

Smart Parking System Designed by using the Arduino for University park

Baraa I AL-Rikabi

Electrical Engineering Department, College of Engineering, Wasit University, Kut, Wasit, Iraq.

**Corresponding author bfarhan@uowasit.edu.iq

Submitted: 25/7/2017

Accepted: 21/5/2018

Abstract: Due to the rapidly increasing density of vehicles, especially during rush hours of the day, it is a difficult task for drivers (students and teachers) to find a parking space to park their vehicles. This article proposes a Smart Parking system that provides the best possible solution to the parking problem in the University. The purpose of the Smart Parking system is to solve the predefined problem. This system uses a simple microcontroller and an inexpensive sensors that is used to control and allow the user to either enter the park or not, depending on the available parking spaces. Thus, the user is not made to wait unnecessarily. The technology used in this system helps to reduce the cost and human effort.

Keywords: Smart Park, Arduino, microcontroller, Control System, Parking Management Systems.

تصميم نظام وقوف السيارات الذكي باستخدام الاردوينو لموقف جامعة ما براء اسماعيل

الخلاصة: نظرا للكثافة المتزايدة والسرعية للمركبات، وخاصة خلال أوقات الذروة من اليوم، فمن الصعوبة على السائقين (الطلاب والاساتذة) ايجاد مكان لايقاف سياراتهم. والغرض من هذا النظام هو حل المشكلة المذكورة سابقا التي يقدمها نظام وقوف السيارات الذكي. تقترح هذه الورقة نظام وقوف السيارات الذكي الذي يوفر الحل الأمثل لمشكلة وقوف السيارات في الجامعة. يستعمل هذا النظام متحكم بسيط ومستشعر بثمن رخيص الذي يستعمل للسيطرة على السماح للمستخدم بالدخول أو لا إلى الموقف اعتمادا على استيعاب الموقف. وبالتالي، يتم تقليل الوقت الضائع للمستخدم. وتستعمل التكنولوجيا في هذا النظام لتجنب التدخل البشري الذي يقلل من التكلفة.

1. INTRODUCTION

The problem of finding a parking space in large cities and universities during working hours of the school year or near shopping centers on occasions and holidays is a great problem that causes inconvenience to the entire population and affects its economy and productivity [1]. This problem can be solved and its effect reduced in cities, by reducing congestion in universities and shopping areas through the control of public or private parking, using techniques to enter the intelligent- parking system by using sensors and small microcontrollers [2].

This article aims to build a knowledge based on the parking facility for employees and students of such universities through a study of nine cases, with consideration given to procurement of related issues and parking policy. It is important to have a good understanding of the circumstances that affect employees and students. The University is used as a case study because parking is of great interest to the transport and forwarding operators in the region and because the university characterizes many such aspects[3].

Intelligent Parking uses inexpensive sensors and the 7 segments decoder, which allows the users know if parking places are available or not [4]. Here we aim to automate the system, and thus, minimize time spent by drivers in searching for parking place [5]. The problem can be solved by a complete set of services that permit the driver to enter or not enter to the park. The solution for parking can be helpful to both the user and the authorities of the park.

The most significant advantages of using the smart park are[6]:

1-ideal parking: in this system the users can find the best place available and reduce time and effort in looking for a parking space. The parking lot fills up efficiently and can be managed properly.

2-minimize traffic: This system minimizes traffic flow, as fewer cars will need to search for an open parking space.

3-improve User skills: Smart parking solves all the users' skills in a unified manner. Driver's payment, space determination, space search and time specification all seamlessly become part of the target arrival process.

4-Minimized Management expense: A lot of automation and less manual activity minimize labor expense and resource consumption.

The main idea of this article achieved by smart controlling that contain electrical elements by using Arduinouno programming by C++ code consider that as artificial intelligence application to managing the park in smart way.

2. SMART PARKING SYSTEM

Owing to the importance of using intelligent parking systems, several types of smart parking systems have been developed through the use of modern technology. This first ones were in Europe, the United States and Japan due to the presence of large number of people and the indiscriminate and uncontrolled use of parking situations, which caused problems that led to congestion

in traffic [7][8].

The use of smart parking is helpful for students, teachers, and those who mediate traffic in cities and universities. It helps mediators who have to pull people up for illegal parking on the side of the road or for congestion caused when searching for parking in fully parked places, wasting time and effort, the best solution for this scenario can be achieved through smart management of the available parking spaces, which leads to less time being wasted and also affects the method of pricing and increases profits[9]. The regulation of parking places and traffic leads to the preservation of the environment, by maintaining the level of pollution and reducing smoke from cars and the consumption of fuel, as it relates to the number of miles traveled by the vehicle[10]. Furthermore, the implementation of all of the above will help to provide an ideal environment in universities and streets and provides comfort to those in the university[11].

3. ARDUINO:-

3.1 What is Arduino:-

Arduino is an easy to use but powerful board microcontroller. It is like a small computer that can control multi electronic parts. Technically, arduino uses an open source system that consists of a control letter and an open-code microcontroller (arduino), as an additional development setting for the integrated development environment IDE for the 'writing software'. Arduino can be used to control and manage various electronic parts, such as switches and sensors and to obtain important information such as temperature and light intensity[12].

It is efficient in the operation of LED, servo motor, and many other parts. Arduino projects can be operated directly from the source with the use of a 5V electric transformer or by using a battery or connecting it to the computer.

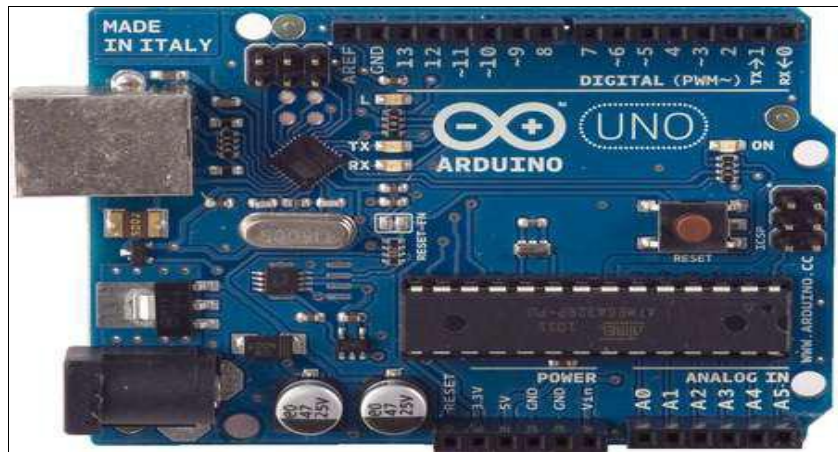


Figure 1:-'Arduinouno'

There are more than 40 variants of Arduino panels to choose from. These vary according to their capacity, size, shape and price, to meet all ideas and designs. Among the most popular are the following: (ARDUINO UNO, ARDUINO NANO, ARDUINO LILYPAD, ARDUINO MEGA 2560, ARDUINO Mini and ARDUINO BT)

In this article, Arduino Uno' (Figure1) has been used as the development board to run the smart park, because it is a simple, inexpensive board, with limited resources, which can be used to implement complex and intelligent tasks. Here it is used with the Servo Motor and a 7- segment decoder.

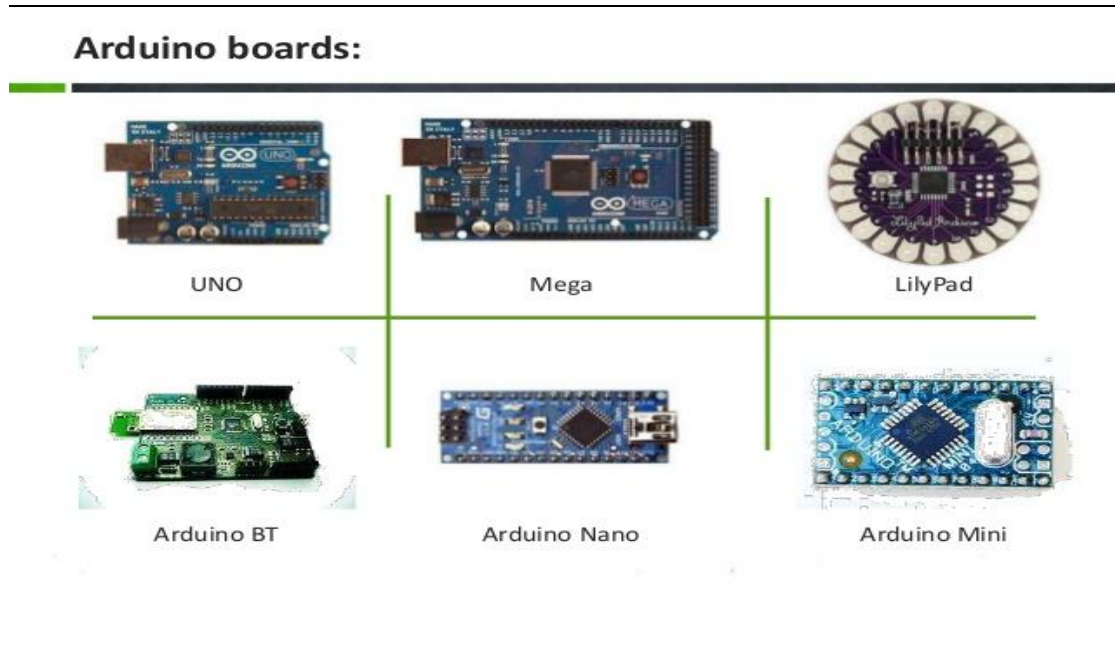


Figure 2:- types of Arduino

3.2 Servomotor:-

It is a device that has a rotating axis. This axis can be attached to parts that need motion at a certain angle. This type of motor is different from the normal motors, because it leads to movement and rotation to the front or back, at an angle (180° or 90°) and does not cause transition from one place to another and defend this work by using the Servo library, which is included in arduino program to have control over the Servomotor [13]. Arduino gives orders to the servo motor to work or stop. In this manner it has control over the gate of the park.



Figure 3:-Servo Motor

4.IMPLEMENTATION:-

The main aim of this article is to have smart control over the electrical elements by using Arduino through a programming code written using the C ++programming language, for regulation of working of parking in the University and for working on the plan and orders. The research consists of three primary parts:

1. Hardware structure and servo motor, Electronic elements (sensors and 7- segment decoders) and Arduino.
2. Software

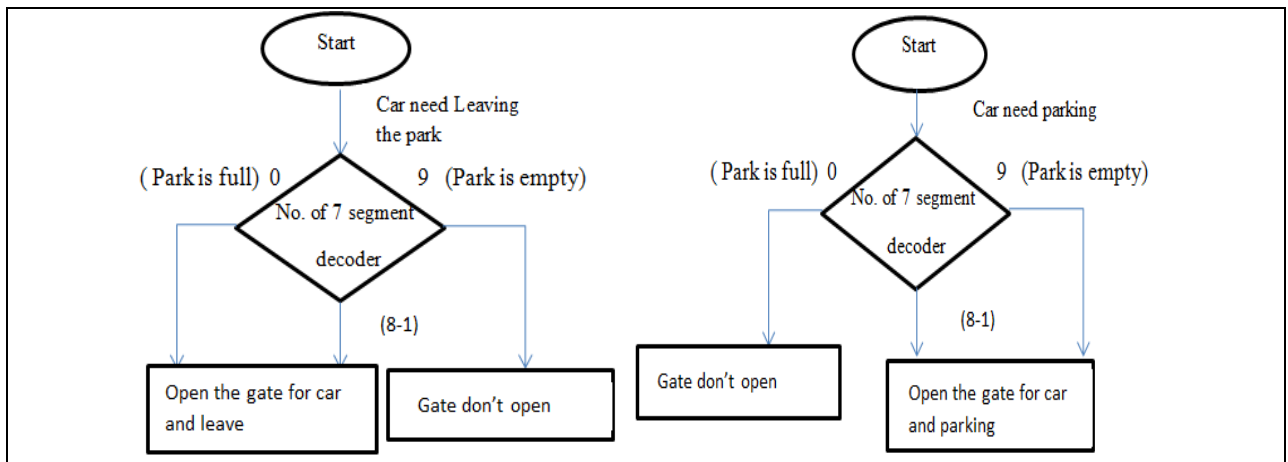
These elements can be used to manage the park depending on the capacity of the park(the proposed capacity 9-spots)to solve the problem of crowding and to avoid losing time searching for parking in a full park. This can be achieved by the smart control that has artificial intelligence. The device used here is the 7- segment decoder, which displays the number of the empty spots available, to informs the driver about not the availability of the empty spots and also if they are not available. There is sensor and a servo motor connected arduino to the arduino is a smart controller device have set of order, when arduino receiver informed from the sensor when it senses a car will translate the order to move the servo motor in angle "90°" and transfer this order to servo motors through trigger wires to the gate of the park, which will apply the function. This happens only if there is an empty space in the park.

When any car enters or exit, the arduino will change the number that shows in the 7- segment decoder, according to availability of places, when a car enters, the number will decrease and if a car goes out of the park the number will increase.

4.1 Flowchart and Cases Table

Case	No.in 7segment decoder	Max capacity	Open gate or not for car need parking	Open gate or not for car need leave
1	9	9	Open	Don't open (Park is empty)
2	(8-1)	9	Open	Open
3	0	9	Don't open (park is full)	Open

Table 1:- The cases table for smart park



a -Arrange the leaving of a car from the parking b-Organization of car entry into the parking

Figure 4:- (a,b) Flowchart for smart park

4.2 Fingers for system

When the park is empty number 9 appears on a screen of the 7-segment decoder. Any car can enter the park.

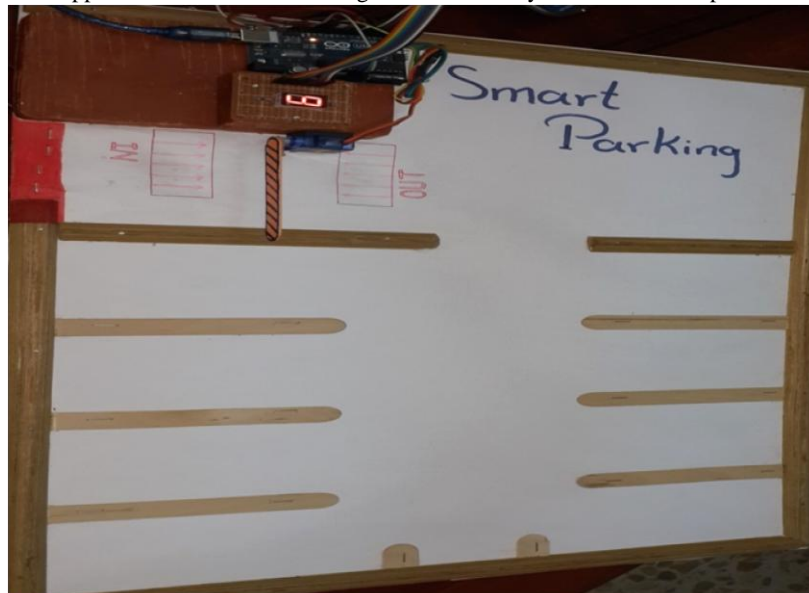


Figure 5:- The park is empty

When the number 0 appears on the 7-segment decoder that indicates there is no empty place in the park. The door will not open and no car can enter.



Figure 6:- Space figure the park is full, no empty spots

When the car enters the sensor senses it. The door will open and the number decreases from 7 to 6 in the 7-segment decoder, which denotes that an extra space has been filled and there is a decrease in space.

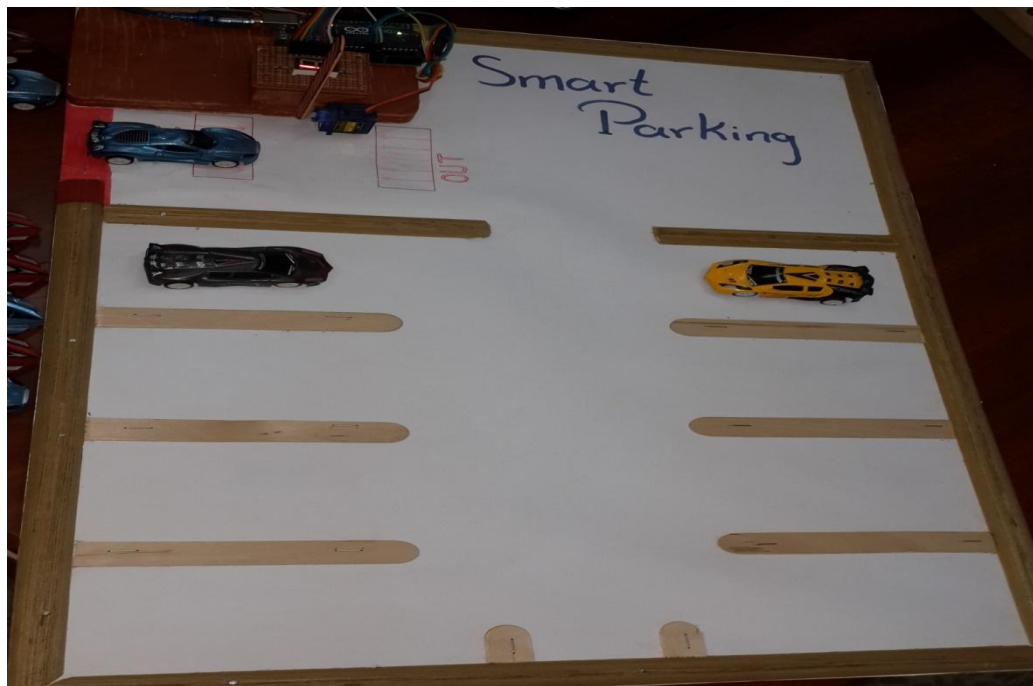


Figure 7:- The car enters to park

CONCLUSION

In this study, the execution of the intelligent parking system based on microcontrollers, using Arduino, is discussed. This technology provides a control system that helps to determine the capacity of the park to avoid losing time searching for parking in a full park. The average waiting time of the users to park their vehicles is effectively reduced in this system. The optimal solution is provided by the proposed system, where most vehicles find parking

space successfully. This intelligent parking system offers better performance, low cost and efficient large-scale parking system. Safety measure to ensure that users do not misuse the parking system can be implemented.

As a continuation to this study, further work the future of the smart parking market is expected to be significantly affected by the access of automated vehicles. Some cities around the world have already begun to trial self-parking vehicles, specialized automated vehicles parking lots, and robotic parking valets.

REFERENCES

1. Yanfeng Geng and Christos G. Cassandras "A New Smart Parking System Based on Optimal Resource Allocation and Reservations" IEEE Transaction on Intelligent Transportation Systems , volume 14, pp. 1129 -1139, April 2013.
2. Willson , Richard W. "Suburban Parking Economics and Policy:Case Studies of Office Worksites in Southern California". Washington, D.C: Federal Transit Administration, University Research and Training Program,1992Print.
3. Clinch, Peter J., Kelly, Andrew (2003), Temporal Variance Of Revealed Preference On-Street Parking Price Elasticity, Department of Environmental Studies, University College Dublin (www.environmentaleconomics.net).
4. John Bradky, Orange County Transportation Authority, 1991. "Parking Management and Implementation Manual." Garden Grove: Orange County Transportation Authority project in university of south Florida.
5. benefits of smart parking solution ; Available from:
<http://www.plasmacomp.com/blogs/benefits-of-smart-parking-solution>.
6. Hinze, D., 2000." Italians drive for smart card parking in major cities".
7. Callum Rhodes, William Blewitt, Craig Sharp, Gary Ushaw and Graham Morgan. "Smart Routing: A Novel Application of Collaborative Path-finding to Smart Parking Systems" . Business Informatics (CBI), 2014 IEEE Conference on volume 1, 2014.
8. D. J. Bonde , Rohit S. Shende, Ketan S. Gaikwad, Akshay S. Kedari,Amol U. Bhokre. "Automated Car Parking System Commanded by Android Application", (IJCSIT) International Journal of Computer Science and Information Technologies, volume 5(3), 2014.
9. Lee, S., D. Yoon and A. Ghosh, 2008. Intelligent parking lot application using wireless sensor networks. Proceedings of the International Symposium on Collaborative Technologies and Systems, May 19-23, 2008, Irvine, CA.
10. explain about ArduinBoard; Available fom:
<https://www.arduino.cc/en/Main/ArduinBoard>.
11. Cui Shiyao, Wu Ming, Liu Chen, Rong Na . "The Research and Implement of the Intelligent Parking Reservation Management System Based on ZigBee Technology". Measuring Technology and Mechatronics Automation (ICMTMA) , pp. 741-744, January 2014.
- 12 . Alan G. Smith, September 30, 2011 , Introduction to Arduino.
13. Servo motor and motion control using digital signal https://www.sciencebuddies.org/science-fair/projects/project_ideas/Robotics_ServoMotors.shtml