Design of Parking Guidance System to Optimize Space

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Abstract— **Paper describes parking guidance system with space management deals with to increase the utility of parking space to park more and more vehicle which based on IR sensor network and Microcontroller. System shows the mathematical equation for finding shortest path of the slot to be monitored, system help us to save the time required to park the vehicle. Parking guidance system design is based on timing, spacing and routing equations. This system is very effectively useful as compared to the existing parking system because it use to minimize the time consumed for finding the nearest available space and increase the utility of space.**

Index Terms — **IR Sensor Network, Microcontroller, Design of System.**

I. INTRODUCTION

Now a day, a parking issue is becoming a serious problem for the drivers. The design of parking guidance system which can help common people to park their vehicles in less space as well as multi utility of the space and secure time and environment. The dense population in multistoried building and skyscraper parking space and parking time management are the major issues whenever certain infrastructure is created [1,2]. The availability of parking space in the parking area and buildings are result in traffic congestion, air pollution, fuel and time wastage as well as drivers frustration, sometimes, it makes the quarrel between the peoples. The design of parking guidance system utilizes various technologies to efficiently manage and optimize the space to avoid this type of difficulties. All over the world many researcher are developed most efficient and smarter parking management system. Use of wireless sensor network along with their applications for parking and space modeling, are very useful to solve emerging parking problems [3,4]. In this paper WSN and microcontroller technologies has been attracted to increase attention of the user and are rapidly growing in various fields which expected to provide an efficient and cost effective solution for parking, time and space management system [5].

In this research paper, the use of IR sensors in wireless sensor network is to sense space data and simple environmental physical parameters, it is used to process raw data according to the characteristics of the interest storing this information momentarily, and using a wireless link to transmit the information to its neighbor's wireless sensors [6]. The design of this type of parking system can avoid the parking problem and also conserve the space in each parking lots. IR sensors network consists of large number of low cost sensor node which are deployed in the sensing area. Information gathered from the sensing area is processed, and transmitted to MCU. With the help of these sensors and AT mega 324 with RS 232 circuit are used to find the shortest distance and empty parking slot to save the fuel, time and avoid congestion as well as drivers frustration [7].

The second part of this work is to indicate the position of parked and vacant slot in each lot. For this purpose IR sensors and RED, GREEN indicators can be used. The received information match with the data base, the control office will send a command to open the barrier [8].

The main part of this research work is, to optimize unutilized space between two slots. The utilization of this work will depend upon the width of the car. Design of parking guidance system is discussed for providing better parking facilities. This system is very helpful in preventing thefts of cars in the parking area and also for thorough detection of the vehicles before they are parked [9].

Design of parking guidance system to save space is a space management deals with to increase the utility of parking space car parking system with space optimization therefore, provides significant opportunities for design and development of next-generation traffic management solutions. Parking management system is playing an important role and affecting people's daily life. By detecting and processing the information from parking lots, smart parking system allows drivers to obtain real-time parking information and alleviates parking contentions, which is a practical application of our system [10].

II. IR SYSTEM

This research paper requires a wide range of IR and Ultrasonic Sensors to obtain information about the nearest empty slot. These sensors detect position, of nearest slot as well as optimize space required for particular vehicle. Vision to design of parking guidance systems to save space are also used to greatly improve the path finding versatility, speed, and accuracy for its vehicle parking.

This section discusses the basic requirements of designing a WSN-based intelligent car-park management system. Many conventional issues of modern day car parking systems have already been discussed in the first section. The common goal for all car parks with space modeling is to attract more and more drivers to use these facilities to avoid drivers' frustrations as well as secure environment. Some basic physical facilities required to be satisfied the vehicle owner or drivers are location of the car park should be easy to find in the street network with suitable parking space, entrance of the car park should be easy to discover, the number of parking lots should be abundance and a parking lot should obtain a large space enough to park a car in and very easy to exit and to re-enter on foot [11].

III. SYSTEM DESIGN

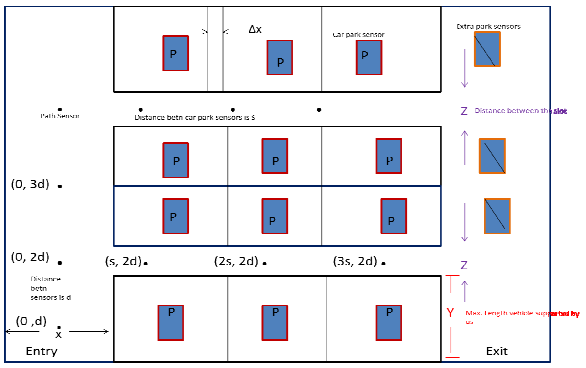

Fig. 1. Design of parking system indicating path sensors and position sensors.

Where

- : - path sensor

: - car park sensor - extra park sensor

X: - max width vehicle supported by us
Y: - max length of vehicle supported by us
Z: - distance between slots (Z > X, Z > Y)
d: - distance between sensors
N: - total no. of slots (max. vehicles)
M:-no. of slots occupied
Δx:- Movement of parking slot for space modeling
Xi: - Width of the incoming vehicle
Yi: - Length of the incoming vehicle
s :- distance between the car park sensors

Initially $\Delta x = 0$ for all slots $M = 0$

GN = 8 Group of 8 vehicle.

IV. SPACE MODEL EQUATIONS

1) For a successful parking the following conditions must be met,

$$Xi < X \quad (1)$$

$$Yi < Y \text{ therefore } Xi, Yi < Z \quad (2)$$

$$M < N \quad (3)$$

If Xs & Ys is the width & height of every slot such that,

$$Xs = X+\Delta x \text{ and } X - \Delta x \quad (4)$$

Where, X → original width of the slot

Δx →the shift in width after space modelling

Then, there must be at least one slot for which

$$Xi < Xs \quad (5)$$

Otherwise parking is not feasible

2) If parking is successfully done then,

$$M = M + 1 \quad (6)$$

Let the Parking be done on Pth slot, then

$$\Delta xp = X - Xi \quad (7)$$

Slot width of Pth slot is, $Xp = X - \Delta xp$

Therefore, the slot width for the next P+1 slot now becomes;

$Xp+1 = X + \Delta xp$

Example:-

Let X = 10m (width of slot),
Xi = 7.5m (width of car)
P = 1 (Slot No. 1)
Δxp = 10 – 7.5 = 2.5m
New width of slot P+1
Xp+1 = 10+2.5 = 12.5m

Here we denote Δxp of Space has been modeled& saved for new vehicle which will be incoming.

If parking is done; then each time the sensor for extra parking is shifted left by dXp units, there placing it inside the car slot when needed.

V. ROUTING EQUATIONS

Let car 'C' be incoming at the entry point.
The position of entry point is assumed to be (0, 0)
If the car has passed criteria 1 of space model equations; then for each empty slot we calculate,

$$d_i = \sqrt{(X_i^2 + Y_i^2)} \quad (8)$$

Where, X_i is the X co-ordinate of parking slot
Y_i is the Y co-ordinate of parking slot
Once the distance is found, then, we make a list of distances in ascending order d_1', d_2', d_3'… d_k'
Assuming there are k empty slots.
Here, we take the first slot d_1', which has the minimum distance from the entry point and guide the user on that particular path.
Once the user reaches a particular path sensor; the next direction is given based on the position of the path sensor and the distance between the path sensor & the empty parking slot.

$$d_{ps} = \sqrt{(X_p - X_s)^2 + (Y_p - Y_s)^2} \quad (9)$$

Where, X_p & Y_p are locations of path sensors & X_s and Ys are locations of slot sensors.

CONCLUSION

This paper introduces parking system to save space to park more and more vehicles. The system is based on wireless sensor network, RF transmitter and receiver as well as MCU. Space has been modeled & saved for new vehicle which will be incoming. We developed hardware design with sensor nodes for vehicle parking and to find the equations for nearest slot, routing equations and timing equations. MCU with RF module is used to guide the management of parking area and space optimization. With the help of this system we employ advanced technologies to permit efficient use of parking space optimization. Smart parking ranges from simple systems shows the way of available slots it is very complex that can model the space as well as increase the utility of parking space. The management system can monitors the step by step approach of parking scenario. This system will enhance the utilization of parking space and find the shortest distance to park the vehicle and help the user to find the availability of parking space within short period of time. Therefore this system achieves

significant role in latest parking and management system.

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