Appearance Based Approach Car Parking Slot Detecting System with Android Application

K.K.Dhivyabharathi, D.Sorna Shanthi

Abstract— **BS-Background subtraction is a computational vision process of extracting foreground objects in a particular scene. The foreground object can be thought of as a coherently moving object in a scene. The project is an appearance-based approach automatic car parking system used to detect available car parking space. The background subtraction (BS) with adaptive background model is used to detect the foreground objects (cars).Automatic car parking space detection can save time and car energy, and also make satisfy the drivers. Android phone used to book the particular slot for park the vehicles. In this project, an android application is also developed, which gives the customer all information regarding the engaged and free slots. Customer can also book slots. Through this application drivers can also be intimated/alerted regarding the period of time to stay inside the area**.

***Index Terms*— Histogram Analysis, Background Subtraction, Decision Making Process, Automatic Car Parking System, Android Application., .**

I. INTRODUCTION

The video surveillance system is an important system and can find in many areas both in parking slot or public areas. Most video surveillance systems are passive system. They always monitor events from recorded videos. With development of computer vision technology, this system can do some functions automatically. For example, we can detect abnormal events on a road or can detect available car space parking slot.

Focus on the available space detection is an important function of automatic video surveillance. Frequently, we have to look for the car space that is not easy in busy time. It takes more time and car energy to look for an available car space. Automatic car parking space detection can save time and car energy, and also make satisfying and impression to drivers.

The automatic parking system aims to enhance the comfort and safety of driving in constrained environments.

Background subtraction is the process of separating out foreground objects from the background in a sequence of video frames. Background subtraction is a widely used approach for detecting moving objects from static cameras.

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Detecting moving objects from the difference between the current frame and a reference frame, called "background model" and this method is known as frame difference method. The four major steps in a background subtraction algorithm are,

A) Pre-processing: In pre-processing most computer vision systems, simple temporal and/or spatial smoothing are used in the early stage of processing to reduce camera noise.

B) Background modelling: Background model provides a statistical description of the entire background scene. Background modeling consists of two main steps:

1) Background Initialization
2) Background Update

In the first step, an initial model of the background is compute, while in the second step that model is updated in order to adapt to possible changes in the scene. A motion detection algorithm begins with the segmentation part where foreground or moving objects are segmented from the background.

C) Foreground detection: Foreground detection compares the input video frame with the background model, and identifies candidate foreground pixels from the input frame.

D) Data validation: Data validation as the process of improving the candidate foreground mask based on information Obtained from outside the background model.

The automatic parking system aims to enhance the comfort and safety of driving in constrained environments where much attention and experience is required to steer the car. The parking maneuver is achieved by means of coordinated control of the steering angle and speed which takes into account the actual situation in the environment to ensure collision-free motion within available space. The car is an example of a non-holonomic system where the number of control command available is less than the number of coordinates that represent its position and orientation.

Working of Automatic Parking System

An automatic parking system uses various methods of detect objects around the vehicle. Sensor installed on the front and rear bumpers can act as both a transmitter and a receiver. These sensors sends a signal that will be reflected back when it encounters an obstacles near the vehicle. Then, the computer will use the time signal it receives to determine the position of the obstacle. Other system mounted on the bumper uses the camera or radar to detect the obstacles. But the result same: The car will detect the parking space size and distance from the roadside, and then drive the car into the parking space.

Features of Automatic Car Parking System

- **Salient Features of the systems**: Accommodates maximum cars in minimum space, Customized parking solution, Designed and manufactured in India

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to provide cost effective solutions, Low maintenance and operation cost, Safety for both car and the driver, Faster parking and retrieval, Eco Friendly, Attractive Modular design

- **Safety Features of the systems:** MLCPS provide complete safety to a vehicle as parked cars are not accessible to anyone else, Damages or a dent to the car is avoided while parking through arrow drive way
- **Possible Accessories for the system:** Fancy cladding, Remote operated retrieval system, Fire fighting sprinklers
- **Failsafe Features:** Manual Car Retrieval option, Area sensor protection for Semi Automatic and Fully Automatic Parking Systems, Brakes Motor Energized to disengage, Multi Rope lifting for each pallet, Free fall protection for car on first level and above, and on displays for Full or vacant parking for fully automated parking system.

Advantages of Automatic Car Parking

- **Efficiency:** Auto Car Parking System provides car parking solutions accommodating maximum cars in minimum space.
- **Cost effective:** Auto Car Parking System improves financial viability of commercial and residential developments
- **Saves Time**: Auto Car Parking System reduces parking and retrieval time. Saves time spend in searching for empty parking slots and time spend is searching the parked car. Retrieval on average is 2 to 3 minutes
- **Easy and cost effective maintenance:** Auto Car Parking System is cost effective in terms of maintenance over the conventional parking systems.
- **Car Safety:** Auto Car Parking System provides improved security, safety for the cars. Cars parked are free from theft and damages that can e caused while parking and retrieving.
- **Safer for drivers:** Drivers collect their cars from secure waiting areas; thus they do not have to walk through a car park alone and are less vulnerable
- **Environment Friendly:** Auto Car Parking System is environment friendly. As the car engines are shut during the automatic parking process there is no pollution.
- **Aesthetics:** State of the art modular design makes the system look very attractive.

Android Overview

Android is a mobile operating system, it is commonly installed on variety of smart phones and tablets. Android is a very user friendly operating system. This means you can easily look for information on the web, watch videos, search for directions and write emails on your phone, just as you would on your computer, but there's more to tell about android these are simple examples. Using this android OS variety of applications can be installed, by this way automatic parking slot detection can be achieved.

Android is a mobile operating system (OS) based on the Linux kernel and currently developed by Google. With a user interface based on direct manipulation, Android is designed primarily for touch screen mobile devices such as smart phones and tablet computers, with specialized user interfaces for televisions (Android TV), cars (Android Auto), and wrist watches (Android Wear). The OS uses touch inputs that loosely correspond to real-world actions, like swiping, tapping, pinching, and reverse pinching to manipulate on-screen objects, and a virtual keyboard. Despite being primarily designed for touch screen input, it also has been used in game consoles, digital cameras, regular PCs and other electronics.

Android is the most widely used mobile OS and, as of 2013, the highest selling OS overall. Android devices sell more than Windows, iOS, and Mac OS X devices combined with sales in 2012, 2013 and 2014 close to the installed base of all PCs. A developer survey conducted in April–May 2013 found that 71% of mobile developers develop for Android. Android's source code is released by Google under open source licenses, although most Android devices ultimately ship with a combination of open source and proprietary software Initially developed by Android, Inc., which Google backed financially and later bought in 2005, Android was unveiled in 2007 along with the founding of the Open Handset Alliance—a consortium of hardware, software, and telecommunication companies devoted to advancing open standards for mobile devices.

Android is popular with technology companies which require a ready-made, low-cost and customizable operating system for high-tech devices. Android's open nature has encouraged a large community of developers and enthusiasts to use the open-source code as a foundation for community-driven projects, which add new features for advanced users or bring Android to devices which were officially, released running other operating systems. The operating system's success has made it a target for patent litigation as part of the so-called "smart phone wars" between technology companies.

II. RELATED WORK

This paper vacant parking slot detection and tracking system that fuses the sensors of an AVM system and an ultrasonic sensor-based automatic parking system.There are some reports in the task of the available car space detection. The available space detection is performed by detecting reflection distance of the ultrasonic sensor.

Azadi Kazemi et al [1] proposed the Adaptive-Network-based Fuzzy Inference System (ANFIS) algorithm for automatic car park in articulated vehicles. Articulated vehicle parking problem is more difficult than passenger car, because under the aspect of control theory, the vehicle and environmental non-lonomic constraint, nonlinear and time varying kinematic equations of motion, they require a sophisticated handling. Automatic Parking of Articulated Vehicle will be considered when articulated vehicle intends to burden in Special Parking lot in two phases: First, Forward man ever to put vehicle in suitable position and then backward to put the back of trailer in the parking slot without collision with parking wall.

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.***Furutani*** et al [2] obstacle detection algorithm for autonomous orchard vehicles. Methodology is based on the classification and clustering of registered 3D points as obstacles. In the current implementation, obstacle avoidance takes in 3D point clouds collected in apple orchards and generates an off–line assessment of obstacle position. Safe robot navigation in tree fruit orchards requires that the vehicle be capable of robustly navigating between rows of trees and turning from one aisle to another; that the vehicle be dynamically stable, especially when carrying workers; and that the vehicle be able to detect obstacles on its way and adjust its speed accordingly. In this paper we address the latter, in particular the problem of detecting people and apple bins in the aisles between rows.

H. Ichihashi et al [3] Around View Monitor (AVM) system and an ultrasonic sensor-based automatic parking system used for vacant parking slot detection and tracking system. The proposed system consists of three stages: parking slot marking detection, parking slot occupancy classification, and parking slot marking tracking. It detects parking slots in individual AVM images by exploiting a hierarchical tree structure of parking slot markings and combines sequential detection results. The parking slot occupancy classification stage identifies vacancies of detected parking slots using ultrasonic sensor data. Parking slot occupancy is probabilistically calculated by treating each parking slot region as a single cell of the occupancy grid. The parking slot marking tracking stage continuously estimates the position of the selected parking slot while the ego-vehicle is moving into it. During tracking, AVM images and motion sensor-based odometry are fused together in the chamfer score level to achieve robustness against inevitable occlusions caused by the ego-vehicle.

Harris Stephens, et al [4] Feature tracking algorithm used for solve motion problem. Consistency of image edge filtering is of prime importance for 3D interpretations of image sequences using feature tracking algorithms. To cater for image regions containing texture and isolated features, a combined corner and edge detector based on the local auto-correlation function is 'utilised, and it is shown to perform with good consistency 'on natural imagery. Computer vision to understand the unconstrained 3D world, in which the viewed scenes diversity of objects for top-down recognition techniques.

Jung Choi Yoon Kim, et al [5] Novel user interface for semi-automatic parking assistance system, which automates steering handling during parking operation. Target position is depicted as a rectangle in touch screen based HMI (Human Machine Interface). Driver can move the rectangle by dragging the inside of rectangle. Automatic target position designation method, manual designation is supposed to have two important roles. Compare the proposed method with multiple-arrow based method, which provides several arrow buttons to move and rotate target position, by measuring total operation time and clicking number. Novel user interface for semi-automatic parking

assistance system, Reduces the operation time and clicking number.

Pless et al [6] background sub-traction algorithms for detecting moving vehicles and pedestrians in urban traffic video sequences. Perform background subtraction, which identifies moving objects from the portion of a video frame that differs signicantly from a background model. Identifying moving objects from a video sequence is a fundamental and critical task in video surveillance, traffic monitoring and analysis, human detection and tracking, and gesture recognition in human-machine interface. A common approach to identifying the moving objects is background subtraction, where each video frame is compared against a reference or background model. Since background subtraction is often the first step in many computer vision applications, it is important that the extracted foreground pixels accurately correspond to the moving objects of interest. A good background subtraction algorithm must handle the moving objects that first merge into the background and then become foreground at a later time.

Schmid, Ates et al [8] proposes the use of a hierarchical three dimensional occupancy grid for the detection of parking spaces. The occupancy grid covers the environment representation of the static world. A hierarchical design allows dynamic selection of the level of detail. Hierarchical three dimensional occupancy grid approaches derives the distance to obstacles and walls and thus is able to represent the free space that forms parking spaces. In a second step, the dimensions of the parking space are calculated. It can describe two contributions. First, the extraction of parking spaces from a hierarchical three-dimensional occupancy grid, and secondly the control of the grid resolution based on the detected parking space. Parking spaces can be detected accurately using three standard short range radar sensors in indoor as well as in outdoor environments.

Wren Seki et al [10] A Background subtraction algorithm Background subtraction is a widely used approach for detecting moving objects from static cameras. Background subtraction algorithm provides a review of the main methods and an original categorization based on speed, memory requirements and accuracy. Methods reviewed include parametric and non-parametric background density estimates and spatial correlation approaches. Detecting the moving objects from the difference between the current frame and a reference frame, often called the “background image”, or “background model”.

III. PROPOSED SCHEME

In the Proposed scheme Appearance-based approach is used to detect the available car parking space.The background subtraction with adaptive background model is used for the object (cars) detection by which available car parking empty space is notify. Here creating three slots with three different places within same location. Android application is developed to view the notified car parking empty space. Using android phone we can book the particular slot for park the vehicles.

Android application collects all information from server through gateway, and it calculates total number of slots, engaged and free slots. It shows graphical view for engaged and free slots via application. Green color indicated as

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vacancy and red color indicated as occupancy. This information frequently updated into server via gateway from android mobile phone.

IV. ARCHITECTURAL DESIGN

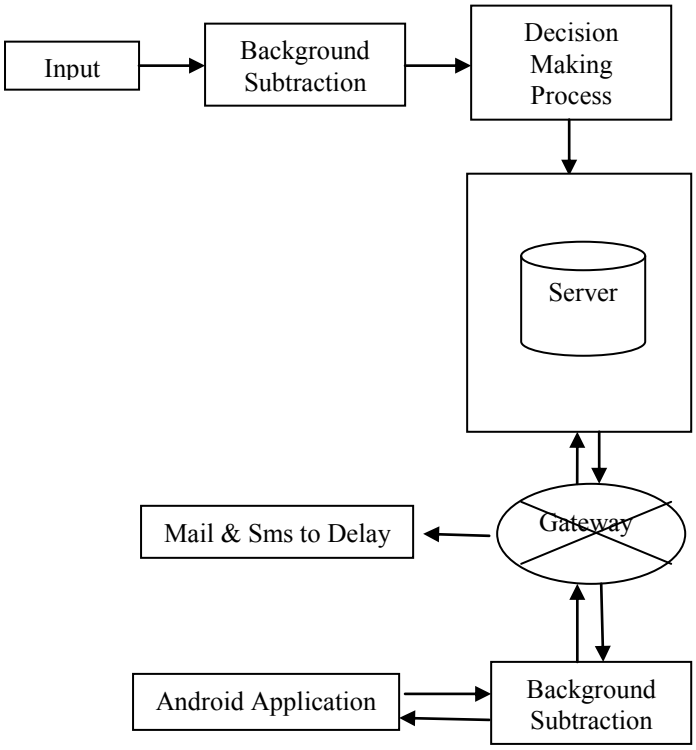

Fig.1 System Architecture

An appearance-based approach automatic car parking system used to detect available car parking space. The background subtraction (BS) with adaptive background model is used to detect the objects (cars).Performed foreground detection by using background subtraction with the adaptive background model. Background subtraction is a computational vision process of extracting foreground objects in a particular scene. The foreground object can be thought of as a coherently moving object in a scene. Automatic car parking space detection can save time and car energy, and also make satisfying and impression to drivers. An image histogram is a type of histogram that acts as a graphical representation of the tonal distribution in a digital image. It plots the number of pixel for each tonal value. By looking at the histogram for a specific image a viewer will be able to judge the entire tonal distribution at a glance. Image histograms are present on many modern digital cameras. The horizontal axis of the graph represents the tonal variations, while the vertical axis represents the number of pixels in that particular tone. The left side of the horizontal axis represents the black and dark areas, the middle represents medium grey and the right hand side represents light and pure white areas. The vertical axis represents the size of the area that is captured in each one of these zones. Thus, the histogram for a very dark image will have the majority of its data points on the left side and center of the graph.

V. METHODOLOGY

Following are the most frequently used project management methodologies in the project management practice:

A. Background Subtraction
B. Histogram Analysis
C. Decision Making Process
D. Gateway Updation
E. Android Application Development

A. Background Subtraction

Background subtraction is a computational vision process of extracting foreground objects in a particular scene. A foreground object can be described as an object of attention which helps in reducing the amount of data to be processed as well as provide important information to the task under consideration. Often, the foreground object can be thought of as a coherently moving object in a scene. Background subtraction is the process of separating out foreground objects from the background in a sequence of video frames. Detecting moving objects from the difference between the current frame and a reference frame, called "background model". The given input video stream will be interpreted as frames. The foreground objects are extracted from the recorded video and shown as output. Here creating three slots with three different places within same location. Background subtraction is a widely used approach for detecting moving objects from static cameras.

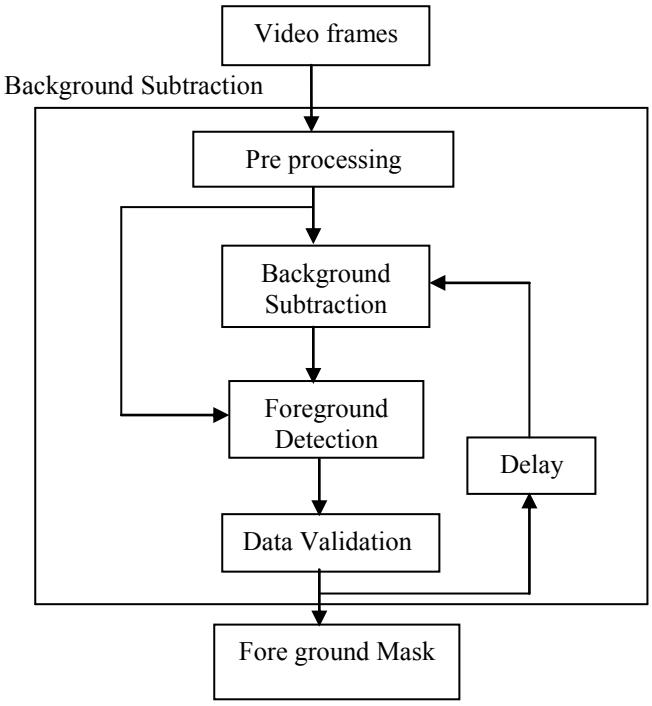

Fig.2 Background Subtraction

B. Histogram Analysis

A histogram is a graphical representation of the distribution of data. Histograms are used to plot the density of data, and often for density estimation. Histogram analysis is used for detect the foreground objects. In the smooth motion histogram is used in a systematic way to obtain the

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threshold value. Main focus is to get a better estimation of threshold so that to get a dynamic value, from histogram at run time.

C. Decision Making Process

Background subtraction algorithm is used to detect the vacant slot in parking area. This information goes to decision making process here; the car parking area was filled by car means it defined as "Occupancy". If the car parking area has a free space means it defined as "Vacancy" .Decision making process every car parking duration time is limited. This decision is updated to the server. From the android application validating information's is continuously passed to the server.

D. Gateway Updation

Server slot information are updated to gateway server, Which provides these information to the android application. The gateway server also sends message or mail to customers as alerts for residing (car) more than their limited time inside the parking area. Android gateway maintains all updationsfrom mat lab server.

E. Android Application Development

In the available car parking using adaptive mixing features specifies the number of available parking slots in the particular area. Using android phone we can book the particular slot for park the vehicles.

Here we are using moving vehicles so while moving itself how we book the parking area in destination place. For that feasibility only we are using android phone. Now a day's all users using Smartphone, so while moving it we can book the slots. In this project we use two servers, android gateway server and mat lab server. Android application collects all information from server through gateway, and it calculates total number of slots engaged and frees slots. It shows graphical view for engaged and free slots via application. Green color indicated as vacancy and red color indicated as occupancy. This information frequently updated into server via gateway from android mobile phone. It validating information's continuously to the server. Android gateway maintains all updations from mat lab server and it also sends a sms for every car delay. Android server sends a delay message to particular user.

VI. DISCUSSION

In proposed system Background subtraction is a widely used approach for detecting moving objects from static cameras.Appearance-based approach is used to detect the available car parking space.Here creating three slots with three different places within same location. Green color indicated as vacancy and red color indicated as occupancy. Slot information continuously updated into server from the decision making process. Server updates that information to the android gateway server.

Server slot information's are updated to gateway server, which provides this information to the android application. The gateway server also sends message or mail to customers as alerts for residing (car) more than their limited time inside the parking area. Android application is developed to view the slot information whether it is filled by car or not, it means parking slot vacant or engaged. It calculates total number of slots, engaged and free slots. Using android phone we can book the particular slot for park the vehicles. It shows graphical view for engaged and free slots via application. Green color indicated as vacancy and red color indicated as occupancy. This information frequently updated into server via gateway from android mobile phone.

VII. CONCLUSION

It is shown that parking spaces can be detected accurately using background subtraction. Background subtraction is used to detect the foreground objects. Empty parking slot information can be gathered effectively while travelling or before reaching the parking lot using smart phone application. Empty parking slots can be booked while travelling or before reaching the parking lot itself so that car energy and time is saved. For future enhancement it is also possible to show the directions to park the vehicle easily.

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