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Shortest Path Finder for Vehicle Parking(SPFVP)

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Abstract— Finding a parking place in a busy city center is often a frustrating task for many drivers, time and fuel are misspent in the search for a vacant slot and traffic jam in the area expand due to the slow moving vehicles circling around. In the existing system sensors are used so it may require frequent maintenance. Although several amount of research works on the development of smart parking system exist in literature, but almost all of them have not addressed the problem of real-time identification of actual parking and automatic collection of parking charges. The shortest path finder for Vehicle Parking System will find the closest path for parking using Dijikstra's algorithm. The SPFVP will guide the drivers smartly to their desired parking destination and the driver can park at the reserved space without any searching. GPS technique is used for helping the driver to identify the nearest parking area. Graphical Interface shows the user for the available and reserved spaces that will help the drivers for selecting the suitable space.

Keywords— Smart parking, Parking slot, GPS (Global positioning System), IR (Infrared Sensor)

I. INTRODUCTION

The increase in vehicle traffic in metropolitan area is one of the effects of the recent rapid population growth in urban areas. In addition to the negative impact on the environment, the increase in city traffic has multiple consequences. As a result, finding a vacant parking spot during important hours is in many cases impossible. Drivers keep circling around wasting time and fuel while hoping that a slot will be available as they drive, above problems generates further traffic delays and aggravation for other drivers. Urban streets searching for an vacant parking space, it not only wastes time and fuel, but also increases traffic flows. A traffic study on several major cities reveals that cruising for vacant spaces is an often overlooked source of congestion, accounting for up to 30 percent of total traffic flows. The frustrating search process, along with the time and fuel wastes are the type of challenges that an Intelligent Transportation System(ITS).

Image capturing devices are used for continuously clicking pictures of parking area to ensure empty slots which results in high power consumption and also high maintenance cost is required. There are some systems in the market like the smart parking services which are based on the wireless sensor networks which uses wireless sensors to effectively find the available parking space. However, to use this system, extra hardware needs to be installed in the car which is not feasible. Finding a parking slot in a congested city is very hard. In many cases people go to a parking station and they find Parking slots are full and there is no space available for parking. Therefore, to search of parking space they have to again roam with their vehicle to find available parking.

The shortest path finder for vehicle parking avoid the traffic problems and provides the shortest path for parking through the use of the devices like microcontroller, IR transmitter and receiver. The IR receiver is connected to the Arduino in each and every parking spot, the infrared sensor is used for the reason that it can support LOS (line of sight communication), The microcontroller gives information to the IR transmitter to the IR receiver and shows information on the display. The SPFVP system contains on site deployment of an IOT module used to control and signal the status of availability of single parking space.

The need to develop a system that indicates which parking slot is empty in a lane. The system includes infrared transmitters and receivers in each lane and LED to display parking slot is vacant or Occupied. The driver can see the parking slot is full or not using the application. Previous car parking systems have some limitations with respect to cost, time and fuel. The use of automatic systems for car parking monitoring will reduce human efforts. The web application will act as interface between the driver and the System.

II. RELATED WORK

1] Nawaz et al. propose a Wi-Fi beacon alliance based sensing system named Park Sense to evaluate if a vehicle driver has come in or driven go away from a parking spot. More specifically, Park Sense uses the Wi-Fi alliance and de-alliance changing rates to sense the parking status. From the empirical evaluation, the authors claim that the Wi-Fi beacon rate is highly correlated with driver's activity. The drawback of the system are that 1) the

existence of both mobile phone and Wi-Fi infrastructure are required, and 2) the access to spartially distributed Wi-Fi access points for analysis is assumed. [9]

2] Mathur et al. presented ParkNet, a mobile street parking system, which collects parking occupancy information as vehicles pass by. ParkNet consists of a GPS receiver and an ultrasonic rangefinder. Over a one-month trial runs with three vehicles passing by the urban streets of Highland Park, New Jersey, the authors built a parking map from collected data. In order to achieve improved location accuracy, the authors utilize an environmental fingerprinting approach, namely, using objects on the street to correct GPS errors. Mathur et al.'s approach is the closest to the approach taken in this paper but map matching is used instead of the environmental fingerprinting and a new detection algorithm is applied. [8]

3] Integrated Smart Parking Solution is a Siemens-led ongoing project aiming at simplifying the searching process, which launched a testing pilot in Berlin in September, 2015. This is different from the previously mentioned embedded sensor approaches as radar sensors are mounted on street lamps to scan larger areas. The radars monitor not only traffic flows but also parking spaces, which can be either used for traffic control or facilitating drivers to find a parking spot. The benefits of the overhead radar approach are claimed to be as follows. Firstly, it is not impaired by weather or light conditions. Secondly, it detects more than just parking spots as it can measure vehicle speed, traffic flows and pedestrian flows. Thirdly, it is mounted on street lamps, which alleviates the infrastructure changes. [10]

4] Parking Spotter is a jointly work of Ford and Georgia. The main concept of parking spotter is to attached sonars and radars which are already broadly used in Ford cars to sense the street parking availability. The sensing outcomes are updated to a cloud server, and the results are shows to other Ford drivers as an added value service. [11]

III. MOTIVATION

To implement Shortest path finder for vehicle parking by which user can able to check the nearest parking space availability and reserve the parking space by using an application. Reduce travel time problem with traffic congestion in city centers and increase performance in darkness condition

IV. SYSTEM IMPLEMENTATION

Our SPFVP system is mainly use to find the parking space and reserve the particular slot using modern technologies.

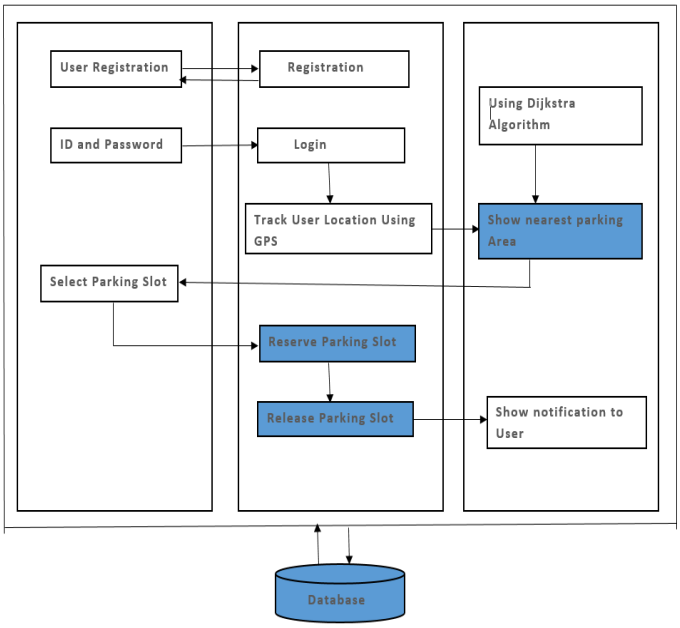

Fig.1 System Architecture

The above diagram (fig.1) shows the working of shortest path finder for vehicle parking. User's details are taken as an input during registration and those details are stored in the database. This stored data is used by the SPFVP whenever user uses the system. Once the registration is completed the user can use the system by using login id and password there is no need to enter the user details again and again. Thus SPFVP system make user easy to access the system by just login into the system.

Once the user login into the system user location is track using the GPS (Global Positioning System). The nearest parking area closer to user location is shown to the user using Dijkstra's algorithm, with the help of GPS. The user gets all information like slot is vacant or occupied about nearest parking area and user reserve the particular slot using this information. The user gets the notification after reserving parking slot and releasing parking slot on mobile application.

A. Dijkstra Algorithm

The problem of finding the shortest path from a specified vertex s to mother t can be stated as follows: A simple weighted digraph G of n vertices is described by an n by n matrix D = [dij], where dij = length (or distance or weight) of the directed edge from vertex i to vertex j: Dijkstra's algorithm labels the vertices of the given digraph, at each stage in the algorithm some vertices have permanent labels and others temporary labels. The algorithm begins by assigning a permanent label 0 to the starting vertex s, and temporary label infinity to the remaining n-1 vertices. Then, another vertex sets a permanent label in each iteration, according to the following rules:

1. Every vertex j that is not yet permanently labelled gets a new temporary label whose value is given by min [old label of j, (old label of i + dij)], where i is the latest vertex permanently labelled, in the previous iteration, and dijis

the direct distance between vertices i and j. if i and j are not joined by an edge, the dij =infinity.

2. The smallest value of all the temporary labels is found, and this becomes the permanent label of the corresponding vertex. In a case of more than one shortest path, select any one of the candidates for permanent labelling. Steps a and b are repeated alternately until the destination vertex t gets a permanent label. The first vertex to be permanently labelled is at a distance of zero from s. The second vertex to get a permanent label (out of the remaining n-1 vertices) is the vertex closest to s from the remaining n-2 vertices, the next one to be permanently labelled is the second closest vertex to s. And so on. The permanent label of each vertex is the shortest distance of that vertex from s.

Simply, the Dijkstra's Algorithm can be stated as: Let ui be the shortest distance from source node 1 to node i, and define dij (> 0) as the length of the arc (i, j). Then algorithm defines label for immediately succeeding node j as

$$[uj , i] = [ui + dij, i], dij > 0$$

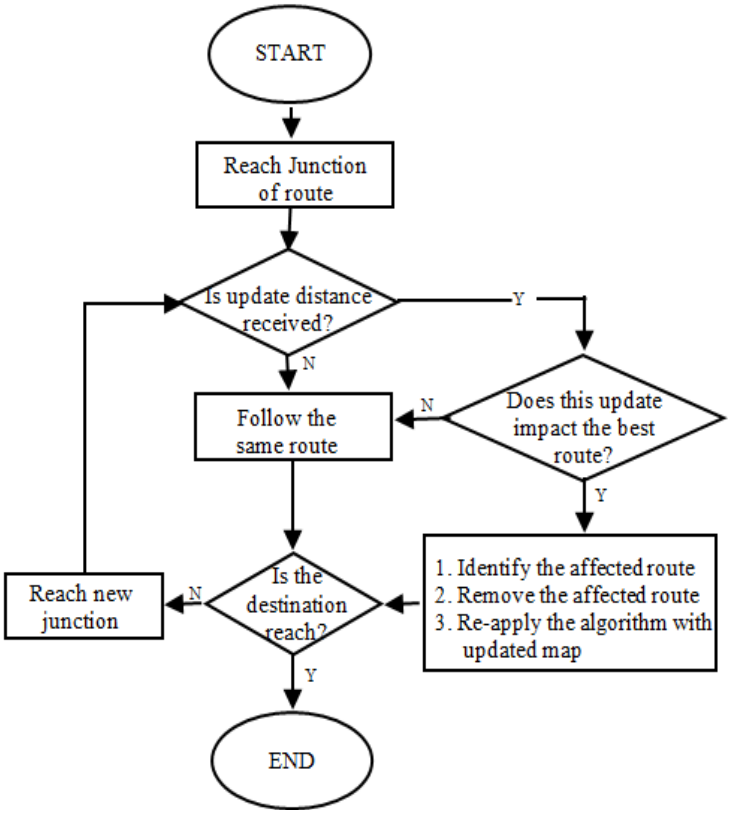

Fig. 2 Flowchart for illustrating the best route update during the journey

V. System Methodology and Working

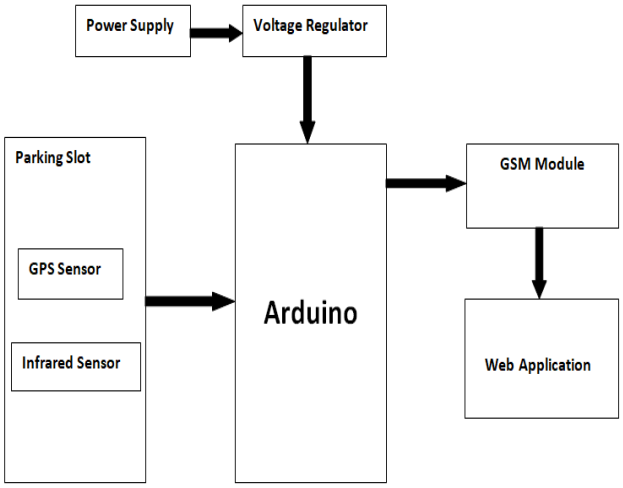

Fig.3 System Block Diagram

The figure 3 shows the block diagram of the SPFVP system. The system consists of Arduino microcontroller unit for the controlling process which has been interfaced with the Infrared sensor, GPS sensor, power supply, mobile application and a GSM module. Infrared sensor is used to sense the parking slot and also use to determine whether the parking spot is free or Occupied. Infrared sensor is connected to the Arduino board. IR sensor is connected to a 5V supply. GPS receiver is used to detect nearest parking space availability. The information is uploaded to the server by using GPS (Global Positioning System) for Mobile Communication. Mobile application or Web application act as an interface between the whole system and the end user. The main goal of mobile application is to provide details about the parking space availability and the user will book the slot accordingly. Once the user books the slot then the car is parked there that car details are sent to the owner mobile application along with the car number.

By using the mobile application, the owner is able to know the parking area information and the time the particular car using the particular parking slot based on that amount paid by the user. The advantages of smart parking system is a less waiting time at parking place, saves fuel, gives direction to nearest parking place and Carbon emission is reduced.

VI. Conclusion and Future Scope

SPFVP provides information which guided to the decision making process of the drivers in reaching their destination place and leads them to locating a free parking space within the vehicle park facility. SPFVP system will avoid wastage of fuel by avoiding roaming i.e. it will give information about nearest available location for parking by using GPS system. Most importantly, traffic congestion can be reduced. In the Future we will focus on parking billing mechanism and security policy

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