Smart Car Parking System

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Introduction

We have implemented a Smart Car Parking System which enables car drivers to get in and out of the parking lot without human help. We have installed an LCD to provide a better view of the parking area which shows the positions of vacant and occupied slots in the parking area. Also, it shows how many slots in total are unoccupied.

Components Used

1. Arduino UNO
2. IR Sensors – 5 Nos.
3. Servo Motor
4. Base Shield
5. RGB Backlight LCD (16 X 2)
6. Connecting Jumper Wires
7. Toy cars for Demo

Implementation

Idea

The first and the foremost part is to determine the presence of a car. So, how to determine the presence of a car? We have used IR sensors for this purpose. We need to build a model which can detect the movement of cars at the gates and their presence at parking slots.

Detecting the presence of cars at parking slots is not much of an issue. The IR sensors would sense the car whose presence can be reflected on the RGB LCD Screen. The real trick lies in the entry and the exit of the car. The most general problem that comes into the mind is how to determine whether the car is leaving the parking area or is entering the parking area. After a bit of thought, you would realize that this could not be implemented with a single IR sensor. One would need two IR sensors to detect the direction of motion of the car.

The next problem is to co-relate these two sensors with the gate of the parking lot. We have used a servo motor to design the gate of our parking lot. So, when a car is willing to enter the parking area and space is available in the parking area, the gate should open, otherwise remain closed. When the car reaches inside the compound after crossing the gate, the gate should close behind the car. Similarly when the car is leaving, the gate should open when the car reaches the gate and should close behind it.

How did we solve the problem of cars entering and exiting the Parking Area?

We analyzed the problem using a truth table which is shown below. Here

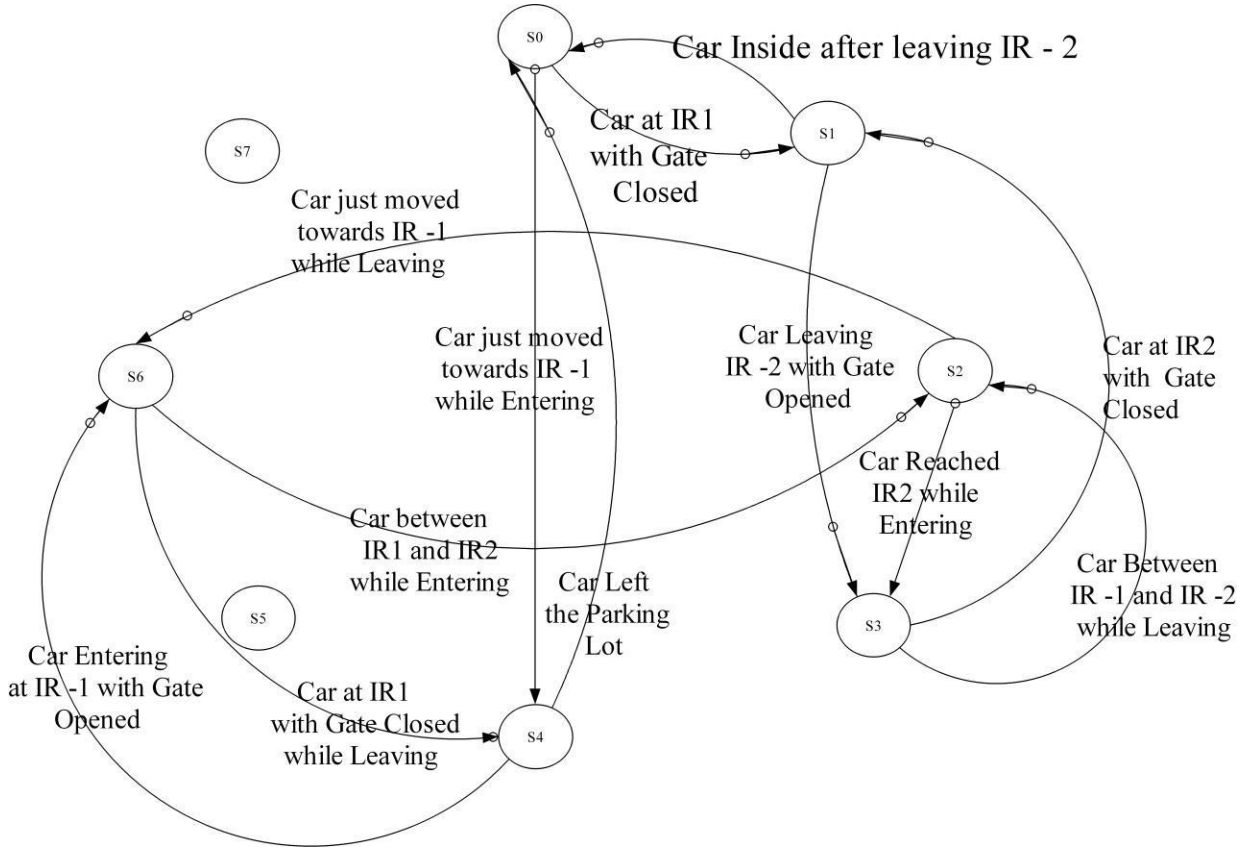
IR -1	:	It is the sensor outside of the gate
IR – 2	:	It is the sensor inside of the gate
Gate – Open	:	If Gate – Open is 1, then gate is open, otherwise closed.
State	:	It is the state corresponding to each unique combination of IR - 1,IR -2 and Gate – Open.
Remarks	:	Events Corresponding to the state.

We depicted the movement and position of the car with changes in state and sensors. We did not use delays for opening and closing of the gates. We are simply performing it via the changes in various states.

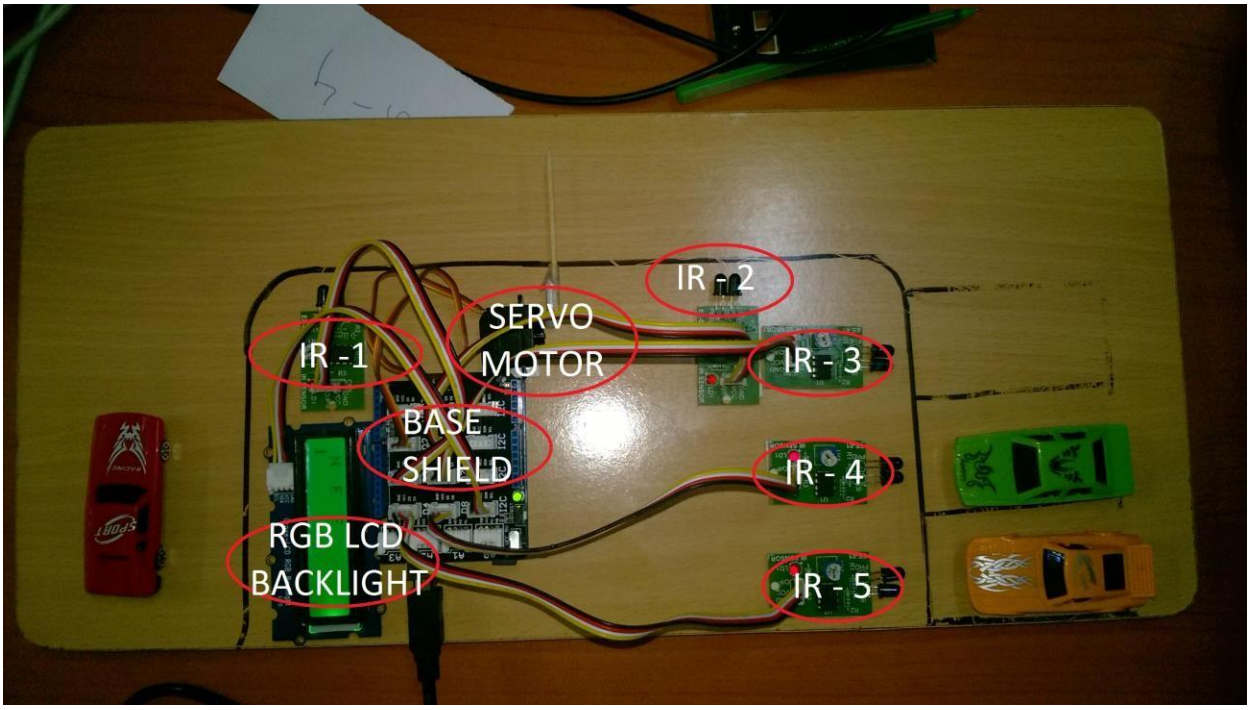
State Table

State	IR -1	Gate – Open	IR – 2	Remarks
S_0	0	0	0	Nothing in front of IR -1 and IR – 2, Gate is Closed
S_1	0	0	1	Car in Front of IR – 2, Get is Closed
S_2	0	1	0	No front of IR -1 and IR – 2, Gate is Open
S_3	0	1	1	Car in front of IR – 2, Gate is Open
S_4	1	0	0	Car in front of IR – 1, Gate is Closed
S_5	1	0	1	Car in front of IR -1 and IR – 2, Gate is Closed
S_6	1	1	0	Car in front of IR – 1, Gate is Open
S_7	1	1	1	Car in front of IR – 1 and IR – 2, Gate is Open

State Diagram



Configuration



Connections (Pin Assignment)

Sensor	Pin in Base Shield
IR – 1	D3 (4 in Arduino)
IR – 2	D6 (7 in Arduino)
IR – 3	D7 (8 in Arduino)
IR – 4	D8 (9 in Arduino)
IR – 5	D4 (5 in Arduino)
Servo Motor	D2 (2 in Arduino)
RGB LCD Backlight	I2C