Surface Detection in Automobile using Sensors

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Abstract:
In this research paper, we deal with the solution of damage to the lower frame of automobile, especially for sport cars. A special type of Hydraulic lift system (HLS) is used to lift the car where needed. A wireless network of sensors will detect the distance inclined angle from a certain point of car to the road surface. Whenever the distance of vehicle from road surface is become lower or greater than a defined limit, the control circuit unit (CU) will activate the hydraulic lift system to avoid damage to the car. We have discussed some more techniques to resolve the issue more effectively by introducing the full automated hydraulic lift system . The proposed strategy is more effective for the developing countries, whereas the technology limitations are available such (No GPS, net connectivity are slower). While, we used distance sensors to detect the distance with the surface of road.

Key words:
Sensors, HLS, CU, potholes.

1. Introduction

Sport cars are considered as the most reliable and speediest method for conveyance due to their lavishness and can be taken anyplace effortlessly [1]. Their shapes are intended for solid optimal design to accomplish rapidity with better road grip, less fuel utilization and cost - effective. These are three principle factors for sports cars manufacture should deliberate to compete the market [2-3]. While, the new models will be more lowered height then the old models to gain high speed and better road grip. This becomes issue for the drivers while driving on rough roads and they can't go outside such cities where the roads are smooth and well-constructed [4]. The developing states don't have the innovative technology to constructs the smooth and fast roadways [5]. The sports car manufacturing firms such as Lexus, Mercedes, Audi and other famous organizations don't take risk to discredit the company reputation by bringing high tech sports cars in developing states due to unavailability of smooth and fast roadways [6]. Furthermore, it is also caused the damage sports car frame. While, the frame of sport car is considered as worthier and primary important piece to develop speedy car [7]. A few sports car companies have offered Hydraulic Lift System (HLS) for evading such destruction [8]. The offered solution is based manual HLS that has a drawback effects in which sports car must be slow down before actuating the HLS.

All of above mention points of interest for lowering car's body are the best characteristics for a sports car. However, it likewise causes a few issues when it comes to unsmooth way that can cause body frame damage. On the off chance that it goes at rapid, its body edge could be damage too. That is the reason the well-known sport car firms don't introduce own latest autos in developing states. The sports car driver has challenges in manual HLS to identify the obstacle and figure out that whether the car is sufficiently lifted or not from the surface.

The proposed scheme is equipped with high tech such as APS (Automatic Parking System) [9] and GPS (Global Positioning System) with HLS to lift sport car; such sort of solution is effective to protect lower down frame through obstacles, muddy and snowy tracks [10].

The primary target behind this thought of venture is to give answer for the mainstream auto organizations who abstain from bringing in their new costly and cutting edge autos to developing states. The high class individuals can't take profit of such extravagant and solid autos. As some of customer can bear to purchase such autos but can't manage the maintenance cost of sports car after they are harmed by unsmooth way and obstacles. While, sports car frame damage by obstacles can effect on actual market price. Mostly purchaser avoid to buying damage sports car.

The technique for recognizing the unsmooth track is least expensive as contrast with alternate strategies, since it just works on the separation estimation with the surface of roadways while different strategies like APS and GPS sensors by monitoring the accelerate-meters.

Manuscript received September 5, 2018
Manuscript revised September 20, 2018

Table 1: Comparison between Automated and Manual HLS

Automated HLS	***Manual HLS***
The performance of HLS depends on the detection done by the sensors.	The performance of HLS depends on the detection done by the driver.
The HLS are activated on the basis of sensed data.	The HLS are activated manually by the driver.
The error rate is very low using sensors.	The error rate is very high in manual HLS.
There are many others applications of sensors HLS like leveling the car while turning etc.	It can only be used for lifting the car.

2. Sensor Networks Applications

Categorically, the sensor based framework has an extraordinary utilization in the various application get a kick out of the opportunity to predict somewhat in crisis circumstances such as military utilize, temperature sensing, and agricultural purpose [11,12]. Moreover, it has an incredible application in cooperate sector because the remote sensor architect has fantastic essentiality presently. Since remote sensor network sort-out truly tackles Ad-hoc node suggests without focal server or some other focal focus point or processing mechanism to lead the structure to-be in impeccable practical condition. All sensor devices are expected to detect or sense the necessary information that might be whatsoever such as weight or temperature [13]. After that the indisputable choices are made which depend upon the recognized information. The reason of the immense utilization of sensor makes each one of the factors which movement must be achieved through the application developer thru the programming encoding.

The remote sensors network is based on the Ad-Hoc network manner. There are various sensors designed through diverse venders for detecting assorted kind of information for example to surface detector, motion sensor, Heat/Temperature sensor, metal detector, and etc... Distinct sensors have assorted extent of detecting information for example a detector may distinguish the weight and temperature up-to 40 meters [14].

The remote detector structure has a splendid usage in the space of vehicle. In auto mobile industry sensor nodes are used numerously. That is the reason globally, there are innumerable on the planet around which are making and conceiving the cars obtaining and trading of the cars. They usually standards are defined between various nations. Mostly standard issues are enlightened the prime lavish cars vendors such as BMW, Audi, Mercedes. Such vendors does not pitch own latest technology cars to the client, those lives in a zone wherever the surface of the street is not sufficient flat for a thriving drive, so far different clients those desire to purchase such autos can't make their need fulfill as a result. The surface in the zone so clearly there ought to be certain system to spare such autos from damage in perspective of the annoying surface of the street like in Pakistan.

It is well understandable that the street condition isn't suitable for various automobiles such as Honda, BMW etc. Because, the developing countries like Pakistan don't have smooth road that can damage the sports care frame and fender. While in Pakistan, there is no such zone in which the surface of the road are not 100% flat and smooth. The author is to propose a methodology for the sports car by usage HLS of remote sensors frameworks to protect sports car franes and fender to bouncy road and cruel boulevards that can moreover empower the venders to launch latest sports cars in Pakistan.

3. Sensor Technology Function

It is an essential offhand framework so all sensors within the systems go approximately as a self-ruling center recommends as a server and other than as a client. Each sensor recognizes information and makes particular development on the base of the distinguished information [15].

Sensor center point is careful to distinguish the desired parameters which are scheduled by the framework designer and after that these recognizing information which is detected at that point forward to the central point which in this way moves it to the client center point to the application layer for the client or client to induce advantage from the constrain of the farther sensor organize [16]. The sensor controllers are used to show the calculated and issues which clearly impacts the data as the title induces that sensor center point is remote infers that usage of power batteries happens. Anyway there are no external source of power but there are diverse sorts of valuable producer are incorporated by sensor that utilizes the best battery power whenever an event is made for that some action to be executed. As matter of fact unique estimations executed and associated in the remote sensor frameworks are accountable for the power usage and setting the rules and situations for the power use such there are different sorts of sensors let's say the sensor those are passed on within the boondocks for the figure of the disastrous a occasions are used in the timberland that have the capacities of empowering around 2 to 5 years. But afterward their due time the sensors must be removed with the better one in light of the way that without charge sensor is nothing [17].

4. Architectural Design

The various types of sensors are available to detect the surface and identify the location. Such activity is realized on a prototypical through designed the sensor circuit and

the smooth appear circuit. The sensors applied are ultrasonic sort of sensors. They are to a great degree essential and effective to usage and are incredible sensor to use in mechanical innovation and other electronic drives [18]. It produces an ultra-sonic pulses and a while later gets the returned resound reflecting off by a question. The beat is discharged by a transducer which changes over between electrical, mechanical, and sonic imperativeness. The time between the sent pulse and the returned resonate is applied to register partitioned. Furthermore, it has a few of downsides due to no faultlessness. The transmitted heartbeat by a ultrasonic sensor has a canoed shape and any address within the beat an region or extend experiences will reestablish a resonate. It can't separate between little questions, for instance, a stick or minimal stone, and vast articles, for instance, a table or divider thusly as both will reestablish a resonate. The beat sent compasses around 40-200 kHz, yet it generally is in the extent of 40-50 kHz.
Transducers are gear type that discharges the first heartbeat and reverted reverberate is detected. There are 2 kinds of transducers.

The kind of transducer used for this undertaking is piezo transducer [19]. It uses the peizo effect to make and measure ultrasonic heartbeats. The sensors use a valuable stone or imaginative material clung to a metal case or cone. To transmit the beat, the valuable stone is empowered by a banner (as a general rule 40 kHz), which develops or gets the piezo material. The related metal cone in like manner broadens or contracts which makes the ultrasonic burst. The landing resonate causes the piezo material to vibrate, which creates a flag. Piezo transducers are generally more reasonable than electrostatic transducers; anyway their advancement enhances them suited for ruthless conditions.

5. Proposed Method

The structure plan is the mix of different small sensor organize recommends 2 sensors are placed at the front side of the sports car lower frame and 2 more sensors are implanted at the back side frame of the sports car and 2 sensors are inserted at the foremost lifted reason of the front for prevention disclosure as illustrated in fig. 1. The structure is plot particularly to be utilitarian and more practical on the rough street of the Pakistan issue arises in to the closeness whereas driving all over the put when the drivers doesn't think around the mutts and speed- breaker or any type of intrusion out on the town which can had to the exceptional misfortune so to energize each driver we have implanted a farther sensors organize in an auto.

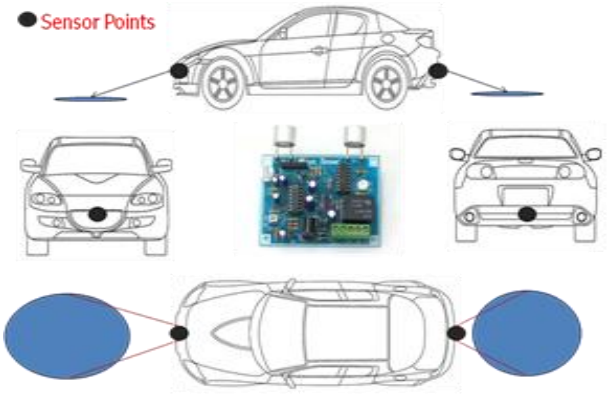

Fig. 1. The sensor nodes and sensing area architectural view

Fundamentally the structure is the mix of six sensors as appeared up in fig 2. Two of them are presented at the front of the auto the diving way and two are organized at the front of the auto within the best ward heading which is fit to sensors will recognize information and getting sensor will choose that an event has happened so it'll be appeared up by LED appear of ruddy shading which is able be Which is reproduced and the execution result are appeared utilizing the mechanical gathering GL3D Max in which each one of the impacts of the auto with the proposed implanted sensor engineer is appeared up with the 3 estimation and encourage more we have completed the thought fit as a fiddle to display the bona fide and viable impact whereas driving on boulevards.
Arranged between front sensor suggests among transmitting and tolerating sensors. Directly we have 2 cases in which an event may jump out at encourage the driver by pressure driven shacks.

Case 1:
A primary event wants the situation that the uncover appears on street. On the off chance that we take a gander now so we will come to realize in which if really there is a burrow implies the scope of the obstruction increment from the sensor. So for this circumstance water powered sheds will be lifted-up that is indicated by the

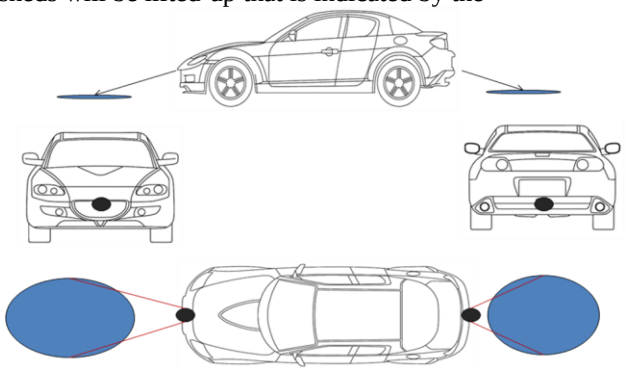

Fig. 2: The positions of sensor nodes

LED indicator, that is arranged overhead of the sports car anyway decently at left side at the above of the auto which that's green shading. In this LED block there are various squares/segments from that utmost of the sections begin squinting. Let's there are no lesser than two portions in flickering state. So for this circumstance of burrow most of the bars will exhibit green LED demonstrating that range has developed the grounds that there is a burrow on street.

Case 2:
Directly the 2nd case happens whenever a speed breaker makes a snag on street while driving. It will suggest the range from the deterrent lessen one might say that speed-breaker is beyond from the common surface level of the road so to encourage the driver through lifting-up the water driven shacks is showed up by another LED which is introduced over the body of the auto at the correct side which is extremely a LED bar that is similar as utilized for flickering because of burrow yet for this circumstance various bars/segments of the LEDs will be empty exhibiting that partition from the obstructions has diminished by virtue of speed breaker/hop.

Case 3:
Presently typically the begin of the circumstance almost the recognizing verification and recognizing of information through the sensors inserted at the front side of the sports car the rising way. These sensors are in like way utilized for affirmation of a hindrance which may be of a divider, corner, turn/daze corner proposes which isn't connected to the revelation or recognizing of the information from the surface of the street and hence we have implanted the 2 sensors one might say for transmitting and the other is as the recipient. The transmitter induces that it is additionally a sensor that is solid to recognize the information that is made configurable through the application designer gathers the check that comes within the front side of the sports car clearly and afterward it'll recognize the information it'll make and occasion which occasion will be send to the beneficiary which is in like way a sensor and will gatherer the occasion as information and will settle on the bases of that occasion that what activity must perform with this occasion.

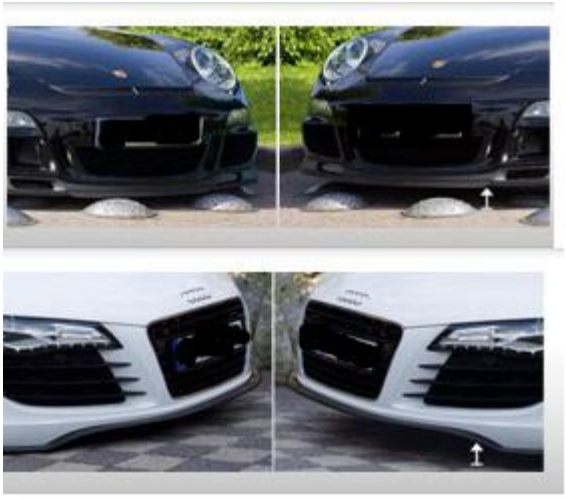

Fig. 3: The HLS lifting the car

Case 4:
In the event that we combine both the cases at that point we are going come to get it that exceptionally are four sensors which are attempted and genuine to distinguish the tangles which are of two sorts. The fundamental sort of the hindrance is burrow and bounces on roads and the moment kind of the obstruction can be any divider or outwardly impeded corner within the street. The bit of the framework inserted at the front side of the sports car within the plummeting and the rising course is the rule portion of the structure in that Ultrasonic sensors are utilized to recognize the surface for the extend up around 5 feet especially presented on the circuit that is the mix of one driven a few calculate resistors with a period intensifier that is related with the operational enhancer which drives the sensor to be within the supportive state infers that marks well the specified factors that has been engineered by the application produce proposes through us that is the separation and extend from the sensor to the surface of the street besides organized within the jumper as shown in fig.3.
A portion of the cars organizations are endeavoring to give the arrangement by inserting the manual HLS in their new models to avoid from harming while at the same time driving on harsh streets or when there are higher speed breakers and little potholes. The present framework has a few complexities like

1. The driver himself needs to recognize the unpleasant streets and the stops the auto.
2. Because of manual framework the HLS must be initiated physically then the auto will cross the obstacle and afterward deactivate the HLS manually.
3. The HLS can't be enacted in high movement because of single oil compressor. The manual HLS isn't sufficient

answer for harm evasion since it don't ensure while driving with fast and synchronous harsh surfaces.
4. A few autos come just with raise power through hydraulics used to lift the auto at backside when it is stacked.

6. Experimental Results and Analysis

It will mechanize the present manual framework by inserting some sensor hubs on the front and back guards of the auto, detecting the separation in slanted point with the surface. We will set as far as possible for potholes and lower confine for speed breaker and we consider that they can harm the auto. We will be particular on an issue i.e. low-rise. Because of a few obstacles on street such like harmed streets, digs, speed breakers and so forth can harm the auto outline which can cost a great deal. It may not be conceivable to drive on such streets with lowered down autos. Here, we are demonstrating the situation of sensors and their territory of detecting the separation with the surface street.
Calculation of Sensed data:
The sensor will simultaneously measure the separation with the surface of the street. There must will be a few changes however in the event that they are between as far as possible then they will be disregarded generally the CU will refresh the counter which have the estimation of the scope of sensor and will begin decreasing as the speed of the auto and at a specific esteem e.g: 5 meters, the CU will activate the HLS and after that the back sensor will begin working as the obstacle is crossed, it will again deactivate the HLS to convey the auto to its typical position. At the point when the auto is switched then the usefulness of front and back sensors will likewise be turned around and the back sensor will go about as front sensor and the front as back sensor.

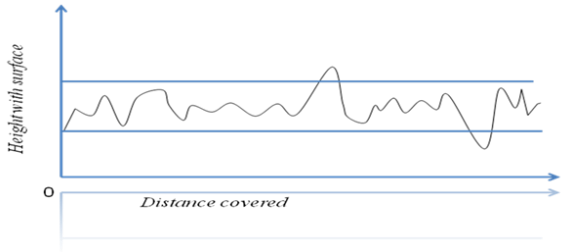

Fig. 4: Surface profiling graph

Note: We consider the auto must be back off when the harsh surface is identified in light of the fact that the HLS require some an opportunity to lift the auto at certain height as shown in fig.4.

A. Calculations at Traveling at high speed:
1. Traveling at high speed:

A portion of the issues may happen in the computerized framework when traveling at high speed so we derived a portion of the fast esteems that what will happen when an auto is going at such speed recorded underneath and how rapidly it covers that separation which is required for the HLS to initiate.

Distance covered at different speed.

1. 100 km/h = 27.78 m/s
2. 90 km/h = 25 m/s
3. 80 km/h = 22.22 m/s
4. 70 km/h = 19.44 m/s
5. 60 km/h = 16.67 m/s
6. 50 km/h = 13.89 m/s
7. 40 km/h = 11.11 m/s
8. 30 km/h = 8.33 m/s
9. 20 km/h = 5.56 m/s
10. 10 km/h = 2.78 m/s

So we can choose and select the most productive estimation of speed and that is the eighth incentive at 30 Km/h speed. At this speed the counter in the CU have enough time to decrease and the HLS can easily lift the auto before the harsh surface.

2. Simultaneous rough surfaces:
Another issue may happen when there is all the while unpleasant surface or numerous speed breaker/potholes. We will utilize another counter in the CU to count the separation among them and the follow up remarkably nearer.
Here, We are thinking about the auto must be slow down when the unpleasant surface is identified on the grounds that the HLS require some an opportunity to Lift the auto at certain height.
This figure 5 demonstrates the changes in the identification of surface, there are a few cutoff points characterized for the activity done after the detected information achieves as far as possible. In addition to focuses demonstrate that the surface by then is harsh. It can harm the sports car frame. So, the essential task will be achieved, for example, the lifting Sports car through activating the hydraulic lift system.

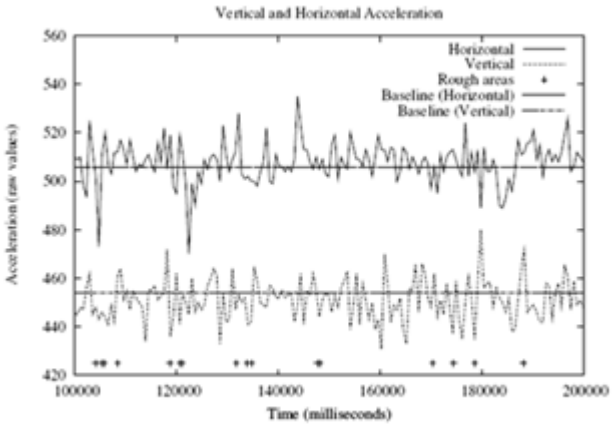

Fig. 5. Acceleration for a road of Horizontal and vertical

7. Conclusion

Automating the current manual system will make the foreign companies to think well enough to import their cars with such technological solution in developing countries. Another aspect of this paper is the cheapest way to automate the manual system without using any satellite or GPS system. It is also the best way to prevent those costly cars which the people already have in those countries.

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