KULLIYYAH OF ENGINEERING

DEPARTMENT OF MECHATRONICS ENGINEERING

PROJECT REPORT

MCTE 2332

Title	:	Smart Car Park System
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Matric No	:	1913066
Section	:	1
Course Title	:	Digital System and Microprocessor

GOAL OF THE PROJECT – OBJECTIVES

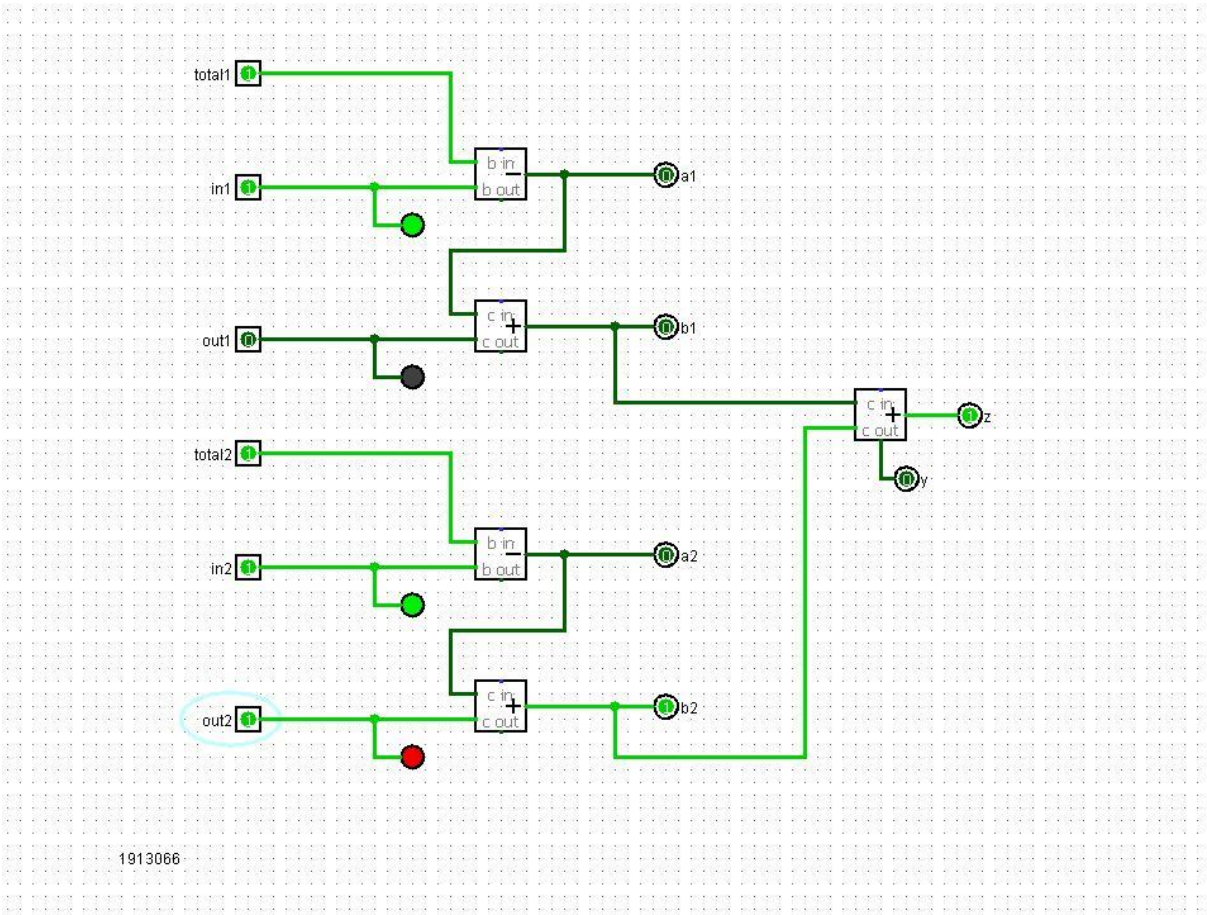
1. To display the messages received from the parking system about the number of parking places.
2. To inform the drivers of the number, and location of available spaces.
3. To improve parking usage especially in a multi-level car parks.
4. To reduce congestion among the driver by making it easier to locate empty parking spaces.
5. To decrease the time spent manually searching for the optimal parking spot.
6. To reduce the risk of distracted driving and accidents by ensuring drivers maintain their attention rather than browsing for spaces.

DETAILS

1. The total number of parking spots is 200 (100 in each level).
2. The system can detect a car entering and leaving the parking spots (total of four inputs).
3. The parking spot has two levels consist of one entry in each level (two inputs).
4. There are two exits to leave the parking place (two more inputs).
5. The number of parking spots decreases every time a car enters the parking spots.
6. The number of parking spots increases back every time a car left the parking spots.
7. A display board will show the number of parking spots left in level one, level two, and the total of both levels (3 outputs).

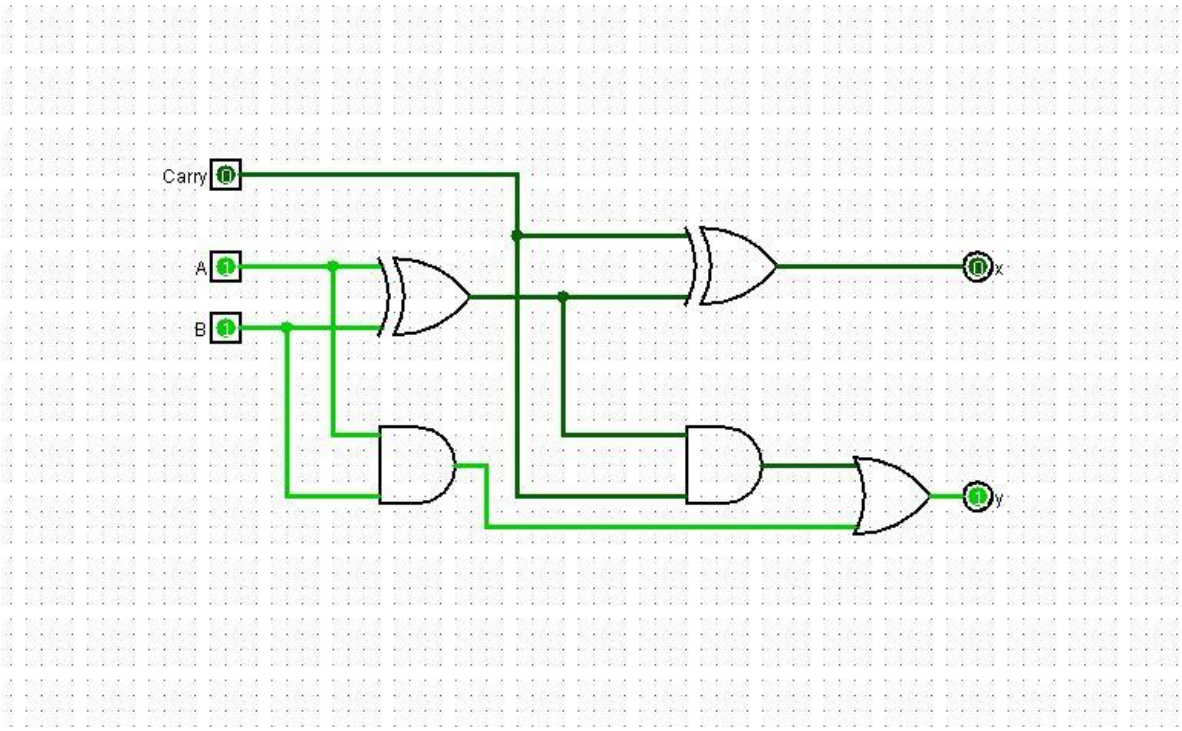
DESIGN PROCESS

Logisim

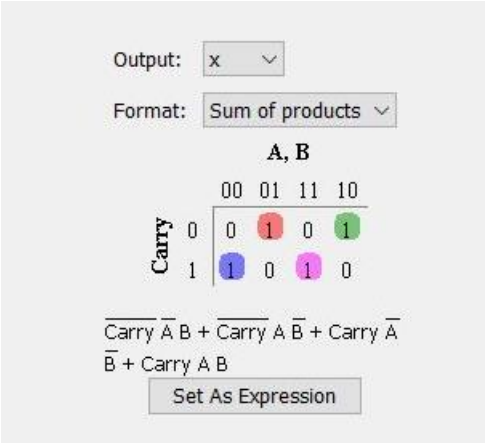


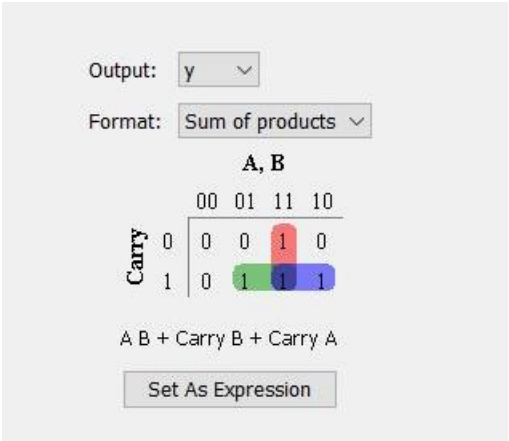
In this Logisim circuit, we assumed that there are only one parking spot at each level as we want to demonstrate it using one bit. There are two sensors (two inputs) at each level, which detects a car entering and leaving the parking place.

In this circuit, we used two adder and two subtractor. If the system detects a car entering the parking place, the subtractor will operates, hence the total number of parking spots available will decreased by 1. Meanwhile, if the system detects a car leaves the parking place, the adder will operates and the number will be increased by 1 back.



The Logisim circuit above shows the full adder which were being used in this project. The total carry out is produced by OR-ing two half adder carry outs as shown in figure. Half adder is a logic circuit block used for adding two one bit numbers. To achieve the binary addition with Ex-OR gate, we need additional circuitry to perform the carry operation. In full adder, the total carry out is produced by OR-ing the two half adder carry outs as shown in the above figure.





DETAILED DESIGNS

Inputs

total1	-	the initial total number of parking available in level 1
in1	-	input of car entering the parking place on level 1
out1	-	input of car leaving the parking place on level 1
total2	-	the initial total number of parking available in level 2
in2	-	input of car entering the parking place on level 2
out2	-	input of car leaving the parking place on level 2

Outputs

a1	-	output of car entering the parking place on level 1
b1	-	output of car leaving the parking place on level 1
	-	the total number of parking space left on level 1
a2	-	output of car entering the parking place on level 2
b2	-	output of car leaving the parking place on level 2
	-	the total number of parking space left on level 2
y / z	-	the total number of parking space in both level

Truth Table

total1	in1	out1	total2	in2	out2	a1	b1	z	y	a2	b2
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	1	0	0	1	0	0	1
0	0	0	0	1	0	0	0	1	0	1	1
0	0	0	0	1	1	0	0	0	0	1	0
0	0	0	1	0	0	0	0	1	0	1	1
0	0	0	1	0	1	0	0	0	0	1	0
0	0	0	1	1	0	0	0	0	0	0	0
0	0	0	1	1	1	0	0	1	0	0	1
0	0	1	0	0	0	0	1	1	0	0	0
0	0	1	0	0	1	0	1	0	1	0	1
0	0	1	0	1	0	0	1	0	1	1	1
0	0	1	0	1	1	0	1	1	0	1	0
0	0	1	1	0	0	0	1	0	1	1	1
0	0	1	1	0	1	0	1	1	0	1	0
0	0	1	1	1	0	0	1	1	0	0	0
0	0	1	1	1	1	0	1	0	1	0	1
0	1	0	0	0	0	1	1	1	0	0	0
0	1	0	0	0	1	1	1	0	1	0	1
0	1	0	0	1	0	1	1	0	1	1	1
0	1	0	0	1	1	1	1	1	0	1	0
0	1	0	1	0	0	1	1	0	1	1	1
0	1	0	1	0	1	1	1	1	0	1	0
0	1	0	1	1	0	1	1	1	0	0	0
0	1	0	1	1	1	1	1	0	1	0	1
0	1	1	0	0	0	1	0	0	0	0	0
0	1	1	0	0	1	1	0	1	0	0	1
0	1	1	0	1	0	1	0	1	0	1	1
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0	1	1	1	0	1	1	0	0	0	1	0
0	1	1	1	1	0	1	0	0	0	0	0
0	1	1	1	1	1	1	0	1	0	0	1

1	0	0	0	0	0	1	1	1	0	0	0
1	0	0	0	0	1	1	1	0	1	0	1
1	0	0	0	1	0	1	1	0	1	1	1
1	0	0	0	1	1	1	1	1	0	1	0
1	0	0	1	0	0	1	1	0	1	1	1
1	0	0	1	0	1	1	1	1	0	1	0
1	0	0	1	1	0	1	1	1	0	0	0
1	0	0	1	1	1	1	1	0	1	0	1
1	0	1	0	0	0	1	0	0	0	0	0
1	0	1	0	0	1	1	0	1	0	0	1
1	0	1	0	1	0	1	0	1	0	1	1
1	0	1	0	1	1	1	0	0	0	1	0
1	0	1	1	0	0	1	0	1	0	1	1
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1	1	1	0	1	1	0	1	1	0	1	0
1	1	1	1	0	0	0	1	0	1	1	1
1	1	1	1	0	1	0	1	1	0	1	0
1	1	1	1	1	0	0	1	1	0	0	0
1	1	1	1	1	1	0	1	0	1	0	1

Logic Equations

a1 = (total1 + in1) (~total1 + ~in1)

b1 = ~total1 ~in1 out1 + ~total1 in1 ~out1 + total1 ~in1 ~out1 + total1 in1 out1

a2 = ~total2 in2 + total2 ~in2

b2 = ~total2 ~in2 out2 + ~total2 in2 ~out2 + total2 ~in2 ~out2 + total2 in2 out2

y = a2 b2

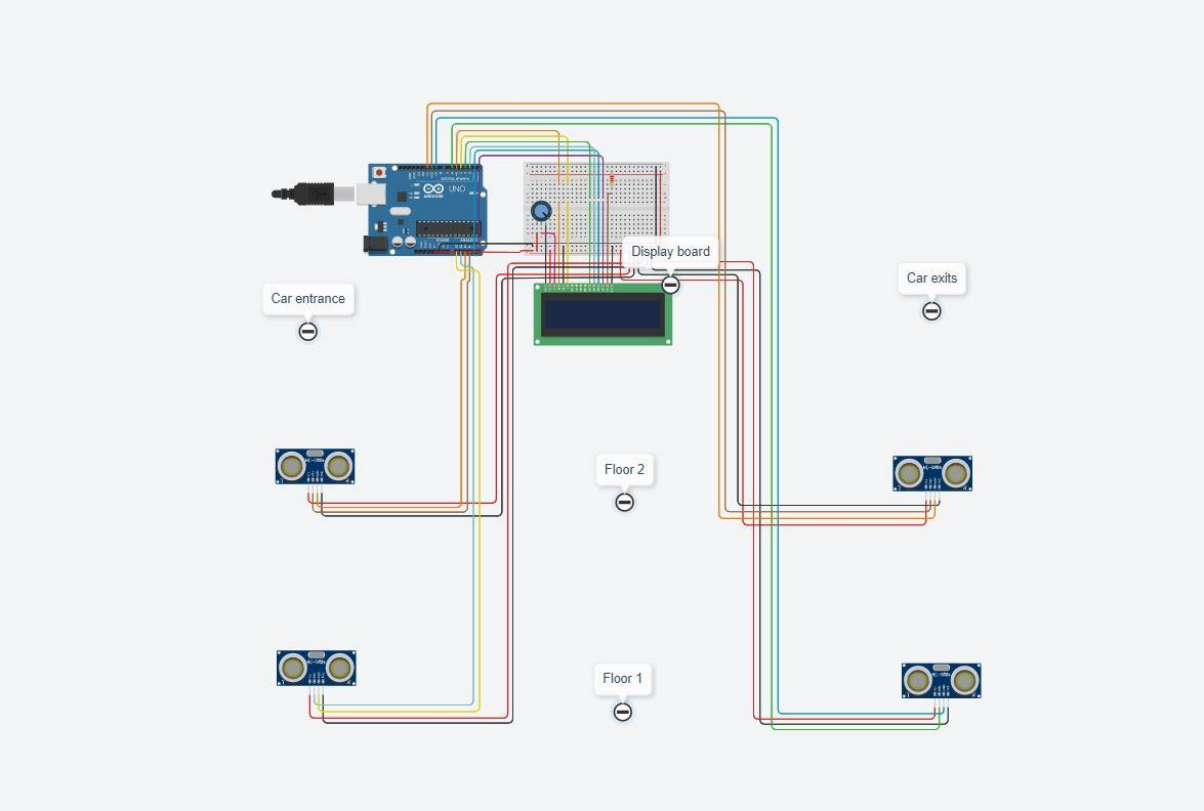
z = ~a2 b2 + a2 ~b2

DESIGN VERIFICATION – TINKERCAD

Link (This link is valid until 7th February 2021)

https://www.tinkercad.com/things/7uNR39Ci2pP-project-mcte-2332/editel?sharecode=XIFFKY_Vee-SG-fMbPbFSzz9D9lieKHJI8A8QSV5Mdc

Circuit



Coding

```
Text                                                    1 (Arduino Uno R3)
#include <Keypad.h>
#include <LiquidCrystal.h>

LiquidCrystal lcd(5, 4, 3, 2, A4, A5);

const int ECHO_PIN_IN_1 = A0;
const int TRIG_PIN_IN_1 = A1;
const int ECHO_PIN_IN_2 = A2;
const int TRIG_PIN_IN_2 = A3;

const int ECHO_PIN_OUT_1 = 9;
const int TRIG_PIN_OUT_1 = 6;
const int ECHO_PIN_OUT_2 = 11;
const int TRIG_PIN_OUT_2 = 10;

const float SOUND_SPEED = 0.034;

int floor1 = 100;
int floor2 = 100;
int total = 200;

long duration_1 = 0;
int distance_1 = 0;
long duration_2 = 0;
int distance_2 = 0;
long duration_3 = 0;
int distance_3 = 0;
long duration_4 = 0;
int distance_4 = 0;

void setup(){
  Serial.begin(9600);

  lcd.begin(16, 2);
  lcd.setCursor(0, 0);

  pinMode (ECHO_PIN_IN_1, INPUT);
  pinMode (TRIG_PIN_IN_1, OUTPUT);
  pinMode (ECHO_PIN_IN_2, INPUT);
  pinMode (TRIG_PIN_IN_2, OUTPUT);

  pinMode (ECHO_PIN_OUT_1, INPUT);
  pinMode (TRIG_PIN_OUT_1, OUTPUT);
  pinMode (ECHO_PIN_OUT_2, INPUT);
  pinMode (TRIG_PIN_OUT_2, OUTPUT);
}

void loop(){

  // INPUTS //

  // CAR ENTERING (from FLOOR 1 & FLOOR 2)

  // FLOOR 1
  digitalWrite (TRIG_PIN_IN_1, LOW);
  delayMicroseconds (2);
  digitalWrite (TRIG_PIN_IN_1, HIGH);
  delayMicroseconds (5);
  digitalWrite (TRIG_PIN_IN_1, LOW);

  duration_1 = pulseIn (ECHO_PIN_IN_1, HIGH);
  distance_1 = (duration_1*SOUND_SPEED)/2;

  Serial.print ("Distance 1 = ");
  Serial.println (distance_1);

  if (distance_1 <= 60){
    floor1 = floor1 - 1;
    total = total - 1;
  }

  // FLOOR 2
  digitalWrite (TRIG_PIN_IN_2, LOW);
  delayMicroseconds (2);
  digitalWrite (TRIG_PIN_IN_2, HIGH);
  delayMicroseconds (5);
  digitalWrite (TRIG_PIN_IN_2, LOW);

  duration_2 = pulseIn (ECHO_PIN_IN_2, HIGH);
  distance_2 = (duration_2*SOUND_SPEED)/2;

  Serial.print ("Distance 2 = ");
  Serial.println (distance_2);

  if (distance_2 <= 60){
    floor2 = floor2 - 1;
    total = total - 1;
  }

  // CAR LEAVING (from FLOOR 1 & FLOOR 2)

  // FLOOR 1
  digitalWrite (TRIG_PIN_OUT_1, LOW);
  delayMicroseconds (2);
  digitalWrite (TRIG_PIN_OUT_1, HIGH);
  delayMicroseconds (5);
  digitalWrite (TRIG_PIN_OUT_1, LOW);

  duration_3 = pulseIn (ECHO_PIN_OUT_1, HIGH);
  distance_3 = (duration_3*SOUND_SPEED)/2;

  Serial.print ("Distance 3 = ");
  Serial.println (distance_3);

  if (distance_3 <= 60){
    floor1 = floor1 + 1;
    total = total + 1;
  }

  // FLOOR 2
  digitalWrite (TRIG_PIN_OUT_2, LOW);
  delayMicroseconds (2);
  digitalWrite (TRIG_PIN_OUT_2, HIGH);
  delayMicroseconds (5);
  digitalWrite (TRIG_PIN_OUT_2, LOW);

  duration_4 = pulseIn (ECHO_PIN_OUT_2, HIGH);
  distance_4 = (duration_4*SOUND_SPEED)/2;

  Serial.print ("Distance 4 = ");
  Serial.println (distance_4);

  if (distance_4 <= 60){
    floor2 = floor2 + 1;
    total = total + 1;
  }

  // OUTPUTS //

  lcd.clear();
  lcd.setCursor (0, 0);
  lcd.print ("Total available ");
  lcd.setCursor (0, 1);
  lcd.print (total);
  delay (1200);

  lcd.clear();
  lcd.setCursor (0, 0);
  lcd.print ("Floor 1  ");
  lcd.setCursor (0, 1);
  lcd.print (floor1);
  delay (1200);

  lcd.clear();
  lcd.setCursor (0, 0);
  lcd.print ("Floor 2  ");
  lcd.setCursor (0, 1);
  lcd.print (floor2);
  delay (1200);
}
```

CONCLUSION

As a conclusion, it can be concluded that all the objectives in this project have been accomplished.

The smart car park display board system had widely being used usually at shopping complex. From this project, we can improve parking usage, reduce congestion among the driver, decrease the time spent manually searching for the parking spot and reduce the risk of distracted driving and accidents.

Even though we are not able to apply the practical work in this course, we are still able to understand the theory behind it. I would like to express my gratitude to the lecturers for creating such a comprehensive task for the learning process as an alternative in this dire situation.