Smart Parking Signaling

Cem. Atılgan[1], Kazım Zengin[2], Muammer Uğur[3], Evren Çağlarer[4]
1- Kırklareli University, Mechatronics Engineering, Kırklareli, Turkey.
Email: cematilgan@klu.edu.tr (Corresponding author)
2- Kırklareli University, Mechatronics Engineering, Kırklareli, Turkey.
Email: kazim.zengin@klu.edu.tr
3- Kırklareli University, Mechatronics Engineering, Kırklareli, Turkey.
Email: m.ugur@klu.edu.tr
4- Kırklareli University, Mechatronics Engineering, Kırklareli, Turkey.
Email: evren@klu.edu.tr

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ABSTRACT:
In today's world, the usage area of intelligent systems is increasing day by day. With the development of technology, applications on intelligent systems that will facilitate human life have also gained momentum. Intelligent systems have evolved from the automotive to the defense industry, from white goods to construction. In large areas with high circulation such as large shopping malls, airports, train stations and stadiums, whose numbers are rapidly increasing, there is a problem of parking space and finding parking space in these areas. Due to the large number of car parks and the large number of vehicles, it is time consuming for customers to search for parking lots for a minute. It is also indisputable that the loss of time is the cause of money loss. In this study, it is aimed to provide a dynamic and quick solution to the operation of intelligent systems in the parking lot. By combining software, control, and sensor technologies, an intelligent system that continually updates itself and at the same time minimizes the loss of life and property in an emergency is designed and integrated into the parking lot infrastructure. Thanks to the designed system, it is aimed to get rid of the problem of searching for places, to reduce fuel and time loss the most, to protect from accidents, and to provide healthy guidance in possible emergency situations. Unlike similar projects in this study, the parking lot plan was created in software environment with all lines. Since the system is constantly updating itself, it has achieved an autonomous structure. In this way, the system does not need to enter any human being in the right direction at the shortest time.

KEYWORDS: Smart Systems, Control and Automation, Software, Sensor Technology, Arduino.

1. INTRODUCTION

Rising technology increases the industrial growth of the world and the consumption of technological products is increasing day by day. One of the products of this technology is undoubtedly the cars which have a great precaution in our lives. Increasing population is increasing the demand for road vehicles day by day. As a result, the increase in the number of vehicles leads to an increase in traffic, which leads to the traffic congestion and the difficulty of finding parking spacesWhile the number of vehicles in 2007 was 13,022,945, it was 21,763,103 in 2017 [1]. According to the these datas, the number of vehicles in the last decade has increased by about eight million. The increase in the number of vehicles not only causes traffic congestion but also causes the problem of finding parking space in large indoor areas such as airport, stadium, shopping mall. Finding a parking space is time consuming, complicated and leads to unnecessary fuel consumption. In this work, it is aimed to remove the problem of finding a parking space in large closed areas, to direct the driver to the parking place as soon as possible and to reach it. It is also aimed to direct emergency exits in order to reduce the complexity in the face of any dangerous situation that may arise. Various studies related to this subject have been made. We can list these studies as follows.

1.1. Fuzzy Logic Based Systems

They are systems that show human-like intelligence and expertise. The application area for the parking lot can be shown as intelligent parking methods. Parallel parking and vertical parking are examples.

1.2. Wireless Sensor Based Systems

It is a system that enables low cost application withlower power consumption. An example is the perception and monitoring of the parking facility. (Figure 1).

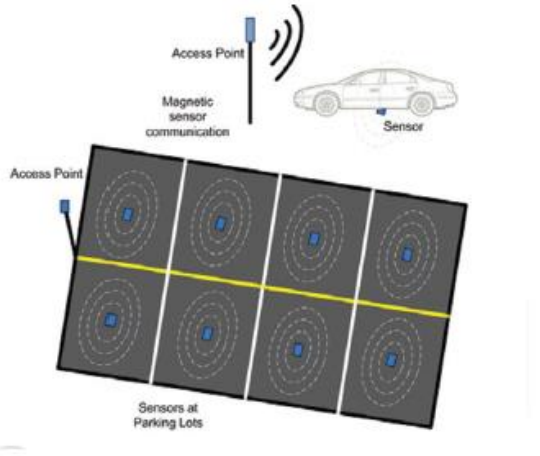


Fig. 1. Wireless sensor network with magnetic sensor [2].

1.3. GPS Based Systems

They are systems that provide real-time location-based information and guidance to the target. The parking area provides information on the status of vehicle occupancy. (Figure 2)

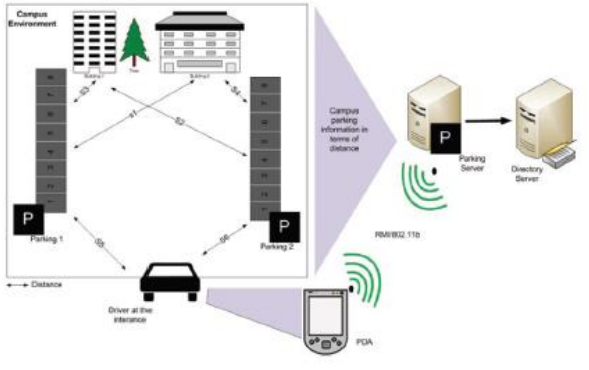


Fig. 2. Nearest free location finder application [2].

1.4. Vehicular Communication Systems

It proposes a new smart parking technique based on vehicular communication for large parking lots. This scheme provides the real-time parking navigation service, intelligent antitheft protection, and friendly parking information dissemination to the driver. (Figure 3)

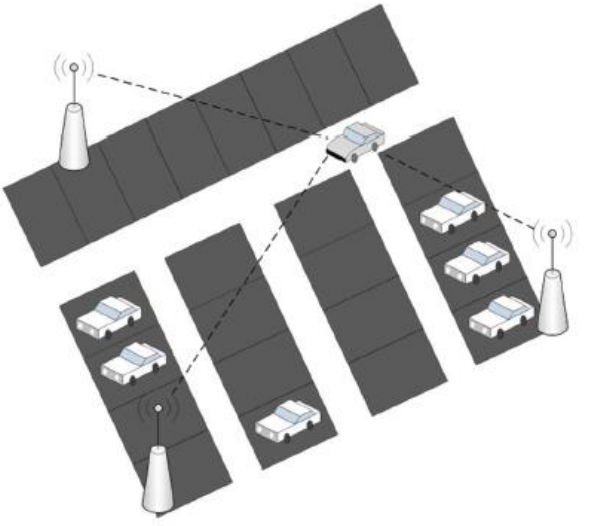


Fig. 3. Vehicular communication-based smart parking technique [2].

1.5. Vision Based Systems

It is a system that includes image processing and camera. It provides information on detecting the occupancy of the places in large parking lots, parking area recognition [2].

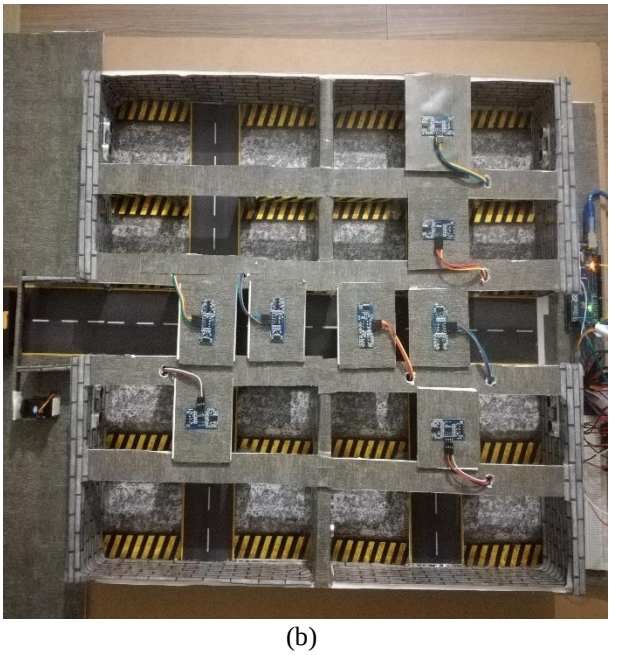
Yamada [3] and Banerjee [4], has used surveillance cameras and image processing techniques to check whether a vehicle is in the parking lot. This is one of the most common techniques used in existing parking systems, but this method is insufficient in accuracy due to a number of reasons, such as indoor and outdoor conditions, shadow effects and deterioration effects. V. Venkateswaran [5], used the Infrared (IR) sensor to detect the vehicle. Detection of the vehicle via the IR sensor is one of the most sensible approaches, but the approach is complex because the authors use separate IR transmitters and a separate IR receiver. Moreover, the authors simply suggest using IR sensors; but accuracy and reliability is still an issue that needs to be addressed. Z. Pala, N. Inanc [6], has proposed vehicle identification with RFID / Tag technology. However, a large-scale RFID / Tag-based vehicle detection for parking is not accepted for two reasons. The first reason is the position of the label to be placed, the second one is that the cost is above the cost of the whole system. L. Wei, Q Wu, M. Yang, W. Ding, B. Live R. Gao [7] have proposed Vehicular Ad-hoc Networks (VANETS) for intelligent parking system. VANETs are especially designed for vehicle-related applications. However, the implementation of VANETs over the world has been slow, since the cost is expensive. Hongwei Wang [8], has proposed a smart parking system based on reservation. The proposed system uses light and vibration sensors to detect vehicles. The authors focus on identifying the traffic jam that would result if a vehicle searches for an empty parking space. The

authors alleviated traffic congestion with the proposed system. However, the disadvantage of the system is the environmental disturbances that may cause misperception through vibrations and the problems caused by the different environmental conditions that the light sensors cannot detect the vehicles. Srikanth [9] designed the Prototype Smart PARKING System (SPARK) using the Wireless Sensor Network (WSN), but it is impractical because the sensor chosen for the prototype detects it in environmental conditions and on objects outside the vehicle. Quinones [10], has proposed an architecture for designing a smart parking system using a wireless sensor network. Mostly focused on reliable information dissemination or connectivity based on topological network design using Zigbee 900 and Digimesh 2.4 GHz. Similarly, Asaduzzaman [11] has done a comparative analysis of wireless technologies such as Wifi, Bluetooth and Zigbee. Zigbee has been considered as an efficient parking system in terms of time and energy but has not specified the sensitivity of the sensor and sensor to be used in the system. Junzhao[12], has proposed a multi-layered image-based free parking detection system that uses the camera sensor for detection. A camera can be used as a sensor that detects empty parking spaces or vehicles, but the system may not work properly due to low light intensity when the ambient is dark. Complex algorithms are needed to solve this problem. Therefore, such systems are expensive and quite complex. The literature presented above describes different wireless sensor based parking systems that can be used for vehicle detection. However, there are many factors and directions to be taken into account in the mentioned systems. Sensitivity in detecting free parking is due to different non-target factors such as creatures (people or animals) that may mislead the sensor or factors such as vehicle detection outside the vehicle objects. In addition, the position of the parking system, such as the interior or exterior, plays an important role in visibility for some sensors. Likewise, environmental conditions such as weather (cloudy or dusty) can degrade the performance of the sensors and cause misperception. For this reason, we must consider these factors and aspects; the current literature is devoid of considerations that can lead to uncertainty in the accuracy of the different sensors and misrecognition [13].

2. SMART PARKING SIGNALING

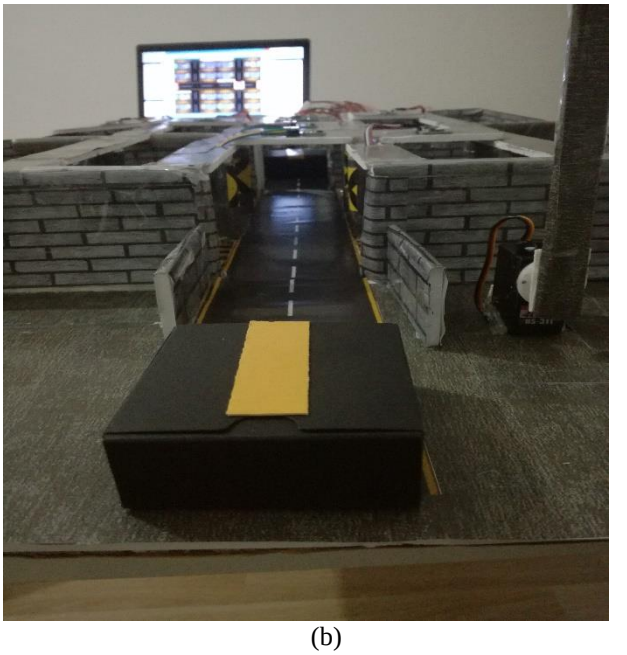
In this study, unlike the other studies, the parking area (Figure 4(b) 5(b) 6(b) and 7(b)) has been realized into the software environment. (Figure 4(a) 5(a) 6(a) and 7(a)) Each parking area is addressed and each parking area has its own sensors. Ultrasonic sensors are used in the system. Thanks to the ultrasonic sensors, we can see the occupancy rate of the parking area that we created in the software environment. This information appears on the screen of the parking lot dealing with the drivers at the entrance. With this information, the driver can see the parking areas full or empty without entering the parking area. After choosing the vacant space here, the parking area you choose is reserved for the driver. The driver cannot make more than one choice and an average time is determined according to the distance and the driver must reach the selected area within this time. If it does not arrive within the specified time, the system will update and display the field selected by the driver again empty. Events such as emergency situations, accidents and stopping on the road are detected by the sensors on the road and feedback is made to the system. In such cases, the system provides an alternative route to other drivers, preventing the accumulation in the transition. In addition, by directing to the exits in an emergency situation, the complexity that may occur in the parking lot is reduced most. When we talk about the technical infrastructure of our system: Arduino microprocessor, software technology, sensor technology are used. Thus, the system became completely autonomous. After connecting to the system, the interface program that we have developed to examine the sensor data and the changes through the computer is executed. In the system, the red circles show the car parked parking lots while the green circles show the empty parking lot areas. If the car park is fully occupied, all car park areas will be lit red and the entrance to the car park will be closed. When the entire parking area is full, and if any vehicle leaves the parking area, the interface is updated and access to the parking area can be made again. The proposed system saves fuel by avoiding unnecessary fuel consumption while minimizing the time loss of the drivers.

(a)



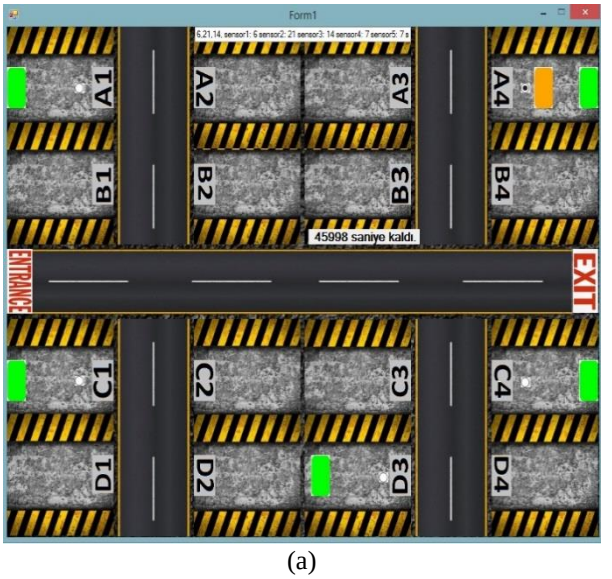
(b)

Fig. 4.(a,b). The entire parking lot is empty.



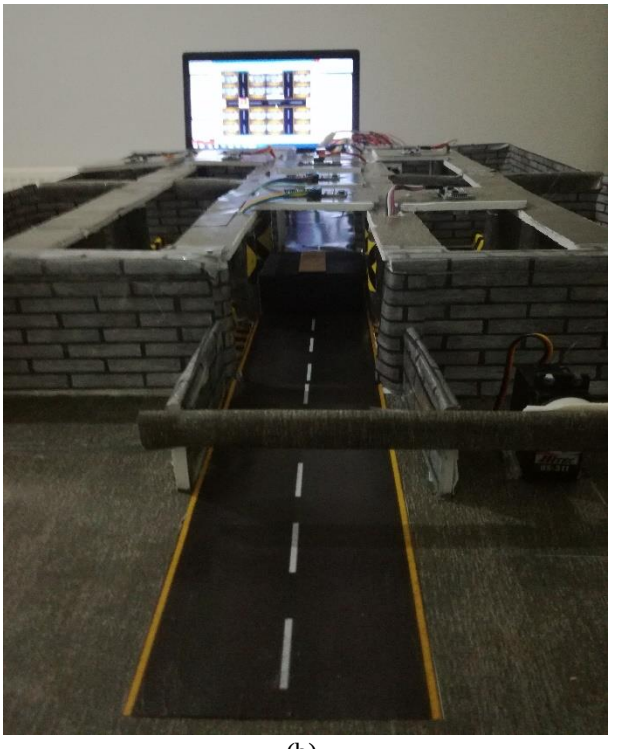
(b)

Fig. 5. (a,b). The A4 parking lot is chosen by driver.



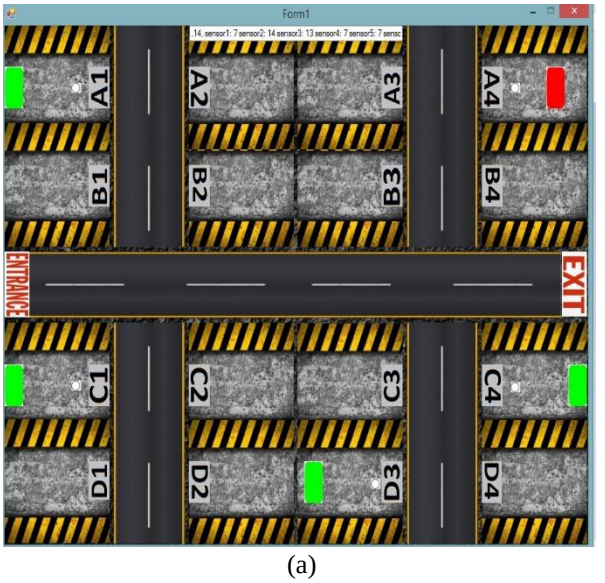
(a)

(a)



(b)

Fig.6. (a,b). The car is inside of the park.



(a)

(b)

Fig.7. (a,b). The driver reach at A4 parking lot.

3. CONCLUSIONS

Thanks to the sensors used in the project, the system constantly updates itself without intervention from the outside. At this point the system has become completely autonomous. The waiting times of vehicles in and out of the parking lots have been reduced. Thanks to the system designed in the parking lot, parking times of the vehicles are reduced.Thanks to the created interface, it is possible to monitor the entrance and exit of the parking lot. As the system is implemented as a prototype, more advanced systems can be produced by the works to be done in this area.

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