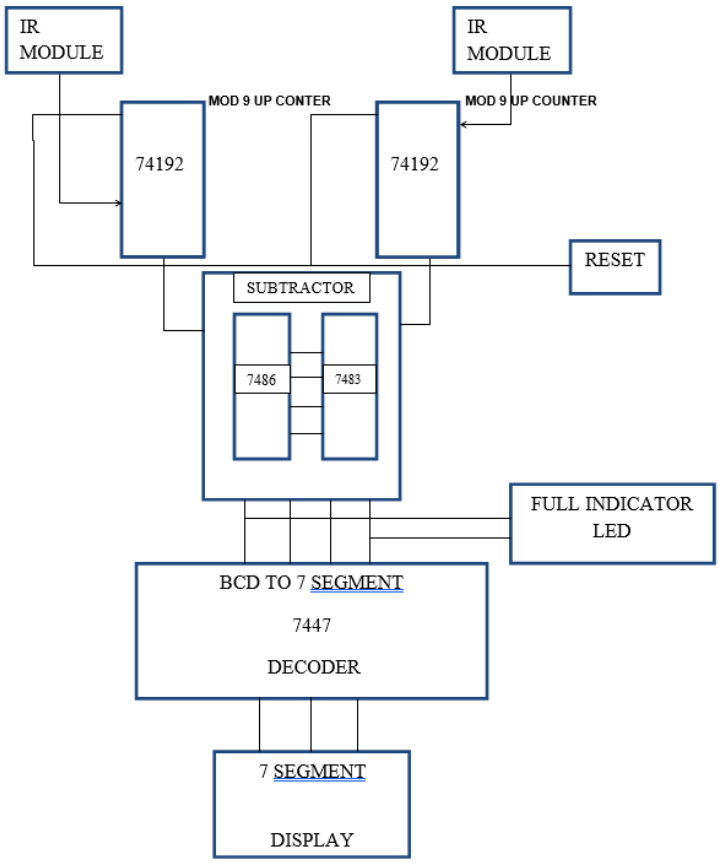
Parking Lot Counter
Using Digital Electronics

INTRODUCTION

A parking lot has definite number of spaces in which the cars can occupy. Once the parking lot is full, other cars do not have space to occupy. To indicate the number of occupied spaces in the parking lot an indicator is used.

This is a project on a simple parking lot counter. This simple circuit can be used to count the number of cars entering and exiting a parking lot. We need to monitor the number of occupied slots in the parking area by setting up proximity1 sensor at the entrance whereas the output of this sensor is high(1) when a car is entering the parking area. On the other hand proximity2 sensor is allocated in exit. The output of the sensor is high(1) when there is a car leaving the parking area. By calculating these values we can determine the number of occupied spaces.

BLOCK DIAGRAM



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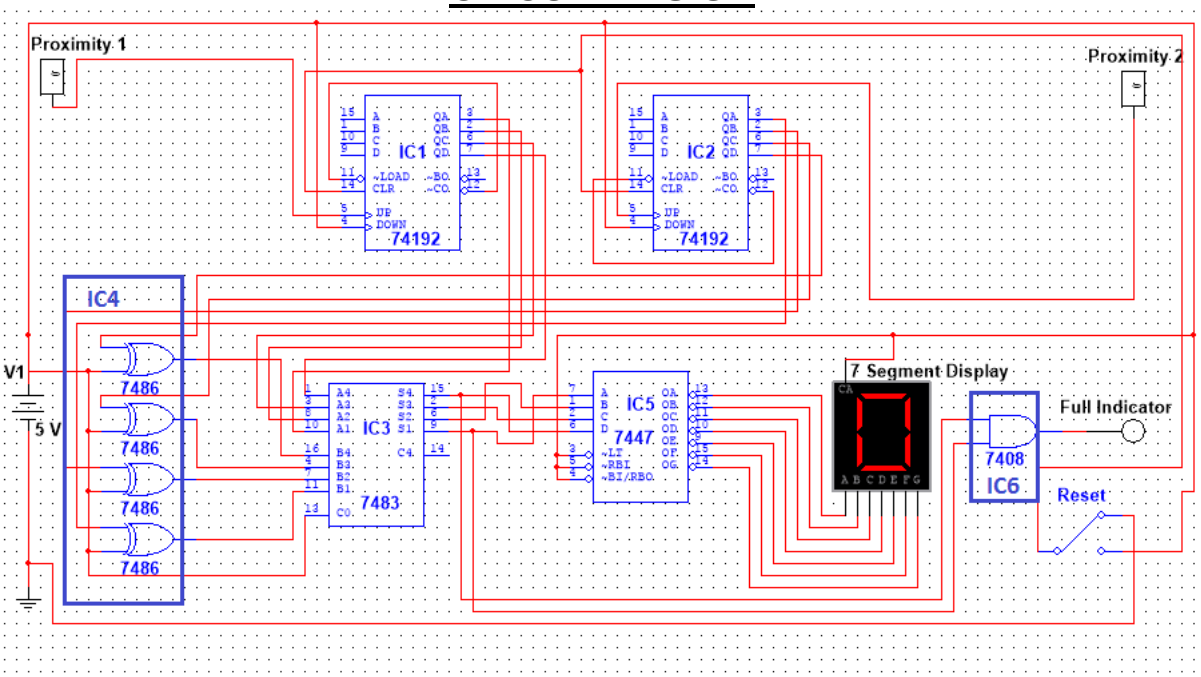
CIRCUIT DESIGN



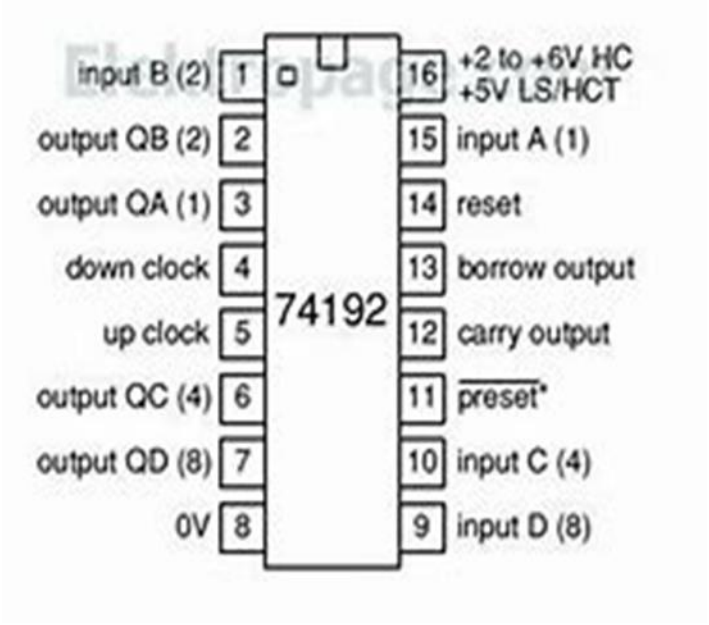
The above mentioned is the circuit diagram of a simple parking lot counter.

Note*: The circuit of IR Module is not mentioned in this diagram. In place of it, an interactive input is placed. While constructing the circuit replace the proximity with IR sensor Module.

Component Description:

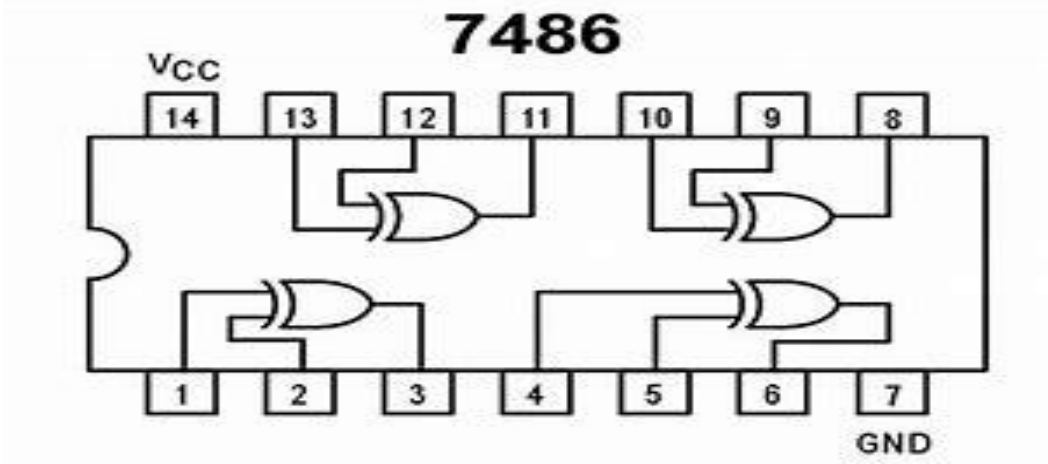
Sl.No.	Component	Description
1	IC1, IC2	IC 74192 Counter
2	IC4	IC 7486 EX-OR Gate
3	IC3	IC 7483 BCD Adder
4	IC5	IC 7447 BCD to 7 Segment Decoder
5	IC6	IC 7408 AND Gate
6	Proximity 1, Proximity 2	Infrared Sensor Module
7	Full Indicator	LED
8	Reset	Mini Push Button

IC 74192 Counter:



The 74192 is a Preset table Synchronous 4-Bit Up/Down Count. It contains four master/slave flip-flops, with internal gating and steering logic to provide master reset, individual preset, count up and count down operations. Synchronous switching, as opposed to ripple counting, is achieved by driving the steering gates of all stages from a common Count Up line and a common Count Down line, thereby causing all state changes to be initiated simultaneously. Circuit has an asynchronous parallel load capability permitting the counter to be preset. When the Parallel Load (PL) and the Master Reset (MR) inputs are LOW, information present on the Parallel Data inputs (P0, P3) is loaded into the counter and appears on the outputs regardless of the conditions of the clock inputs.

IC 7486 EX-OR Gate:



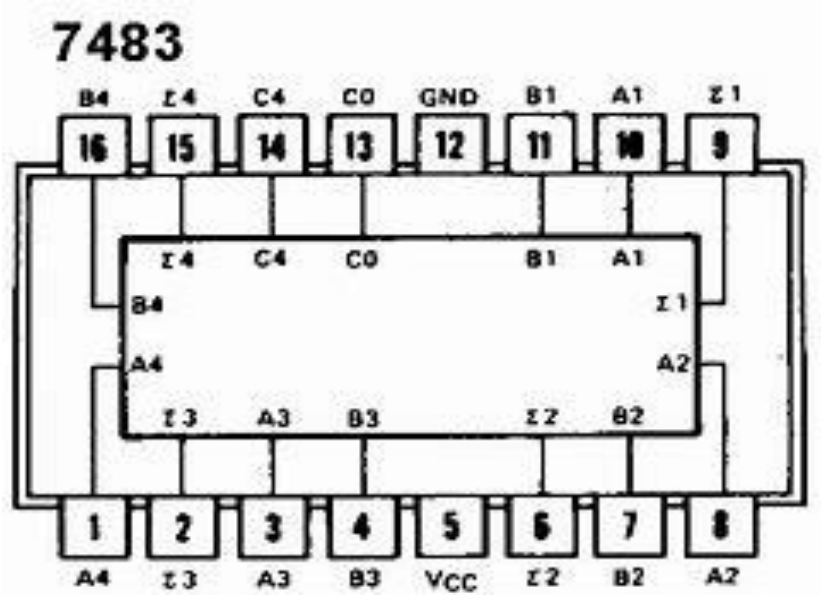
An XOR gate (sometimes referred to by its extended name, Exclusive OR gate) is a digital logic gate with two or more inputs and one output that performs exclusive disjunction. The output of an XOR gate is true only when exactly one of its inputs is

true. If both of an XOR gate's inputs are false, or if both of its inputs are true, then the output of the XOR gate is false.

If an XOR gate has more than two inputs, then its behavior depends on its implementation. In the vast majority of cases, an XOR gate will output true if an odd number of its inputs is true. However, it's important to note that this behavior differs from the strict definition of exclusive or, which insists that exactly one input must be true for the output to be true.

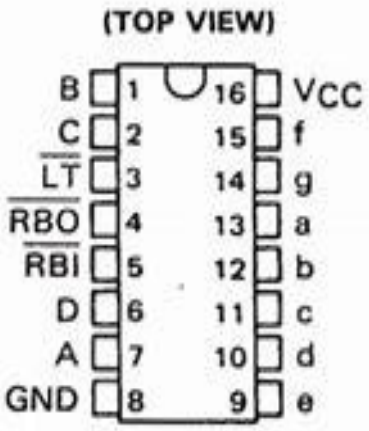
Inputs		Outputs
X	Y	Z
0	0	0
0	1	1
1	0	1
1	1	0

IC 7483 BCD Adder:



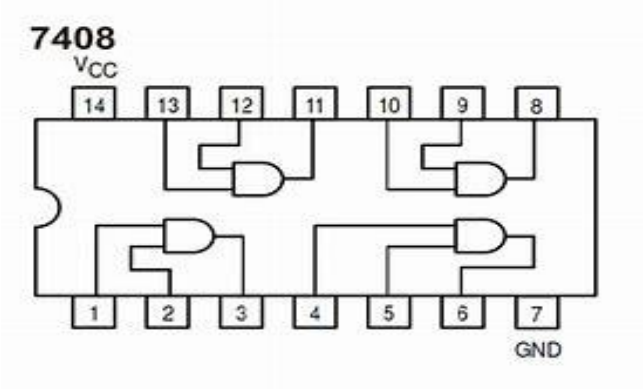
IC 7483 is a four bit parallel adder which consist of four interconnected full adder along with the look ahead carry circuit.
It is a 16 pin IC. The input to the IC are A, B, Cin while outputs are S and C out.

IC 7447 BCD to 7 Segment Decoder:



74LS47 is a BCD to 7-segment decoder/driver IC. It accepts a binary coded decimal as input and converts it into a pattern to drive a seven-segment for displaying digits 0 to 9. Binary coded decimal (BCD) is an encoding in which each digit of a number is represented by its own binary sequence (usually of four bits).
For example 239 in BCD is represented as 0010 0011 1001.
74LS47 IC accepts four lines of BCD (8421) input data and generates their complements internally. The data is decoded with seven AND/OR gates to drive indicator LEDs of the seven segment directly. The outputs correspond to Common anode (CA) configuration of seven segment.

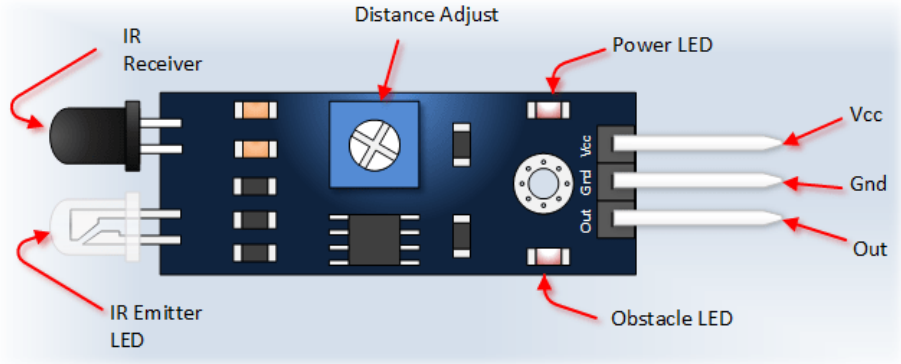
IC 7408 AND Gate:



The AND gate is a basic digital logic gate that implements logical conjunction - it behaves according to the truth table to the right. A HIGH output (1) results only if all the inputs to the AND gate are HIGH (1). If none or not all inputs to the AND gate are HIGH, a LOW output results. The function can be extended to any number of inputs.

Input	Input	Output
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

Infrared Sensor Module:



An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor .The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, The resistances and these output voltages, change in proportion to the magnitude of the IR light received.

LED

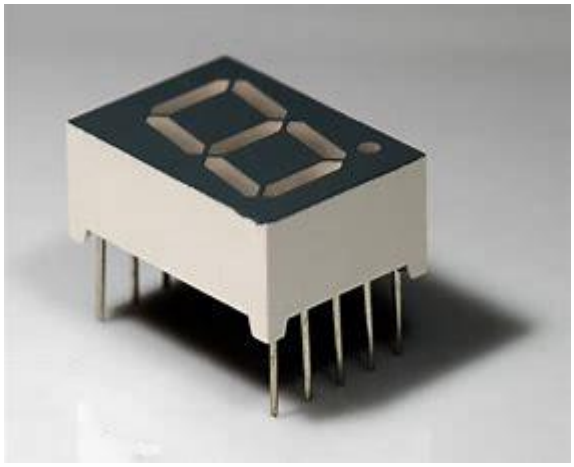
A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–n junction diode that emits light when activated. When a suitable current is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor. LEDs are typically small (less than 1 mm2) and integrated optical components may be used to shape the radiation pattern.

MINI PUSH BUTTON:

The "push-button" has been utilized in calculators, push-button telephones, kitchen appliances, and various other mechanical and electronic devices, home and commercial. In industrial and commercial applications, push buttons can be connected together by a mechanical linkage so that the act of pushing one button causes the other button to be released. In this way, a stop button can "force" a start button to be released. This method of linkage is used in simple manual operations in which the machine or process has no electrical circuits for control. Red pushbuttons can also have large heads (called mushroom heads) for easy operation and to facilitate the stopping of a machine. These pushbuttons are called emergency stop buttons and for increased safety are mandated by the electrical code in many jurisdictions. This large mushroom shape can also be found in buttons for use with

operators who need to wear gloves for their work and could not actuate a regular flush-mounted push button.

SEVEN SEGMENT DISPLAY:



A seven-segment display (SSD), or seven-segment indicator, is a form of electronic display device for displaying decimal numerals that is an alternative to the more complex dot matrix displays.

Seven-segment displays are widely used in digital clocks, electronic meters, basic calculators, and other electronic devices that display numerical information. Seven-segment displays may use a liquid crystal display (LCD), a light-emitting diode (LED) for each segment, or other light-generating or controlling techniques such as cold cathode gas discharge (Panaplex), vacuum fluorescent, incandescent filaments (Numitron), and others. For gasoline price totems and other large signs, vane displays made up of electromagnetically flipped light-reflecting segments (or "vanes") are still commonly used. An alternative to the 7-segment display in the 1950s through the 1970s was the cold-cathode, neon-lamp-like nixie tube. Starting in 1970, RCA sold a display device known as the Numitron that used incandescent filaments arranged into a seven-segment display.

WORKING PRINCIPLE

The IR Sensor Modules are placed at the entrance and exit of the parking lot. Each module consists of a transmitter and a receiver. As the vehicle approaches and passes by the sensor and digital signal is sent as a clock input to the Up Count of the IC 74192 Counter. The counter is set to its maximum count, i.e. 9 since this is a BCD counter. There is an individual timer and counter on both entry and exit side of the parking lot.

A subtractor circuit is designed using BCD Adder and EX-OR gates. The output of the counter on the entry side is connected to the first set of inputs of the

subtractor and the outputs of the exit side counter are connected to the second set of inputs of the subtractor. The resulting value from the subtractor is given to the decoder. The decoder IC 7447 converts the BCD value into 7 segment display code. The final vale is displayed on the 7 segment display.

An LED is used as a full indicator. The outputs from the subtractor are given to the led such that it only glows for the number 9. A reset button is connected to the clear pins of both counters to start back from 0.

TEST PROCEDURE

1. Circuit connections are done as shown in the circuit diagram.
2. VCC and GND are given to appropriate IC pins.

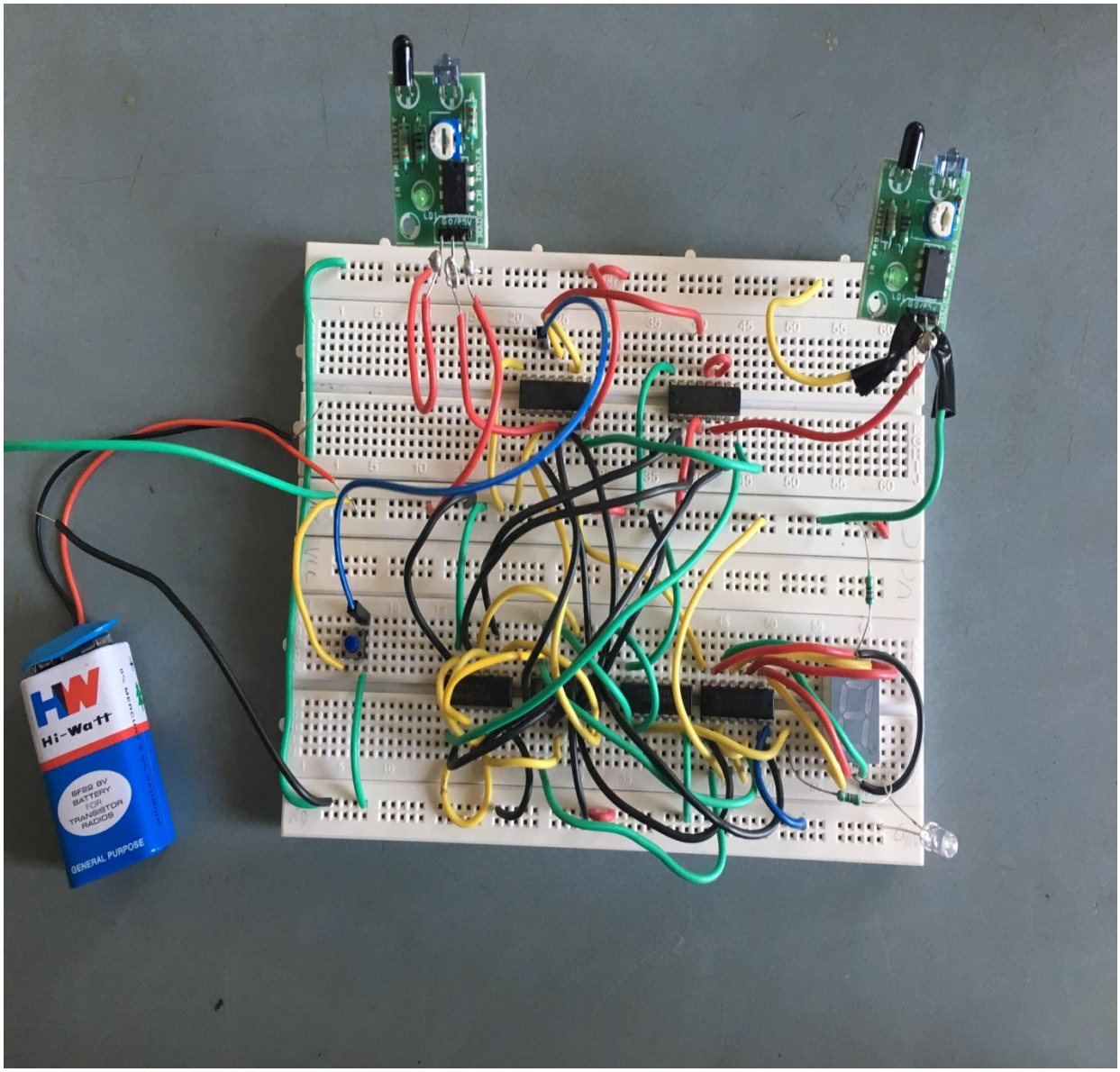
To check maximum capacity of the parking lot:

3. An obstacle is brought near Proximity 1 until the led on the module glows.
4. An Up count is observed on the 7 segment display
5. Repeat steps 3 and 4, eight more times.
6. The full indicator Led glows when 9 is displayed on the seven segment display.

To check display count when cars leave the parking lot:

7. An obstacle is brought near Proximity 2 until the led on the module glows.
8. A down count is observed on the 7 segment display.

RESULTS



The parking lot counter circuit diagram is implemented and outputs are verified.

CONCLUSION

This design is restricted to count up to 9 cars. When more number of cars is considered, this design fails. By changing the counter to a counter having higher maximum count or by using a programmable module such as an Audrino, this issue can be solved. Furthermore the proximity sensors can be improved by addition of pressure plates and ultrasonic sensors.