Reservation Based Parking System with Dynamic Slot Allocation

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Abstract- The objective of this paper is to highlight the implementation of dynamic memory allocation using arrays and how it is better than other methods. It is often observed that parking vehicles manually takes longer time wherein user searches the parking area and parks the vehicle which is a tedious task, to save the time spent for searching the slot a registration based application circle parking system is designed which provides platform to users to book parking spaces online in advance for a given location and then park the vehicle with a minimal fees. This application allocates slots dynamically using array and stores the booking details. This paper discusses the benefits of the dynamic allocation in circle parking system.

Index Terms- Manual; Automated; Parking; location; Array; Memory; Circle parking system.

I. INTRODUCTION

Parking of vehicles in existing scenario is getting difficult as number of vehicles keeps on increasing whereas the parking area remains the same. As a result, people would spend a certain amount of time looking for parking space and thus cause a situation where the traffic would be slowed down and cause congestion. The situation of looking for parking space and traffic congestion in parking areas is due to the fact that the information of available parking spaces is not readily available to the people looking for parking spaces. As such different approaches have been used to develop a car park management system such as wireless sensor network system and a vision system. This paper highlights the difficulties faced by the customers searching for spaces while parking vehicles, shows difference between manual and automated parking system, outlines circle parking system architecture and how the dynamic slot allocation is done in it and the devices required to implement it.

II. CHAPTER SUMMARY

The previous section offers conclusions and discusses current research. Chapter 3 is about existing parking system, chapter 4 comparison of existing system, chapter 5 discusses the dynamic slot allocation done using array in circle parking system, the chapter 6 is the conclusion of the paper and finally chapter 7 is about references.

III. EXISTING SYSTEM

Time and cost are two important factors of human life, whether for an individual or a business. As quality of life increases, more and more people are inhabiting cities. Urban life requires centralized public facilities. Shopping complexes are an important point of interest both for a city's inhabitants as well as for visitors. With the emergence of modern shopping complexes which provide a variety of services, more and more people are attracted to visit them. Hence, more shop owners prefer to locate their business in shopping complexes to target more customers and increase revenue.

Recently, shopping complexes have begun providing services much more diverse than just pure selling and buying. Customers can use banking services, post offices, food courts, cinemas, children's play areas, and so on. The growth of shopping malls has influenced shopping culture and behavior. For instance, in Bangalore window-shopping, or visiting shopping complexes simply for looking rather than buying, is a common activity.

Providing sufficient parking for visitors is one of the main issues in developing shopping complexes. Offering safe and secure parking lots with a sufficient number of spaces and paying attention to handicapped drivers are a few of the factors which can increase customer loyalty and attract customers to visit a shopping mall more frequently. Among the various types of parking lots are multilevel parking, roadside, roadside with ticket and barrier gate and roadside with parking meter; of these, the multilevel parking[2] lot is the most preferred by patrons [3]. Safety, weather conditions, proximity and car park fees respectively are the main factors by which patrons choose a specific parking lot. Hence, multilevel parking lots are preferred, and for this reason were selected as the parking lot type for this study. Sensors detects parking space occupancy through circle parking system application which shows the present status of the parking slots. Vacant, occupied, handicapped or reserved spaces are indicated by different colors of slots in the application. "Improper parking" is the situation in which one car is parked straddling two vacant spaces and occupies both. Detection of improper parking and providing directions to vacant spaces and payment facilities are other services offered by wireless sensor networks have attracted a great amount of attention[1][9].

A multistoried parking system can be an automated one or it can be a manual system. Such systems can be implemented above or below the ground level and it aims at providing parking space to large number of cars in a comparatively smaller area.

Here it becomes quite necessary to quote an example of an existing parking system situated in a very crowded area. It is a manual multistoried parking system containing steep slopes, blind turns and a single path for both entry and exit. Now, it need not be mentioned what degree of menace must be created every day in that parking system on account of traffic jams, accidents, quarrels and sometimes, even physical assaults.[10]

IV. COMPARISON OF EXISTING SYSTEM AND RESERVATION BASED PARKING SYSTEM

Automatic vehicle parks provide lower building cost per parking slot, as they typically requires less building volume and less ground area than a conventional facility with the same capacity. However, the cost of the mechanical equipment within the building that is needed to transport cars internally needs to be added to the lower building cost to determine the total costs. Other costs are usually lower too, for example there is no need for an energy intensive ventilating system, since cars are not driven inside and human cashiers or security personnel may not be needed.

Automated [4] vehicle parks rely on similar technology [5] that is used for mechanical handling and document retrieval. The driver leaves the car in an entrance module. It is then transported to a parking slot by a robot trolley. For the driver, the process of parking is reduced to leaving the car inside an entrance module. At peak periods a wait may be involved before entering or leaving. The wait is due to the fact that loading passengers and luggage occurs at the entrance and exit location rather than at the parked stall. This loading blocks the entrance or exit from being available to others. Whether the retrieval of vehicles is faster in an automatic car park or a self-park car park depends on the layout and number of exits.

Fig 1: Automated parking system

Manual Parking system [6] account for much higher building cost as compared to the automated parking system. Also, the cost of ventilating systems, security personnel etc. to be borne by the developer. In the case of manual [8] Parking system, the car is to be driven in and parked in available slots. Waiting period maybe limited to payments to the cashier as against loading and unloading of passengers as in automated system. Although, the benefits may seem obvious between the automated and manual Parking system [7], the pros and cons of each are significant and may help in deciding the technology to be implemented or the technology that may be feasible at the parking system. These issues may be further discussed in the feasibility report.

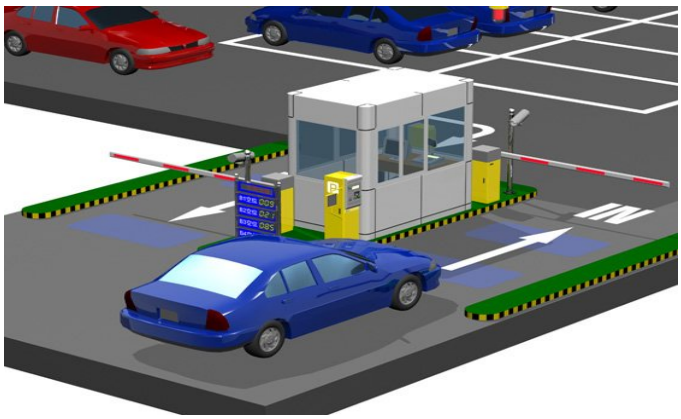

Fig 2: Manual Parking System

V. DYNAMIC MEMORY ALLOCATION USING ARRAY

There are two type that is associated with memory allocation of array. First one is static and another one is dynamic allocation [13][14]. The size of array is predefined in static allocation whereas the size is unknown in dynamic allocation. In dynamic allocation size of it index is decided at run time. So it is better operation considering memory management problem while working with array. The wastage of memory is less in matter of dynamic allocation. Generally when working with patterns example, this two types are used to assign a method of allocation. [12]

Following is the comparison between automated and manual parking system based on the below parameters:

Sl.No	Parameter	Automated	Manual
1.	Cost of setting up system	High	Low
2.	Maintenance cost	High	Low
3.	Land Requirement	Low	High
4.	Wait Time	Low	High

```
Data_type Var_name[ ];
Var_name=new Data_type[size];
```

Code.1. Syntax to define array allocation in 1 dimension

```
Data_type Var_name[ ] [ ];
Var_name= new Data_type [size][size];
```

Code.2. Syntax to define array allocation in multiple dimension

The size of an array is fixed when it is created. Elements are not allowed to be inserted or removed. However, it is possible to implement a dynamic array by allocating a new array and

copying the contents from the old array to the new one. A dynamic array has variable size and allows elements to be added or removed. For this, allocate a fixed-size array and divide it into two parts: The first part stores the elements of the dynamic array and the second part is reserved, but not used.

Then elements can be added or removed at the end of the array by using the reserved space, until this space is completely consumed. After that, a bigger array is created and contents of the old array is copied to the new array.

- **Logical size (size):** the number of elements in the dynamic array
- **Capacity:** the physical size of the internal array (the maximum possible size without relocating storage)

Dynamic arrays of integers has two attributes:

- int[] data: an integer array, and
- int size: the logical size, the number of elements used

The capacity of this dynamic array is simply data.length. An important method needed is to add elements to the end of the dynamic array. This method should provide automatic extension if the capacity is not large enough to hold the added element. Designing Dynamic Array can be done with the following members: Attributes / Constructors / Methods:

- int[] data: the array storing the elements
- int size: the number of elements
- DynamicArray(): initialize this dynamic array with size 0
- DynamicArray(int capacity): initialize this dynamic array with the capacity
- int get(int index): get the element at the specified index
- int set(int index, int element): set the value of the element at the specified index
- boolean add(int element): add the element to the end of the array
- void ensureCapacity(int minCapacity): increase the capacity
- int size(): return the size of the dynamic array
- boolean isEmpty(): check whether the array is empty
- void clear(): clean up the elements [11]

Circle parking which is taken as example involves the use of computer controlled mechanism, which allows patrons to drive up to the bay, lock the cars and let the machines automatically place the vehicle in the allocated space. This type of car park offers maximum utilization of space as it is machine controlled unlike conventional car park where space is needed for navigation of vehicle within the car park. Among its benefits are that the implementation works great in locations, where there are limited room for expansion due to its structure. Besides that, the Automated Parking System also offers efficiency in car storage as it allows car stacking and the patron does not even need to go into the car park which indirectly provides extra safety measures which covers both the vehicles and patron.

5.1 DYNAMIC SLOT ALLOCATION IN CIRCLE PARKING SYSTEM

Circle parking system is a registration based parking system where in users can register the parking slots and park the vehicles. This application offers users facilities such as user registration, booking slots prior to occupying parking space, booking slots for weekly, monthly and yearly format. The application uses array in dynamic slot allocation where the user selects the slot and books it, here the memory is allocated in an order and released in same order. Here fixed allocation is not used so that pre-allocating structures is not allocated, and dynamic memory allocation during normal processing. VARIABLE ALLOCATION avoids unused empty memory space by using dynamic allocation to take and return memory to a heap. MEMORY DISCARD simplifies de-allocating temporary objects by putting them in a temporary workspace and discarding the whole workspace at once. POOLED ALLOCATION avoids the overhead of variable allocation given a large number of similar objects, by pre-allocating them as required and maintaining a 'free list' of objects to be reused. COMPACTION avoids memory fragmentation by moving allocated objects in memory to remove the fragmentation spaces. REFERENCE COUNTING manages shared objects by keeping a count of the references to each shared object, and deleting each object when its reference count is zero. GARBAGE COLLECTION manages shared objects by periodically identifying unreferenced objects and deleting them. The following diagram shows the relationships between the patterns.

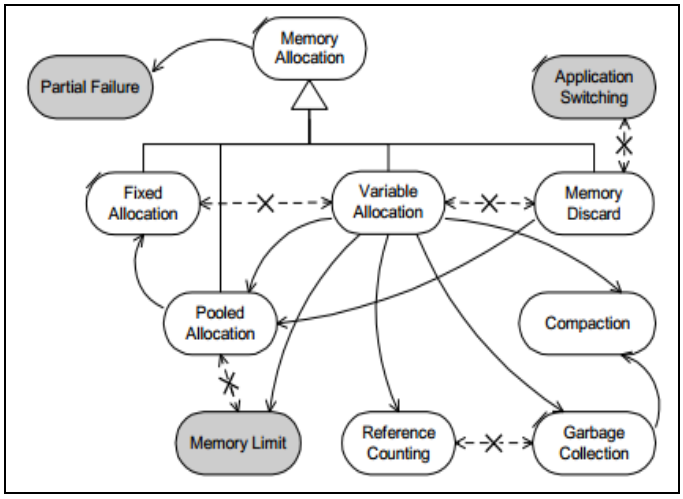

Fig 3: Allocation Pattern Relationships

5.2 IMPLEMENTATION OF RESERVATION BASED SYSTEM IN CIRCLE PARKING SYSTEM.

Circle parking system allows user to do registration and reserve [15][16] the parking slit before going to the location which saves two important factors for users' i.e., time and money.

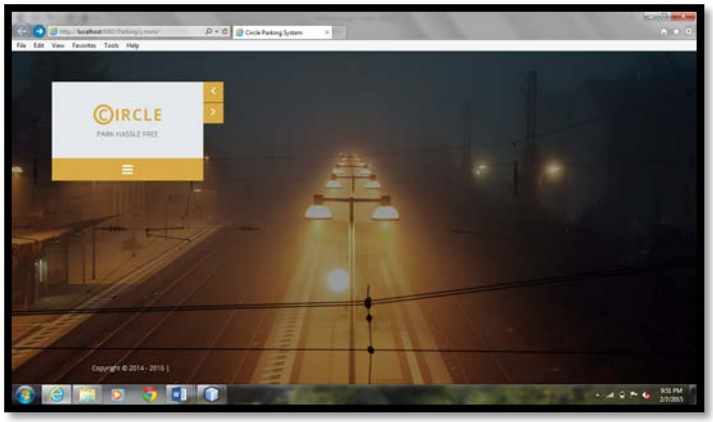

Fig 4: Circle Parking System Home Page

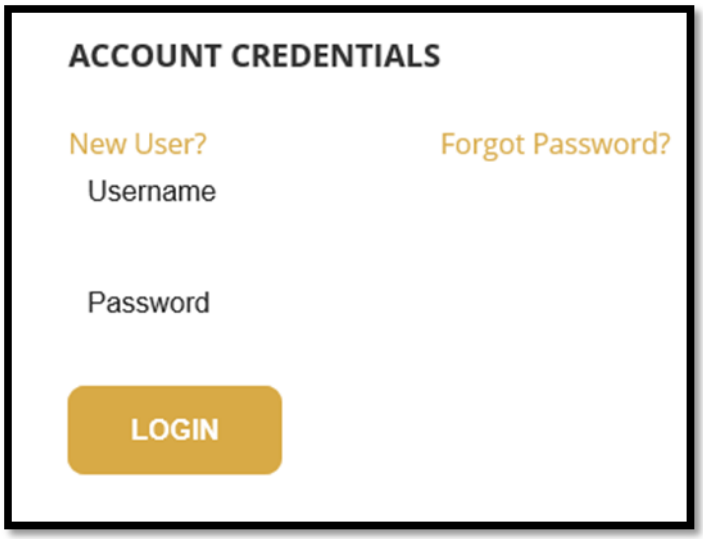

Fig 5: Circle Parking System Login Page

For booking slot the users are required to register first and then proceed with booking, in the booking module the user is given option to select and book the slot. User logs into the application, navigates to booking page and clicks on the one of the slot area, a slot booking modal window opens up in which the user is required to fill in the requested details, once the user submit these details the pop up closes and the selected slot color changes to green color and the value is stored in database. When the user releases the slot by clicking the slot and clicks on release button the color changes to red color. Based on the booked and released status the time is taken into consideration and the parking fees is calculated which user is required to pay during leaving the location. If the user books the slot for specified time the booking time is taken in account and parking fees is calculated.

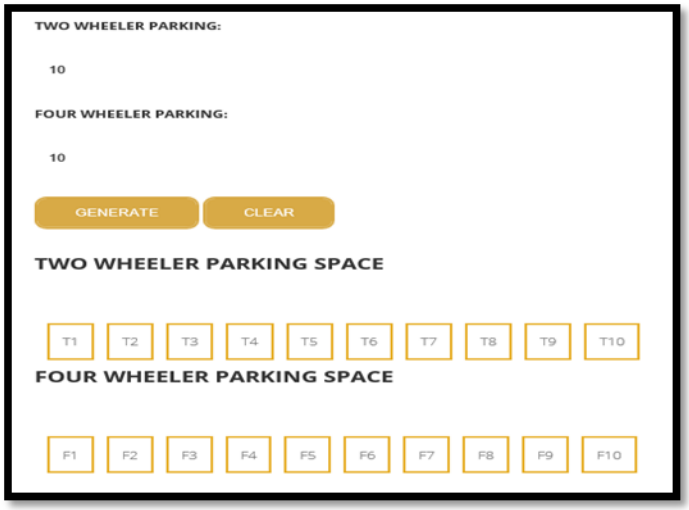

Fig 6: Circle Parking System Booking page

VI. CONCLUSION

Reservation based dynamic slot allocation in parking system first and foremost reduces human intervention required for parking vehicles. It is time efficient and cost effective as the whole process of building a software system is being automated. The delivery of the software system can be assured on time with reduced cost and quality code which is mostly spent on the resources if there were manual work. Hence, this approach plays a vital role in reducing time required in manual parking system. This system is not the replacement for the current manual and automated system available but can be implemented to remove time and cost constraints to build robust applications.

Drivers spend more time in finding place for parking and to overcome this issue the final solution is rarely known at the beginning. Circle parking system implemented using reservation based dynamic slot allocation is a working system that is built to overcome the parking issues. Subsequent planning sessions will be helpful to uncover the unseen issues.

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