IOT based Wireless Sensor Network for Retracing the parked Vehicle

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ABSTRACT

It is expected to be in the next 100 years, world's maximum population is going to be living in cities. Hence the usage of vehicle and its related services will be crucial. As the number of vehicles increases, parking of the vehicle in cities are going to be challenging issue, especially in terms of pollution and maintaining the eco system of the area. Many people are not interested to use traditional or automated parking area because of the difficulty they face during the usage. Even people find it difficult to trace the return path to their own vehicle. The larger number of smart car parking systems is implemented in various countries which normally solve the problem of parking space and effective utilization of utilities. But in a highly populated area safety of the people in a parking slot and retracing of the vehicle is going to be very challenging due to its nature of heterogeneous people and variety of vehicles. An IOT enabled Sensor network based Advanced parking space with camera and audio sensors will be able to collect large amount of data which can be utilized to generate interesting pattern using suitable machine learning algorithm. As the environment is complex and heterogeneous; a better optimization always will be able to provide improved safety to the people as well as vehicle in the area.

Key words : Automated parking, Fruitful information, Machine Learning, Pattern matching, IoT.

1. INTRODUCTION

With the high percentage of vehicle population in India, parking has become a conflicting and confusing situation for the people. Finding a space to park in the city is becoming difficult as the number of vehicles are increasing. The cities in India are highly congested and on top of that the parked cars claim a lot of space that could otherwise be used in a better way. This creates lot of befuddlement in locating the parked vehicle. The parking problem stresses on the point that how the parking system could be used more efficiently, effectively and also how to improve the retracing of parked vehicle by using new technologies and methodologies. One of the challenges of a modern urban environment is to be agile and friendly towards the needs of people with disabilities. One service towards this direction is the provision of convenient parking access to various locations so that people with even disabilities can carry out their activities with ease.

There are lots of safety issues that would occur in the parking area such as accidents between vehicle, accidents to pedestrians and fire issues etc. If the parking area is located within the safe area or unsafe area etc, then parking could be allotted based on the safety of the customers including children, aged people and physically challenged people etc.
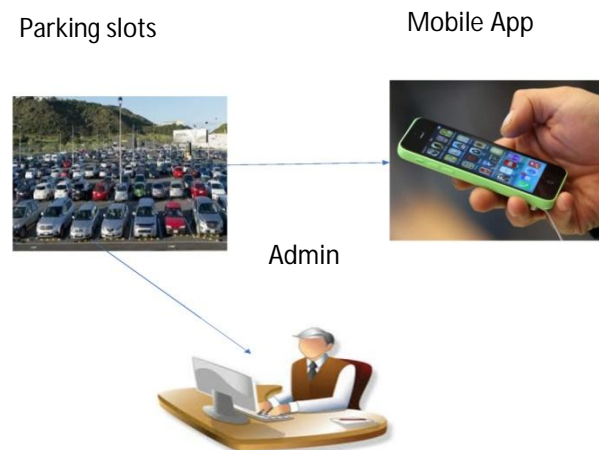

Parking slots   Mobile App

Admin

Figure 1: Architecture of automated parking system

The system as shown in figure 1.1 is an automated parking area which is connected to an android phone through which the user can find the number of free slots .These slots are being managed by the admin. The user can register through his/her phone by any means of input such as voice, gesture or manually making it easy for the specially abled.

2. VARIOUS APPROACH TO AUTOMATED PARKING SYSTEM

The autonomous car parking system with use of camera[2,11] and detection of vehicles using images yield a cost effective solutions but it increase the computational complexity of the system and the accuracy of the detected image always depend on the intelligent technique applied.

The camera based vehicle detection technique can be improved by using convenient indoor using wide-angle fisheye-lens[1] or catadioptric cameras hence the overall performance of vision based parking system can be improved.

IOT[3,6] based wireless sensor network[4,7] arrangement for gathering the parked car information makes the system smart but effective use of gathered information need to be ensured otherwise the system cannot be considered as cost effective. The sensor network always suffer from coverage and network lifetime, computational complexity or cost also a challenging issue here.

As the industrialization[5] of the world increases, the parking related issues also increased and it become crucial for the development of a city. The Expert[4] system with agent based approach or multi-agent system, fuzzy based decision making, wireless sensor based monitoring, Vehicular ad-hoc network based communication etc are the different approach used to improve the traditional parking system. Even though all the above techniques could solve few classical issues but the system performance in terms of various parameters could not be reached to the benchmark.

Overall parking capacity or the utilization of resources can be ensured by Mixed Integer Linear Program (MILP)[6,10] problem approach . The solution of each MILP is an optimal allocation based on current state information and subject to random changes in the scenario.

The latest technology like Internet of Things (IoT) paradigm[8, 9] with cloud-based intelligent car parking services in smart cities gave good result in terms of user convenience and application connectivity of various web servers. But the use of internet merely for connectivity alone is seems to be underperformance as other scope like information from internet etc is not effectively used.

3. INTELLIGENT PARKING SYSTEM WITH PREDICTION SUPPORT

The system will help the physically disabled people to travel confidently in their vehicles even in a complex transportation environment and provides assistance for finding vehicle parking location through smart phone and to trace back the vehicle with direction support. This paper introduces an IOT based smart parking system where parking area and user applications are get connected .With this system, the users can easily find a free parking slot at least cost based on new performance metrics to calculate the user parking cost by considering the distance and the total number of free places in each car park. It also helps the user to find the return path to their vehicle using an android application. This system is designed in such a way that it should also help people with disabilities. One service towards this direction is the provision of convenient parking access to various locations so that people with disabilities can carry out their activities with ease. A Machine learning based well trained system is used to specifically support person with disabilities and the heterogeneous people coming for parking.

Safety of vehicles, peoples etc at huge and closed parking area considered to be a challenging issue because their could be accidents in parking due to not so well experienced drivers, design of that particular area etc. it is very crucial to be identify such vehicle as well the parking area and improve the safety across the area. An Internet of Things based solution which connects the details of parking spaces and smart phone of a person which primarily helps to find out available parking locations, inform the user in case of accidents and also render directions to their own vehicle from anywhere.. The solution Improves confidence of disabled people to use their own vehicle in a complex parking environment like shopping mall, multiplex, public parking areas, etc. It also aims to improve the probability of successful parking and minimizes the user waiting time.

Figure 2: .Outline of parking setup

Figure 3 shows the overall architecture of the system where multiple sensors are deployed at the parking area which include camera for video capture and image collection, microphone for capturing audio/sound. As the data is collected periodically it need not to be in a useful form hence suitable preprocessing is applied with help of filters to make the data collected into more precise. Even after preprocessing as the data is huge and collected at regular interval the all the data need not be informative. A suitable regression technique/ feature selection technique could be used to separate fruitful information from this huge data. Now from the informative data system could apply any suitable machine learning approach like naïve bayes or support vector algorithm to derive interesting pattern.
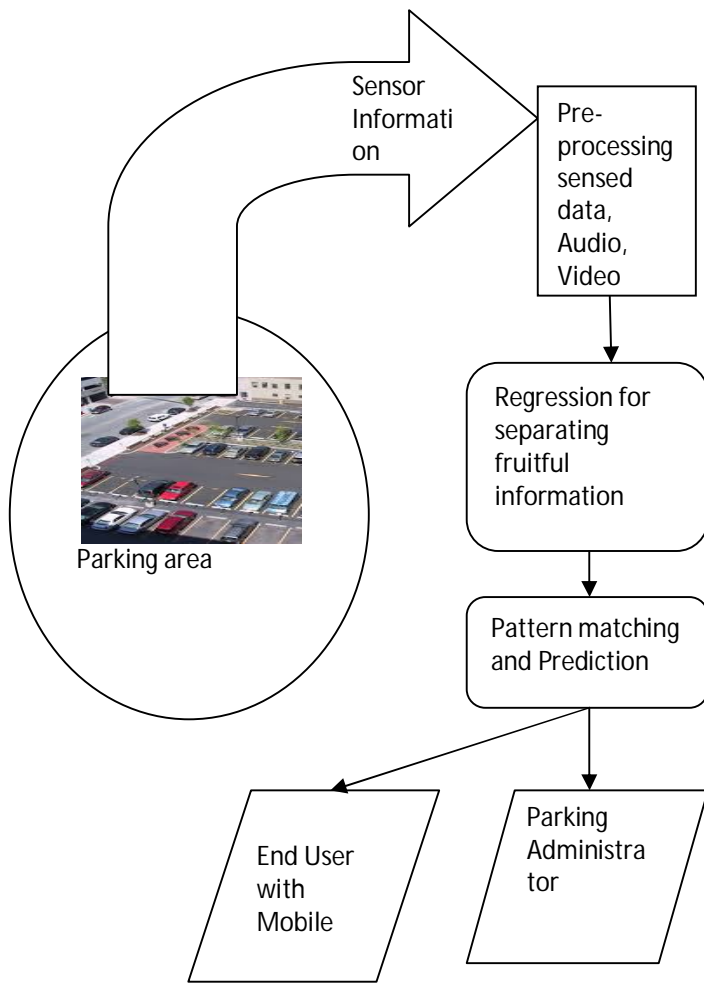
The operational performance of the system is mainly depend on the machine learning technique and other operations included in the algorithm.
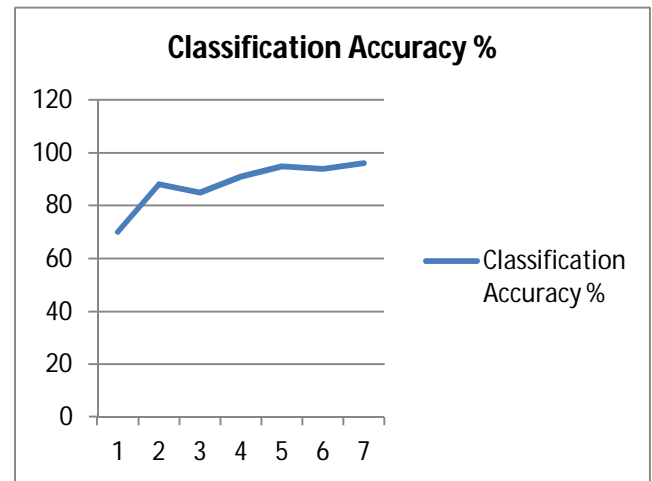

Figure 4: Classification Accuracy Vs No of data set.

The graph shown in Figure 4 is a plot to describe the performance of the classification technique against the no of data set used. The graph evidently shows that as the no of data set increases the system performances also improves.
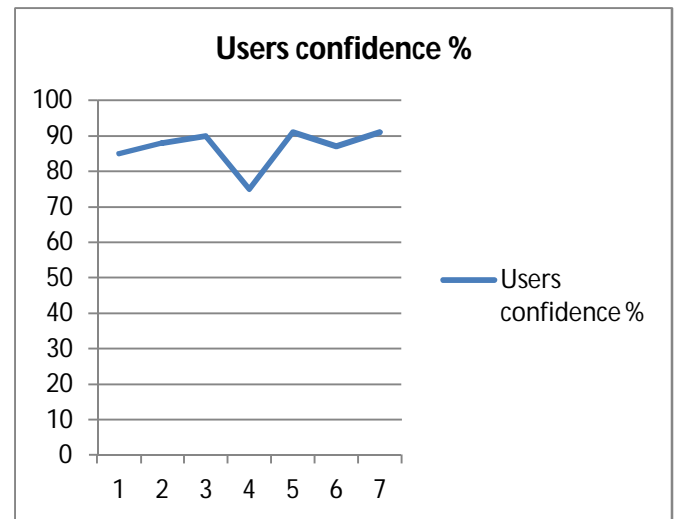

Figure 5: User acceptance ratio in percentage.

The operation of the system is also tested against the user satisfaction rate, the same is plotted as graph shown in figure 5. The plot shows that as the numbers of users are varying the satisfaction ratio of users are still high.

5. CONCLUSION

One of the challenges of the modern urban environment is to be agile and friendly towards the need of people with difficulties and disabilities. One service towards this is the

Figure 3: Automated parking system with prediction.

3.1 Operational Algorithm

 The operational algorithm of overall system could be explained as below**.**

Step1: Collect various data from parking areas using sensors.
Step2: Preprocessing of data for eliminating noise and
         anomalies.
Step 3: Regression for extracting fruitful information.
Step 4: Naïve bayes/Support vector machine for pattern
          matching.
Step 5: information to user and Control information to
          Administrator.

4. EXPERIMENTATION AND RESULT

As the implementation of realtime system is costly a testing model of the proposed system has been developed. The user module is developed using Android application. The sensor network and data collection is done with the help of Raspberry pi based hardware system. The same hardware is wifi enabled and it is accessed through internet. The Administrator module is a JAVA based desktop application where vehicle allotment has been done.

provision of convenient parking access in various locations so that people can carry out their activities with ease. Here the IOT based solution helps the users to find their parking slot with least cost based on new performance metrics. It mainly helps people to relocate their vehicle by supporting location based services. Also it provides user friendly interface with the help of machine learning based well trained system which helps the people with disabilities and also helps in detecting accidents in the parking area. The machine learning approach helps the system to yield good performance in terms of accuracy and user satisfaction.

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