Developing Smart Car Parking System Using Wireless Sensor Networks

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ABSTRACT

Car parking is a serious problem and one of the major contributors to traffic congestion in urban areas. This challenge is as a result of sharp increase in numbers of automobiles on the roads. This paper presents the development of a smart parking system using wireless sensor networks. The system can monitor the state of every parking lot by deploying a magnetic sensor node on each lot and also identify improper parking using infrared sensor to check if vehicles are properly parked. The system uses Xbee radio for transmitting information to the base station which performs necessary information processing, analysis and interpretation on the data received to usable and meaningful format for the end users. The results obtained after qualitative testing of the developed prototype shows that server concurrency utilization is in the average of 12 users per minute. It was also observed that the system acquire speedup in terms of average response time of 1.414 seconds. This implies that the system is robust to handle large number of users and is also fast enough in terms of response which gives accurate information about the parking lot. With the system in place, traffic related hazards, fuel wastage and other relted hazards could be reduced.

CCS Concepts

• **Hardware → Communication hardware, interfaces and storage → Wireless integrated network sensors**

Keywords

Car park, Xbee, wireless sensor networks, automobile, traffic, Magnetic sensor

1. INTRODUCTION

Car park are commonly found in cities and suburban areas which have significant effect in reducing the amount of traffic. They are often found in places such as shopping malls, sports stadiums, schools, churches and similar venues. Parking is an act of bringing to a halt and (or) leaving a vehicle unoccupied. A parking lot, also called a car lot or a bay, is a cleared expanse of land - often of extensive or massive size that is meant and designed for parking vehicles. Car parking system is developed with a view to effectively manage parking of vehicle. Smart parking is a scheme which uses numerous technologies to effectively manage a parking space [1, 2]. Traffic congestion in cities and suburban areas have increased due to increase in the number of car users. Recurrent traffic congestion in general is as a result of roadway lacking sufficient capacity for the volume of cars – too many cars or too little roads. The bases of traffic congestion (traffic jam) are complex and composite but they all stems from having too many cars on the same road at the same time. Car drivers searching for parking space contribute to between 8% to 74% of traffic congestion as argued in the research of [3]. A related study conducted by International Parking institute, 2012 appraised that 30% of car steering the city at any instant of time are doing so as car drivers are scanning for parking space [3]. Consequently, traffic congestions lead to frustration on the part of the driver and also waste of time. Economically, it translates to wastage of fuel and carbon emission can lead to environmental pollution and other associated hazard (e.g. Global warming as a result of carbon emission).

A significant way out of these car parking problem is to de- crease the time taken by car drivers to search and find parking spots. This can be achieved by incorporating new technologies to exist- ing systems and this give rise to Wireless Sensor Network (WSN) to be considered as an effective way to improve parking situation [4]. WSN is drawing bigger interest thus, allowing them to speed- ily evolve owing to their massive usage capability across several disciplines [5]. As a result of advancement in technology, WSN stems from wireless networking, which is an interconnection of nodes that do not necessitate any form of cable [6]. This offers mobility and flexibility in transmitting data over a network medium [7]. WSN have found many civil, industrial, military, general engineering, civil engineering, environmental, agriculture and medical application which includes smart office spaces, commercial and residential security, border surveillance, intelligent buildings and bridges, precision agriculture, disaster recovery and so on [2]. With this wide range of application, it is reasonable to consider WSN in car parking system.

In this paper, we present the development of a parking system that will operate by sensing parking spaces if available via sensors, notably a magnetometer. With a parking space in place, combining WSN with the system offers the possibility of developing a smart system for car parking that could be an important factor in solving the problems of parking and none the less offers an easy and cost effective solution which would maximize utilization and minimize