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Detection of Actionable and Non-Actionable Street Bumps in Smart Cities

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Abstract: The proposed system has an infrastructure free approach for roadway detection and identification based on data collected through a smart phone application. There are very few systems available that provide detection of roadway obstacles using accelerometer. The proposed system concentrates on the problem of detecting and classifying roadway obstacles so as to differentiate between actionable and non actionable obstacles. The solution results can be obtained using machine learning algorithms which will be used to aggregate the acquired information. The proposed system is available on a social platform so that users would be able to provide indirect contributions towards development of smart city. The Data captured from the proposed system provides aggregated result of the obstacles irregularities being computed.

Keywords: Classification, machine learning, artificial intelligence, database system.

I. INTRODUCTION

Smart Cities Mission is renewal of urban areas where there is the program taken by the Government of India with a mission in mind to develop about 100 cities (the target has been revised to 109 cities) over the entire country that makes the citizen of those cities comfortable and sustainable. The Union Ministry of Urban Development is responsible for proper implementation of the mission in collaboration with the cities respective state government. The government of India under has a vision of developing 100 smart cities as satellite towns of larger cities and by modernizing the existing mid-sized cities

There are hundred potential good cities that were appointive by all the states and union territories based on Stage one criteria, ready good town plans that were evaluated in stage a pair of the competition for prioritizing cities for funding within the initial spherical of this stage, twenty prime scorers were chosen for funding throughout 2015-16. The remaining are going to be asked to create up the deficiencies known by the Apex Committee within the Ministry of Urban Development for participation within the next 2 rounds of competition forty cities are going to be hand-picked for funding throughout ensuing rounds of competition.

The rising example for a wise town is one in every of Associate in Nursing urban environment with a replacement generation of services for the transportation, energy distribution, health care, environmental monitoring, business, commerce, emergency response, and social activities. The term “Smart City” is employed to capture this overall vision also because the intellectual content that supports it. The technological purpose of read, at the guts of a wise town could be a cyber-physical Infrastructure with physical parts that square measure underlying monitored through varied sensors to look at, as an example, air/water quality, traffic conditions, occupancy of parking areas, the structural health of bridges, roads, buildings, also because the location and standing of town resources as well as transportation vehicles, police cars, police of cars, and municipal staff. The info collected has to be compelled to be firmly communicated to scientific discipline and management points. The information is also shared and therefore the management points will work to get sensible selections relating to the safe operation of those physical parts.

The exciting feature of Smart Cities, Smart City goals in an infrastructure free manner. The majority of urban populations nowadays carry a Smart phone, a device that contains three important functionalists: (a) the ability to locate itself through GPS, (b) an accelerometer which can provide several forms of movement information, and (c) a wireless Internet connection which enables it to communicate with other devices or with servers in an already existing network infrastructure.

India has a road network of around out of which 60% it is urban road According to Indian National Highway Development more than 70% of roads are in very bad condition. Currently India's annual expenditure is around Rs 20,000-30,000 corer for the road sector. One of the major reasons behind this huge expenditure on maintaining roads is because of the problems of poor maintenance of the road services. To detect road obstacles in an automated and cost-effective manner, the proposed system is going to develop the Smart phone application, which records information from the phone's sensor like the accelerometer and GPS. This information can adequately describe and locate “bumps” as a Smart phone carrying vehicle drives through the streets of a city. The proposed

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system uses the term ``bump'' in a generic sense to describe various obstacles which include potholes, manhole covers, utility patches, drains, train tracks and speed bumps, all substantial enough to be clearly sensed by a driver and potentially cause damage to the wheels or other parts of a vehicle. The main component of this approach is the collection of real data through crowd sourcing, an approach which allows citizens to contribute to a massive and continuous data collection process without the need to build and deploy any infrastructure. Moreover, there is the added social benefit of reinforcing a feeling of participation in the mass project of smart cities.

II. LITERATURE SERVEY

[2] The system propose a reservation-based system for alleviating traffic congestion, the system will consider this if the cars are driven by agents and they are considering the area of intersections only. First, the system has described a custom simulator that measures the different delays associated with intersections while conducting traffic. Second, the system specifies a precise metric for evaluating the quality of traffic control at an intersection. The combination of the this simulator and this metric, the system show that the systems reservation-based system are two to three hundred times better at performance than that of the traffic lights which are being used at the intersection for now. As a result, it can smoothly handle much heavier traffic conditions than that of the traffic lights. The system shows that it is the optimal solution for the problem with which people are dealing that is delays at the traffic lights.

[4]Intersections have a high number of accident rates. Intersections have a high accident rate because that is where the car are not traveling parallel as they are in normal roads so the intersection trajectory play an important role for accidents. This system present a framework designed which is for fully automated cars i.e. are cyber-car. It is that part where the cars are able to reserve the road and operate as per the instructions given to it. This system is actually based on previous such papers where the reservation algorithms were used in major effect which helps this paper to implement the necessary things as per required.

[11] This system represents the five methods to the problem of network anomaly detection. These methods cover most of the common techniques like Statistical Hypothesis Tests (SHT), Support Vector Machines (SVM) and clustering analysis. The evaluation of these methods contains three flowlevel anomalies and one packet-level attack. Through analyzing each of the given methods a conclusion can be gathered which relates to the combination of results of each method being used to get the best possible result.

[14] This system considers the problem of detecting formation of wireless sensor nodes which are based on pair wise measurements of signal strength corresponding to all transmitter/receiver pairs. The composite hypothesis testing approach uses a Generalized Likelihood Test (GLT) as the decision rule. The GLT is comparable with the simple Likelihood Test (LT) that is more supportive towards the system. The (GTL) is very much suitable and accurate for formation detection. The system has also adapted to one prevalent supervised learning approach, Multiple Support Vector Machines (MSVMs).The (MSVMs) can be compared with some of the probability methods. The formation detection is very helpful for health rehabilitation.

[16]The proposed system has two methods for traffic anomaly detection in communication networks where the properties of normal traffic can evolve dynamically. The system has formulated it as a binary composite hypothesis testing problem and developed two methods one is a model-free and the other one is a model-based method. Both methods detect anomalies by assessing deviations of traffic from the probability laws(PLs).The methods used considers identifying the families of probability laws (PLs) first before detecting anything. The system uses an optimization-based approach for selecting the family of PLs from the history of traffic data. The system does the validation of the methods on networks with time-varying traffic patterns and one common anomaly related to data ex-filtration as a representation.

[17] This is the developed system of anomaly detection and decision support system based on data collected through the Street Bump smart phone application. The system is capable of effectively classifying roadway obstacles into predefined categories using machine learning algorithms, as well as identifying actionable ones in need of immediate attention based on a proposed “anomaly index.” We introduce appropriate regularization to the classification algorithms we employ, which has the effect of utilizing a sparse set of relevant features to perform the classification. Further, the novel “anomaly index” allows the system to prioritize among actionable obstacles. Results are provided on an actual data set which is being provided by the City of Boston illustrate the feasibility and effectiveness of our system in practice.

III. PROPOSED SYSTEM

The system proposed is to demonstrate how the large availability of wireless devices can enable the development of effective infrastructure-free approaches for solving problems in Smart Cities. In particular, the system has concentrated on the problem of detecting and classifying roadway obstacles so as to differentiate between actionable bumps and non-actionable bumps where bumps are generally considered, in this case the actionable bump is the one which correspond to obstacles that require immediate attention, and the non-actionable bumps for which there is no need to take any immediate action. The examples of Actionable can be potholes, cracks etc. Whereas the examples of non actionable can be

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train tracks, speed breaker's etc. This aggregate information then will be provided to the remote server of that specific area.

The proposed system will have two complementary methods. The first method that uses classification algorithms like Decision trees algorithm. The second method introduces threshold criteria which capture the degree of regularity of a bump, and uses this threshold to differentiate between more "normal" bumps (non-actionable) from the "anomalous" (actionable) bumps, here anomalous is the potholes/bump that is below the threshold and is more likely to be in need of repair. The important part about this system is to identify the difference between which is a pothole and which is a train track/speed breakers. The concept about this system is to use the sensor present in a smart phone to detect the given differentials. The accelerometer sensor is used to detect the bump depending upon the threshold applied to it. The system also uses the GPS which enables to find the exact location of the detected bump which will help in locating the bump and making more effortless for the officers in charge to take decision. The accelerometer uses its three axis x,y, z to make sure the direction in which the car is traveling and the depth of the bump. This will help in identifying the direction of the car thus making sure that there is no conflict between which side of the road the bump exists. The application will start working the way it is supposed to only if the speed of the car is more than 10kmph.

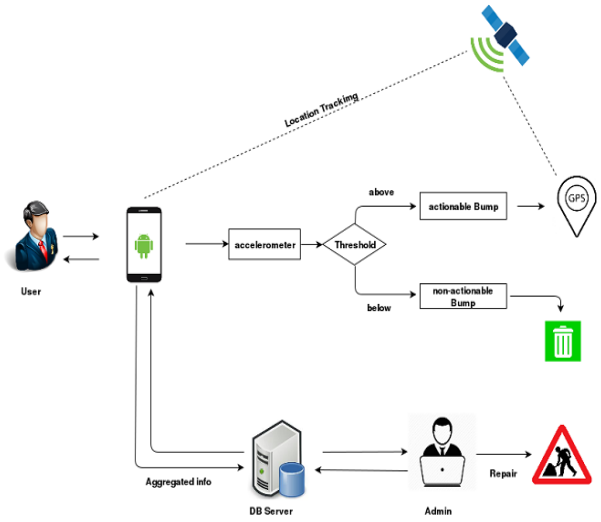

Fig (a): System Architecture

The data of actionable bumps will be sent to the remote server after aggregation that is when more than a considerable amount of bumps at that same location are being detected. This system also provides information of the detected bumps to the users which may travel the same path so as to avoid the bumps or drive carefully through that region thus making it safe for the drivers and also complementing their vehicles. The architecture of the system is being shown in the figure given. This system is ought to achieve more accuracy from the sensors being used. The vision of the system is that the accelerometer and GPS data collected by the app can be used in additional applications. An example is detecting the traffic and providing an alternate route and detecting the road condition like ice-covered or wet which can be used to provide proper information and also helping in proper maintenance of the traffic. All these results, combined can be integrated together to be used with other applications like Google maps for navigation purpose and many such application which will increase the overall efficiency.

IV. CONCLUSION

The proposed system is to demonstrate how using mobile phone sensors the system can detect the roadways obstacles and thus applying effective infrastructure-free approaches for solving problems in Smart Cities. The system concentrates on the problem of detecting and classifying roadway obstacles. The main purpose of the system is to use the features available in the smart phone which is a daily commute of people. The idea of contributing to the smart city mission socially will make people contribute more for the development of their future as a whole. This proposed system can be used as a social platform so as to involve people directly/indirectly. This system can be used globally and integrated with other application for increase in the overall efficiency.

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