

Windows Phone App Based Real Time Tracking of Smart Parking System

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Abstract — searching for a parking space in Urban cities cause problems for drivers, especially during the peak business hours. The vehicle searching for available spaces at that time creates traffic congestion. Apart from frustration of drivers, vehicles looking for parking burn tons of fuel which result as environmental pollution. The most current parking systems are not fully equipped to overcome parking space problem and cause traffic congestion as well as the environmental pollution. We have designed and implemented prototype of smart Parking System to eliminate the issues in traditional parking system and convert the parking system into fully functional Smart parking system. This paper proposes an effective method to overcome these problems. We have implemented and designed a prototype of parking system. This prototype is divided into three main category Image processing, Control System, and Windows phone application. Windows phone parking application is being integrated in parking system to track the real time status of parking plaza and to increases the efficiency of this prototype. This app shows the real time status of parking system also allows drivers to find and reserve the vacant parking spaces by using smart phones as per their desire location.

Keywords— Control System, Image Processing, Windows Phone Parking application, Parking system Prototype, smart parking system , smart phone

I. INTRODUCTION

Over a decade, the increasing ratio of traffic congestion, environmental pollution and parking de-management affecting daily life gained popularity in academic as well as industrial community. The parking problem is a challenge which requires the simultaneous consideration of many options. Only in United State, annual revenue of the parking industry is in billions, and parking law might have an effect on people's concerns about traffic congestion, environmental pollution. For instance, a recent survey [1].that during rush hour in most metropolitan areas, the traffic generated by vehicles searching for available parking space takes up to 40% of the total traffic. Thus the traffic congestion in metropolitan areas are somehow due to parking A recent study [2], in a business district of Los Angeles, vehicles searching for parking lots burn 47,000 gallons of gasoline and produced 730 tons of carbon dioxide, which is equivalent of 38 trips around the world. Clearly, the problems linked with parking impose significant societal costs, both ecologically and economically [3].

The most current parking or guidance systems today, only collect data and publish collective information of whole parking area near their destinations. These systems do not have capability to guide drivers inside the parking area to exact free available parking lots. In contrast to such parking information guidance systems, this paper proposes a Windows phone application which is specially designed and integrated in parking system that not only point out the near parking areas but also provide real time tracking services as part of user-targeted services. On the other side, the windows phone app guide drivers to find exactly the available parking lot in a crowded parking area.

II. LITERATURE REVIEW

Most research work on parking is from the perspective of system design, which focuses on implementing a wireless sensor network to detect parking information. In addition, we introduce the Smart parking system which is integrated with windows phone application, which provides us a powerful tool to search parking areas and see the current status of parking lots.

We reviewed background on parking systems techniques, containing the performance metrics, existing solutions and challenges. There is a limitation in existing parking guiding approaches like: Buffered PIS (BPIS), to alleviate the “multiple-car-chase-single-slot” phenomenon. An approach to leave a buffer publishing the live information. But it is difficult to determine the threshold for the buffer. Another proposed Parking Lots Detection [4], in which camera inside the garage take the image from static position and send that to web server, that data determine number of unoccupied parking space, but the limitation is that this project shows the collective information of whole area. Some other approaches are VANET (vehicle Ad-hoc Network)-Based Smart Parking [5], Bay Area Rapid Transit [6].

Blind searching is adopted by users when no parking information is available. So drivers search parking spaces randomly within a certain distance to their destination. This research paper mainly focuses on a parking management system that assists drivers to find nearby parking areas and exact available parking lots in a specific parking area, and satisfies the needs of both, parking providers and drivers.

III. SMART PARKING SYSTEM DESIGN AND IMPLEMENTATION

Implementation and Methodology are planned for project is divided in to four main parts, which are “Vehicle Number Recognition”[7][8], “Hardware (prototype) execution”, “Interfacing of prototype with Web Server”, “Real Time communication between Web server and Windows phone mobile app”. This research paper emphasis on these four main areas to overcome the issues in parking system and fulfill the user’s need.

A. *Vehicle Number Recognition (VNR) System*

Image processing was performed for Vehicle Number Recognition which is based on MATLAB (matrix laboratory) [9]. The camera, installed at the entrance and the exit gate, takes image of every entering vehicle and pass that to the computer which execute the image processing using MATLAB vehicle number recognition (VNR) algorithm [10]. The designed algorithm uses four modules, image acquisition, Number plate extraction, character segmentation and template matching to successfully extract Vehicle Number plate as shown in Fig 1(a), (b) (c).

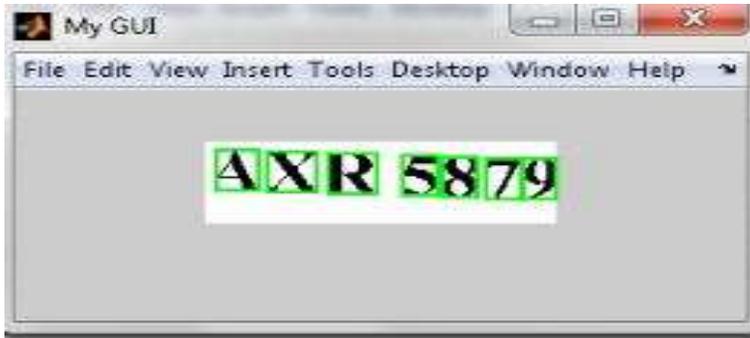


Figure 10: (a) Segmentation of Number Plate

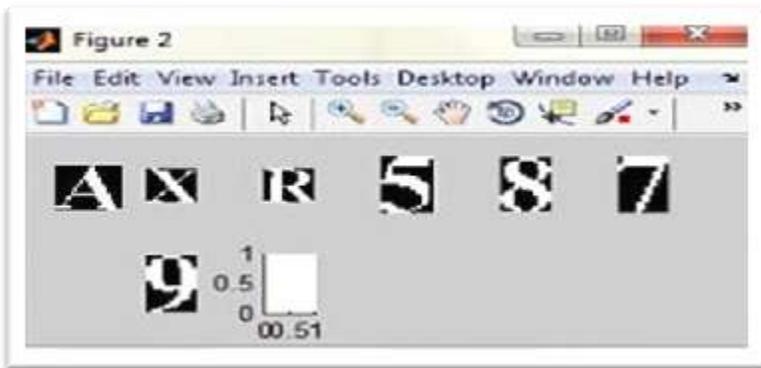


Figure 1: (b) Number Plate Extraction

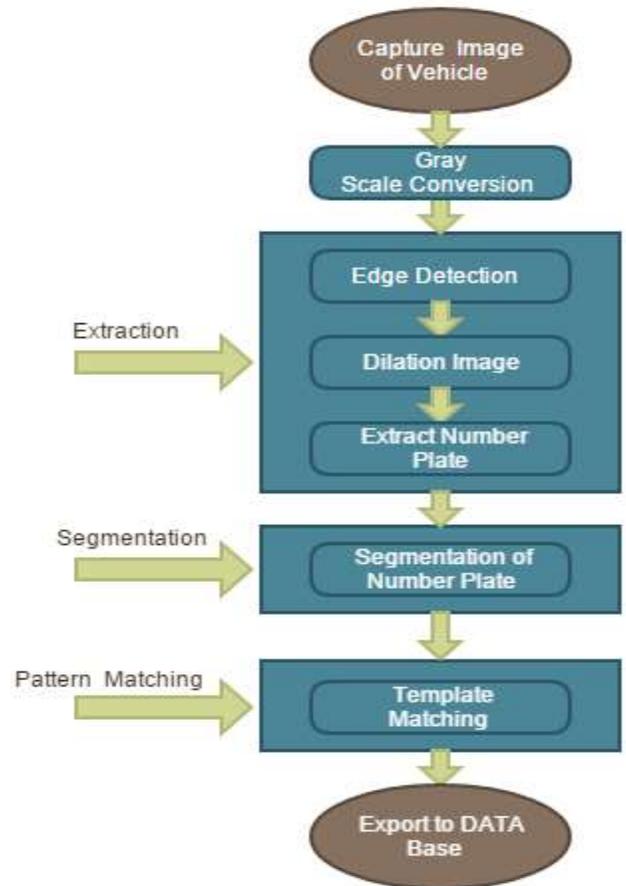


Figure 1: (c) Vehicle Number Plate Recognition

Further, the detected vehicle registration number with time and date are exported to Matlab Database using JDBC and GUI for maintaining record of each vehicle entering or leaving parking area [11]. This database is being utilized to maintain the up to date list of each vehicle with date and time and to calculate and collect the parking tax, and could also be used for legal purposes as well.

B. Hardware Implementation

Hardware development was based on Arduino UNO [12], proximity sensors, stepper motors, light detecting sensors & other devices to control the flow of vehicles, detects vehicles, and appraises the data-base & basic information of every vehicle. This controlled system detects the presence of every vehicle at entrance and exist point and open/close the gate barrier respectively. The proximity sensors deployed at the entrance and exit gates which detect the vehicle and send signal to Arduino UNO. Arduino is interfaced with stepper motor which controls the road barrier. It also includes of 2x16 Character LCD & seven segment display with microcontroller which acts as welcome screen on entrance gate, the LCD also display the number of available space at that location.

C. Interfacing of Hardware with Web server

The sensors were installed at each parking lot, which send the data to Arduino UNO on every second. Arduino makes decision based on the data received and pass that information to the web server. The web server was Developed using ASP.NET application. This involves configuring the web application, web server, and record in the manufacture environment. Synchronize the ASP.NET pages, code files, the gatherings in the Bin folder, and HTML associated support files like CSS and JavaScript files. Synchronize the database

schema and/or data consists of graphical interface, and other files running on it. Web server fetches the information from Arduino and displays that in graphical form. A program was burned in Arduino to send the Data in Hexa Decimal form, so web servers organize the data in same pattern and display the reserved and empty parking spaces same as the original module as shown in Fig 2.

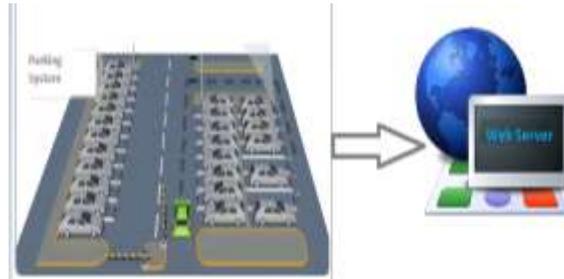


Figure 2: Communication between Hardware and Web Server

D. Real Time communication between Web server and Windows phone app

A unique Smart Phone application is designed using C#, to track real time status of parking area. This app allow users to choose their desire parking location and remotely view the run time status of Parking area, so the user can view the exact parking area status even the most effective and innovative feature, proposed in this parking application is that user can exactly view the parking lots by lots which parking lots are reserved, which are still empty. The app takes the input from the consumer, as the user select any place in windows phone application to remotely view the status of parking spaces, the application connects itself with the central web server on back-end, using Hyper Text Transfer Protocol (HTTP) that location and it shows the real time status of the location as shown in Fig 3 (a) (b) (c).



Figure 3: Windows Phone App GUI (a)



Figure 3: Windows Phone App GUI (b)



Figure 3: Windows Phone App GUI (c)

The designed and implemented prototype is a smart and cost effective system; it not only customizes the parking capabilities of parking area but also provide the real time monitoring from remote location. The exact free parking lot can be found using the smart phone app even in the most crowded parking areas. This helps to parking management system to save fuel, and reduce the frustration level of drivers searching for available parking spaces.

IV. RESULTS AND DISCUSSIONS

Vehicle Number Recognition is an important phase of smart parking system. Number plate extraction and recognition is done by using MATLAB algorithm. The system also have also database & GUI based java software for the Smart Parking System as shown in Fig 4. Main purpose of database is to maintain the detailed record of vehicles, purpose of GUI based software is to access the stored record & search the vehicles against car number, time & date. C# is used as programming language for the development the GUI based software. The database can be used for collecting parking tax amount and can also be used for other legal purposes.



Figure 4: MATLAB GUI Database of every entering vehicle

In parking plaza each spot have pre-installed sensors, which continuously transmit data to the web server through serial transmission port, using Arduino UNO. As soon as the data reaches to the server, it updates the website created by using .Asp. Now data is continuously updating to the website on the Webserver. The Web server interface is also shown in Fig 5. Through the windows phone application a user can view the run time status of parking plaza even with the details of parking lots (Which parking lots are free and which parking lots are reserved). Our implemented prototype is also shown in Fig 6.



Figure 5: Web Server Interface



Figure 6: Prototype of Smart Parking System

The Windows phone based application to choose desire parking area and check the current status remotely. The applications is first tested within the development environment using emulators and later subjected to field testing as shown in Fig 7(a) (b).

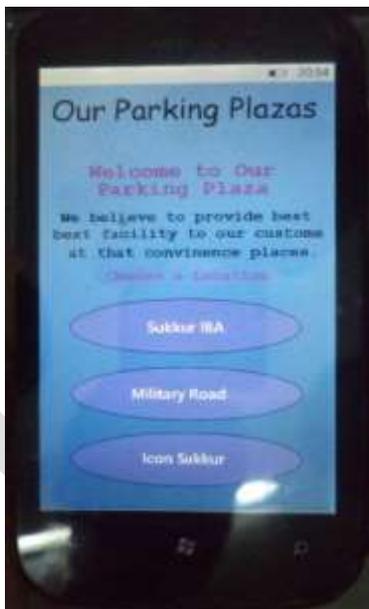


Figure 7: Windows Phone Application
(a)



Figure 7: Windows Phone Application
(b)

V. CONCLUSIONS AND FUTURE RECOMMENDATIONS

The objective of this research paper (Windows Phone Based Real Time Tracking of Smart Parking System) is to design a system based on Image processing, control system, and smart phone application that will not only change the hectic manual parking system but also show the real time status of parking area on smart phone application remotely. The proposed designed is cost effective and efficient system. This technology is used in various security and traffic applications. One important phase of smart parking system is

control system, which is autonomous, and does not need any external effort to work. Beside this image processing and Database method developed in this research project can be also used for various other important applications such as smart toll tax systems, border control, finding stolen cars, airport parking & can also be used as a marketing tool.

In future, this system can also be used for Deploying prepaid vehicle account, Nation-wide connected parking system, Reservation of parking lots through application.

ACKNOWLEDGMENT

Our foremost thanks go to our Head of Department Professor Dr. Madad Ali Shah, for his vital encouragement and support.

Last but not least, we would like to express our appreciation to our beloved parents for the unconditional love and support that let us through the toughest days in our life.

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