues the roads face is worsened road conditions. Thanks to several reasons like rains, oil spills, road accidents or inevitable wear and tear build the road tough to drive upon. Surprising hurdles on road could cause a lot of accidents, additionally thanks to the dangerous road conditions, fuel consumption of the vehicle increases; inflicting wastage of precious fuel. Thanks to these reasons it's vital to induce the knowledge of such dangerous road conditions, collect this info and distribute it to different vehicles, that successively will warn the motive force. However, there remain numerous challenges concerned during this time measure numerous strategies to induce the knowledge concerning the roadconditions.Thenthis info should becollectedanddistributed toallorany thevehicles whichmay require this info. Finall y, the knowledge should be sent within the manner which might be understood and utilized by driver. This project tries to style and build such a system. during this system the access purpose collects the knowledge concerning the potholes within the neighbourhood of a wireless access purpose and distributes to different vehicles employing a wirelessbroadcast.Here'vicinity' couldbea user outlined term.Ideallythe neighborhood is each rout until consecutive

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access purpose.Weather conditions are a unit extremely associated with road safety. There are a lot of various weather applications during which Wireless detector Networks will improve safety in our roads. Weather stations or remote sensors to live temperature, humidness and different similar parameters area unit already being employed in highways to create them sensible Roads. however why not extend it at a better level? As an example, the Spanish capital town government has recently put in a series of temperature sensors buried beneath the paved surface to observe the looks of ice plates in real time.

III. METHODOLOGY

Wireless sensing element network (WSN), are just like wireless accidental networks within the sense that they place confidence in wireless property and spontaneous formation of networks so sensing element information are often transported wirelessly. typically, they're known as mud networks, concerning minute sensors as tiny as mud. Sensible mud may be a U C Berkeley project sponsored by authority. mud Networks opposition., is one in all the first corporations that created wireless sensing element network merchandise. WSNs are spatially distributed autonomous sensors to watch physical or environmental conditions, like temperature, sound, pressure, etc. and to hand and glove pass their information through the network to a main location. The a lot of trendy networks are bi-directional, additionally sanctioning management of sensing element activity. the event of wireless sensing element networks was driven by military applications like field of honour surveillance; these days such networks are utilized in several industrial and client applications, like process observance and management, machine health observance, and so on.

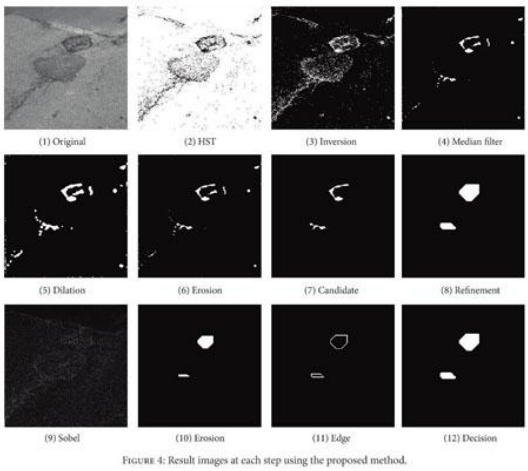

FIGURE 4: Result images at each step using the proposed method.

Figure 1: Results of Matlab

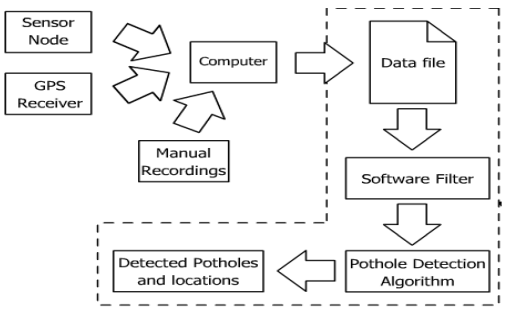

Figure 2: Flow Procces

The WSN is made of "nodes" – from many to many a whole bunch or perhaps thousands, wherever every node is connected to at least one (or generally several) sensors. every such sensing element network node has usually many parts: a radio transceiver with an indoor Associate in Nursing tenant or association to an external antenna, a microcontroller, Associate in Nursing electronic circuit for interfacing with the sensors Associate in Nursing and

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energy supply, sometimes battery or Associate in Nursing embedded style of energy harvest home. A sensing element node would possibly vary in size from that of a shoebox right down to the scale of a grain of mud, though functioning "motes" of real microscopic dimensions have nevertheless to be created. the value of sensing element nodes is equally variable, starting from many to many greenbacks, looking on the quality of the individual sensing element nodes. Size and value constraints on sensing element nodes lead to corresponding constraints on resources like energy, memory, procedure speed and communications information measure. The topology of the WSNs will vary from an easy star network to a sophisticated multi-hop wireless mesh network. The propagation technique between the hops of the network is routing or flooding.

1. Wizwiki W7500 ARM Cortex-M0
- 48MHz maximum frequency

Hardwired TCP/IP Core
- 8 Sockets
- SRAM for socket: Max. 32KB
- MII (Medium-Independent Interface)

Memories
- Flash: 128 KB
- SRAM: 16KB to 48 KB (Min 16KB available if 32KB socket buffer is used, Max 48KB available if no socket buffer is used)
- ROM for boot code: 6KB

Clock, reset and supply management
- POR (Power-On Reset)
- Internal Voltage Regulator : 3.3V to 1.5V
- 8-to-24MHz external crystal oscillator
- Internal 8MHz RC Oscillator
- PLL for CPU clock

2. Camera
- Camera resolution must be high enough to identify potholes
- Minimum shutter speed
- Possibly mount to bumper or roof of car
- 5MP, supports image resolutions up to 1080p

3. Accelerometer and gyroscope
- Triple-Axis Accelerometer
- Acceleration range of ± 4g
- Typical driving conditions don't exceed ± 3
- Low power consumption - 3.3V, 140uA

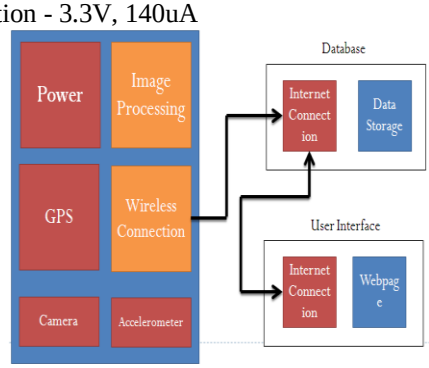

Figure 3: Block Diagram

This is the actual implementation of each block. At this stage we have designed each block separately and finally integrated them into the complete working system.

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By the realization of the above proposed system it cannot only get the exact location of Pothole but transmit it to next upcoming vehicle.

1. System consists of three main parts: hardware, software and data analysis.
2. Hardware includes Wizwiki w7500, Gyroscope, Accelerometer, Camera and GPS modules to collect data.
3. Data analysis helps converting data into usable information.
4. Software detects bumps/holes using data analysis results and locates them on coordinate axis.

This system detects potholes and provide a warning system. This vehicle transmits alert message to next vehicles and hence second vehicle can be saved from potholes. Whenever a vehicle passes over a pothole, the accelerometer senses the vibration and if the vibration value is equal to the one specified in the code, the latitude and longitude value of the pothole is stored into the database. The database stores all values of the potholes detected. If a pothole is detected three times by the user then it will be saved automatically by the system regarding the location of the pothole. Once the problem is rectified, potholes values are removed from the database. In this project so it is assumed that commuters on the road use this application, which makes it easy to know location of potholes with related information.
As the vehicle travels along the road the sensor collects the vertical (Y) acceleration, and horizontal (X) acceleration of the vehicle, one hundred times per second; the sensing element collects one hundred samples per second.

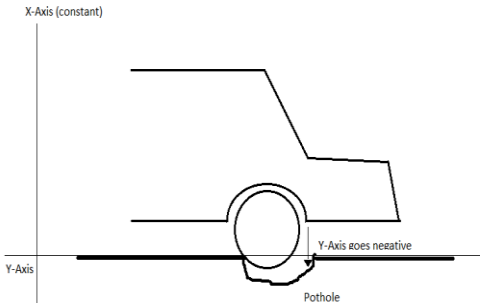

Figure 4 : Pothole and Vehicle

- Though the sensing element captures each Y and X acceleration, only the Y acceleration is employed for this experiment because the vertical movement of the vehicle will be directly mapped to the movement once the vehicle fall into a hollow. The horizontal part of the acceleration additionally changes once a vehicle goes over a pothole, however we tend to limit the scope of this experiment to analysing solely the vertical part of the acceleration.

- For every of those samples, the organizer submits this GPS coordinates to the pc. Thus GPS coordinates for each sample are going to be recorded within the file.

Application Pothole detection system could be a system that aims at warning the driving force concerning the uneven roads and potholes in its path. This could be obtained in numerous ways in which within which goal of the system are often achieved. This project justifies the strategies then it provides details concerning the operating of the various sub systems. The matter statement are often given as follows. This technique consists of two parts one is mobile node and different is that the access purpose. Access points chargeable for storing the knowledge concerning potholes in its neighborhood, taking the feedback from vehicles, change the knowledge in repository and broadcasting the knowledge to different vehicles. Whereas Mobile node that is that the tiny one device placed in vehicle is chargeable for sensing those potholes that it didn't have previous info concerning, locating and warning the driving force concerning the potholes that it's info concerning, and giving the information concerning freshly detected pothole to access purpose. The entire situation works as follows. Whereas deploying the access purpose it stick in some initial information concerning potholes thereto. Then it keeps on broadcasting the information. Vehicle equipped with the shopper device catches that information. Currently the device has the knowledge concerning the locations of potholes. The device is chargeable for warning the driving force concerning occurrences of pothole. However new potholes could continuously be shaped owing to atmosphere or fatigue thus shopper device additionally acts as a device and finds out the prevalence of freshly shaped potholes on the road. If it finds out any new potholes it provides information of recent pothole to Access purpose in terms of the feedback. Access points updates this info to its information store then adds it to the knowledge broadcast.

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1. It can be used at Automobile industries.
2. Implemented in vehicles to reduce the wear and tear action of tires.
3. Due to implementation of this system accident due to potholes reduces.
4. Provides the location of Potholes .

By the realization of the above proposed system it cannot only get the exact location of Pothole but transmit it to next upcoming vehicle can also the detection of potholes during low daylight the detection potholes is quite a difficult and the processing of it might be not done.

Our goal is to create a traffic and road watching system for intelligent route designing, road usage and maintenance that fulfills the constraints obligatory by the Indian situation. this method ought to work below varied road conditions, chaotic, dense and unstructured traffic and an outsized style of vehicles. It cought to be price effect, straightforward to deploy (no got to dig or build overhead structures) and need lowest maintenance. we should always avoid the requirement for specialised instrumentality. so as to fulfill these somewhat conflicting necessities we tend to are willing to be content with system that will AN approximate, mixture traffic analysis and close to realtime reportage. we tend to don't desire a specific count or classification of vehicles however rather some info through that we will deduce the state of traffic on a road section. Hence, we tend to are willing to trade-on accuracy of reportage with simple preparation. we wish to create a road watching system that's able to higher quantify a road anomaly. Thus, our efforts are to do find out ways in which to report severity, intensity or dimensions of a hollow or a broken road section.

IV. FLOWCHART

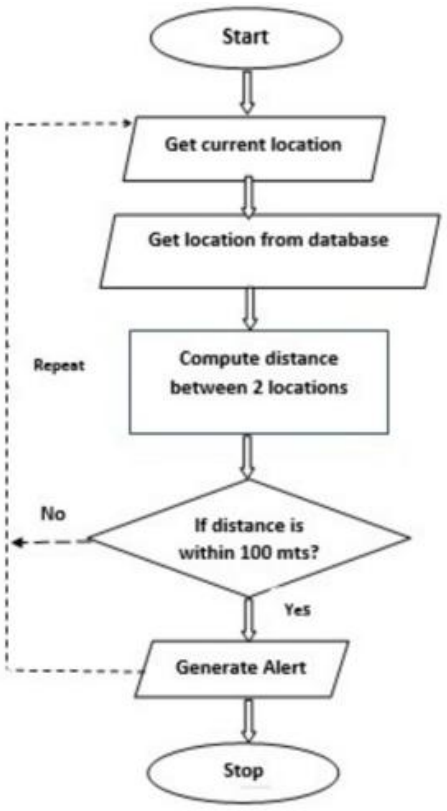

Figure 5: Flowchart

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V. RESULTS AND DISCUSSION

(a) (b)

This is an image of a pothole which has been converted using dip and once the program senses that it is a discontinuity on the flow of the road it will alert the user and mark this as a pothole.Note tht the crack and hole on the road is clearly visible in the system and can be marked as a pothole.

```
#include "mbed.h"
// including for serial communication between our device and board
#include "Serial.h"
#include "HCSR04.h"
#define data_chr '>'

//function used for taking gps location from mobile phone sensor
//via bluetooth of phone to bluetooth(HC 05) connencted to wizwiki board
void ggp();
//function used for determining the depth of the pothole for dummy purposes we have taken (10 cm) as threshold value
void ultra();
int flag=0;
//bluetooth device pin no for transmiiter and reciever
//D1 is tx pin of board connected to rx pin of hc05
//D0 is recievepin of board connected to tx pin of hc05
Serial bt(D1, D0);
//pc is used for serial communication or for printing of msgs to console
Serial pc(USBTX, USBRX);
Timer timer;
int main()
{
while(1)//for repeating forever
    {
   ultra();//ultrasonic sensor reading
  // pc.printf("\r\nflag is %d\n",flag);
//if flag is one that means the distance is more than the threshold value set and chances of pothole present are more
ggp();//fetching gps location if flag is one
  }
}
void ggp()
{
    unsigned char rx;
  int sensorType = 0;
  float value0=0;
  float value1=0;
  float value2=0;
  unsigned long logCount = 0L;
    //setting baud rate by calling the object
    bt.baud(9600);
  //  while(1) {
        if(bt.readable()) {
            // if some data is there then print it on console
            rx = bt.getc();
           if(rx!=data_chr)
           {}
           else if((rx==data_chr)&&(flag==1))
           {
```

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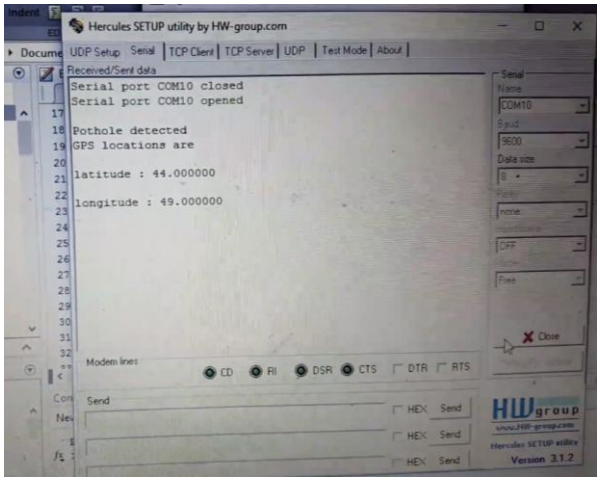
```
            sensorType=bt.getc();
            logCount=bt.getc();
            value0=bt.getc();
            value1=bt.getc();
            value2=bt.getc();
           // pc.printf("\n\nreceived : %c",rx);
            //pc.printf("\n\nreceived : %d",sensorType);
           pc.printf("\nPothole detected");
           pc.printf("\nGPS locations are");
            pc.printf("\n\nlatitude : %f",value0);
            pc.printf("\n\nlongitude : %f",value1);
          //  pc.printf("\n\nreceived : %f",value2);
            wait(0.9);
            }
            }
            else
            {}
    //}
}
void ultra()
  {
        float distance;
        //int flag=0;
       HCSR04 sensor(D2,D7);
     sensor.setRanges(5, 300);// setting the minimum range as 5cm and maximum as 300cm
    // pc.printf("Min. range = %g cm\n\rMax. range = %g cm\n\r",sensor.getMinRange(), sensor.getMaxRange());
    //  while(true) {
        timer.reset();
        timer.start();
        sensor.startMeasurement();
        while(!sensor.isNewDataReady()) {
            // wait for new data
            // waiting time depends on the distance
        }
        distance= sensor.getDistance_mm()*0.1;//getting the distance in mm
        //converting it to cm
       // pc.printf("\nDistance: %5.1f cm\r", distance);
       //if you want to see distance
        timer.stop();//5.1
        wait_ms(750 - timer.read_ms()); // time the loop
        if ((distance > 10)&&(distance!=300))
        {
```

ttps://www.tutorialspoint.com/codingground.htm

This is an image of the actual program running on the system and the main code used in implementation of this concept.



The coordinates of the pothole are noted along with the notification which is sent to the driver, the program also sends and stores the coordinates on a cloud based server systekm which will then transmit it to all other vehicles connected to the same system

VI. RELATED WORK

When we mention road condition observation systems, we tend to generally mention knowledge targeted systems. knowledge is usually collected by devices and analyzed to higher perceive the matter in hand, and to accumulate information regarding it. However, information is tough to investigate and exhausting to grasp. knowledge has to be reworked so as to be a lot of comprehensive, increasing its usability in data processing algorithms.

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Road surface observance with refined devices is introduced within the previous segment. However, as road quality will amendment quickly over time and with varied usage masses, **it's exhausting to watch road quality in realtime exploitation** commonplace observance cars, that square measure costly and few. Recently, the hole Patrol[1] system uses a three-axis measuring device and GPS to find and report paved surface conditions. this technique is put in at a fixed orientation on the dashboard of AN automobile. knowledge is collected by seven cabs round the Bean Town space. Another system, TrafficSense[2], uses GPS, AN measuring device, and a mike to gather vehicle-based road knowledge, observance traffic and road conditions. one in all the contributions of Traffic Sense is that it uses the Leonhard Euler angle to reorient the acceleration knowledge letting arbitrary placement of the measuring device. These 2 approaches utilize straightforward device to accomplish road observance. Several websites aim to gather problems from native residents and report the raised problems to the suitable body units. SeeClickWatch2 (based within the US) introduces AN easy-to-use interface on each the net and mobile devices with that users might report issues to governmental agencies relating to their native surroundings. FixMyStreet3 provides an analogous service within the GB for promoting on-line democracy. Volunteers will report native issues, like roads with potholes, unlit lampposts, or discarded mattresses at the wayside. problems identified by users of the Fix My Street system square measure forwarded to relevant council. In Taipei, the town government free a web site, RCIS, four in Apr 2009, that provides a platform wherever users will report route hazards. though the RCIS system has reportablely suffered from inconsistent downside handling and lacks some options like automatic follow-up of reported problems, it so offers a decent define of a communications pathway between government and voters.

VII. CONCLUSION

Taking under consideration the present road situations, there's a desire to plan a system that warns the driver concerning the future potholes. several on-going comes within the field of transport networks square measure operating within the direction of providing driver with relevant data concerning roads and traffic movements. we tend to gift here, a unique plan of chuckhole Detection & Warning System based on 3 subsystems, that aims at providing acceptable data to the driving force concerning potholes. Within the sensing scheme, measuring device was used as device owing to its low response time and low maintenance value. 'Hotspot approach' was used for communication scheme, in which associate Access purpose is deployed at high-traffic locations, making certain that the knowledge reaches maximum range of vehicles. it's advantageous to use GPS for localization scheme thanks to its high effectiveness and recognition.

VIII.RESULT

We have implemented a system that will constantly scan for images and convert them into viable format visible and counting deformities on the road and also mark it on a gps as a tracker to record its location for other drivers and authorities to see and take evasive action. We have implemented a system that can In the future, we tend to develop systems that would mechanically guide a automotive around potholes while not the automotive exploit its lane and inflicting a danger to alternative drivers. If the hole hazard was important enough, safety systems may slow or perhaps stop the automotive to minimize the impact. This might all facilitate create future autonomous driving a secure and pleasant reality.

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