



INNOVATIVE TECHNOLOGY FOR SMART CAR PARKING SYSTEM

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One of the major problems people face in big cities is the lack of proper traffic and car parking management systems. In the smart city, which will be built in the coming years, it is planned to build multi-storey car parks for residents' cars, office employees cars, service systems cars and other specialized vehicles. When cars are not in use for a short or long time, parking lots are needed to park them. For optimal placement of a large number of cars for various purposes in parking lots, of course, automated smart parking spaces are needed, which means that it is advisable that the parking lots of the smart city should also be "smart". One of the key components of smart cities being built today is smart parking systems [1-4].

Conventional car parking systems that are not properly managed can't fully meet the needs of smart cities. The smart parking solution allows drivers to easily and quickly identify available parking lots [3]. Cars play an important role in the life of a smart city. That is, the ecology of the city, motion of transports in cities, traffic jams, the time required to do certain tasks in cities and other phenomena are one of the main indicators of urban traffic, and urban life is closely related to them. From this point of view, since the large role of parking in city management is felt, part of the research work in the field of "smart cities" falls on smart parking [4].

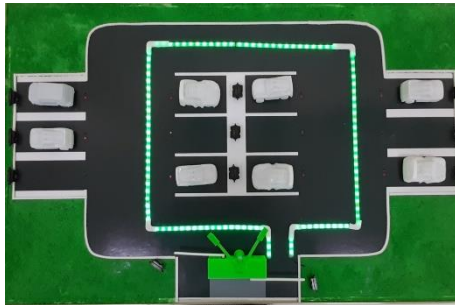
In view of the above, an automated smart parking technology based on innovative technologies was developed, and its prototype is shown in Figure 1. As shown in the figure, the smart parking prototype consists of 2 parts. These are the left and right parts. Each part consists of 6 individual parking lots for a total of 12 parking spaces. This prototype consists of 1 entry and 1 exit.

In order to implement a prototype of an innovative smart parking system were used 2 Arduino platforms (1 Arduino MEGA and 1 Arduino UNO), 14 SHARP GP2Y0A21YK0F infrared sensors, 1 HC-SR505 PIR sensor, 2 MG996R servo motors, 12 red, 12 green and 2 white LEDs and also 2 peaces of RGB LED strips.

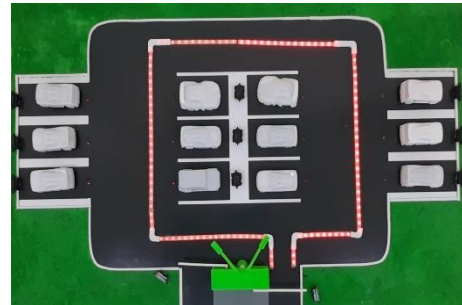
When the individual parking lot is empty, the IR sensor detects that it is empty and informs the central control unit about it. And the central control unit will activate a green LED to indicate that the space is empty. When the driver parks his car in any free parking lot, the IR sensor detects the occupied space and informs the central control unit about it. The central control unit, in turn, activates a red LED there to signal that the parking lot location is not empty, i.e. busy.

RGB LED strips serve as an additional accessory for informing drivers in advance about the availability of a free space in a smart parking lot. On both right and left parts of the car parking system, 1 RGB LED strip is installed. Figure 1, a, c and d shows the moments illustrating the presence of at least 1 free parking lot in the left and right parts, respectively, and vice versa. If all spaces in the right or left lane are occupied, these LED strips turn red to alert drivers that there is no parking space in the parking lot (figure 1 b).

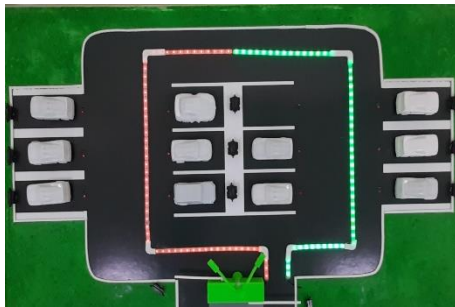
As a result, a smart, energy-saving, understandable and user-friendly innovative technology of car parking system has been developed and implemented. Using this smart parking system will make optimal and efficient use of existing parking spaces, thus avoiding the costly construction of new “redundant” car parking lots.



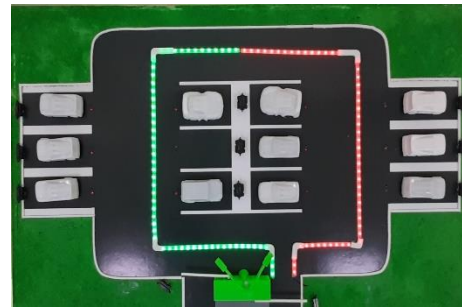
a) There are free parking lots in both parts of the car park (the LEDs in both parts are green)



b) There are not free parking lots in both parts of the car park (the LEDs in both parts are red)



c) There are not free parking lots on the left side of the car park, but there are on the right side (LEDs on the left side are red, on the right side are green)



d) There are not free parking lots on the right side of the car park, but there are on the left side (LEDs on the left side are green, on the right side are red)

Figure 1. The working state of the LED strips for indicating free and occupied parking lots in the developed smart parking system

The use of computer softwares and mobile phone applications to manage and use various services in smart cities is becoming more and more popular these days. Therefore, future scope of this project consists of creating computer software and mobile application for parking management in order to further improve the innovative smart car parking system.

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