# PARKING SPACE INDICATOR

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**Abstract**

Design, implementation and testing of parking space indicator is described. The design make use of infrared sensors to detect the state of the parking space. The state of each parking space is identified with the use of one set of infrared transmitters and receivers. This information from each parking space is then multiplexed and transmitted via communication channel to indicator station.. The indicator station that collects the state information of different parking lanes make use of demultiplexers to identify the state of different parking lanes. The station further provides a display at a distant from the parking space indicating the availability of parking space with the use of LEDs.

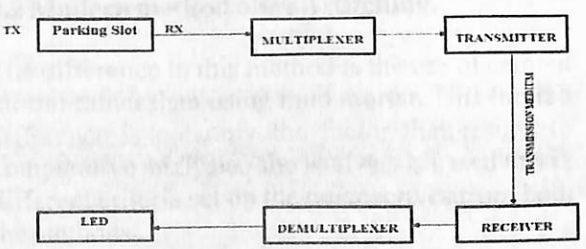
***Key Words : IR Transmitter, IR Receiver, Multiplexing, Demultiplexing.***

## 1. INTRODUCTION

Time and money are two important factors of human life, whether for an individual or a business. As living standard increases, more people inhabit cities increasing the demand for parking space, be it in town areas or at private residences. Urban life demands centralized public facilities which includes providing efficient parking tools for the drivers. Bhutanese car parking systems does not have any intelligent monitoring system and parking lots are monitored by human beings. Parking space users face difficulty driving around the town for a proper parking slot often consuming more time and fuel leading to traffic congestions and pollution.

The rapid urbanization leads to increase in the number of vehicles that will further increase in the time required to find a parking space. Designing a parking space indicator will definitely reduce the above mentioned concern thereby reducing frustration and will enhance the visitor's overall experience. Parking space indicator will alternately help the environment by reducing fuel consumption and also minimize traffic congestion.

Parking space detector consists of one pair of transmitter and receiver for each parking lane. The transmitter emits infrared light with a help of an IR LED. The receiver has a IR receiver compatible to detect the IR emitted by the transmitter. This detectors evenly covers for each parking space increasing the efficieny of the indicator as it will show the availability and unavailability of the inividual parking space. . If the parking space is available a high signal is send and low signal otherwise. The signals from the sensors of different parking space are send to the entraince of the paking lot as a single signal .That is, the signal is multiplexed and send through the communication channel to indicator station. The communication channel used here is an optical fiber. At the end of communication channel the signal conversion from light to electrical is performed. And signal is send to indicator station that consist of demultiplexer to get the orginal signal fed to the demultiplexer. The output can be directly be used for indicating the availavility of the parking for a particular parking lane. This provides a higher efficiency by saving time of searching for a parking space by the driver as this system will directly pinpoint which parking space is available.



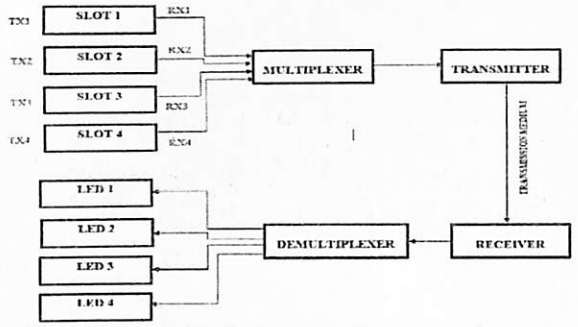



**Fig. 2** Complete block diagram of the porposed system

**The basic working of the parking space can be explained as following steps:**

1. Firstly power supply of 5 volts is supplied to all the circuitaries of the system.
2. A transmitter and receiver pair in each parking slot will detect the availability and unavailability vehical. There will be output of 5 volts from the transmitter if there is no vehical and 0 volts if there is car.
3. The respective outputs from he sensors of different parking slots are multiplxed into a single signal by a multiplexer.
4. The multiplexer output are send trought a optical fiber.
5. Optical fiber output is fed to a demultiplexer which gives out the same output that was fed to the multiplexer input.
6. Finally a disply section consistes of LED corresponding to to the number of parking spaces.

## 2. SYSTEM DESIGN

The proposed system consists of a detector station, transmission system and indicator station. Detector station consist of IR transimitter and IR receiver. Whereas the transmission system consists of multiplexing unit, optical fiber transmission channel and demultiplexing unit. Finally the indicator station consist of threshold circuit and display unit.

### 2.1. IR Transmitter

The system uses an IR LED, OSI5FU5111C-40. This emits IR signal at a frequency of 38 kHz. The IR transmitter is designed using the 555 timer IC in an astable multivibrator mode which generates IR signals at 38 kHz with time period of 0.0264 ms.

The output from the timer is a continuous pulse waveform of 38kHz. In this mode, the trigger pin is connected to the threshold pin causing the output to toggle continuously between the high and low states. The output of 555time is fed to the IR LED with transmits infrared light.

**Fig. 3** IR LED

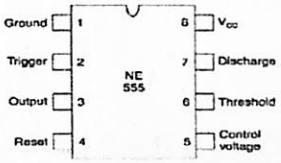



**Fig. 4** 555 timer IC

### 2.2 IR Receiver

In the IR receiver circuit, the IR signal transmitted by the IR transmitter is detected by the IR sensor, TSOP1738 at 38 KHz. TSOP1738 is an active low component so the output from the TSOP1738 is low when there is no interruption between the transmitter and the receiver, and high when there is an interruption thereby hampering the desired output.

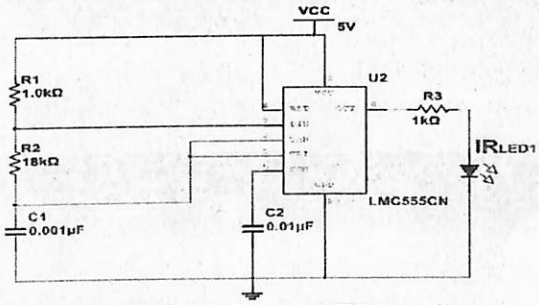



**Fig. 5** Circuit diagram of IR Transmitter

Thus a 555 timer in mono-stable mode is used which will get triggered when there is an input pulse i.e., when signal is not interrupted it will give a high output and low output when there is an interruption. Basically 555 timer in mono-stable.

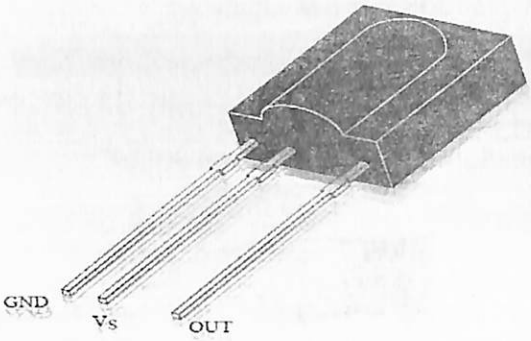



**Fig. 6** TSOP1738 IR sensor

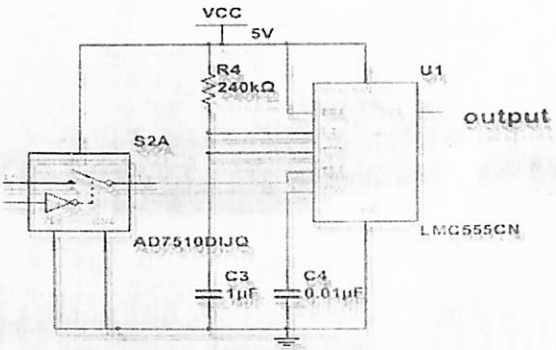



**Fig. 7** Circuit diagram of IR receiver

However, in the figure above, in place of the IR sensor, a switch having the same working principle as the IR sensor is used due to the unavailability of the IR sensor template in Multisim.

## 2.3 Multiplexing Unit

The Parking Space Indicator (PSI) uses a multiplexer to combine all the signals to produce a single signal. The signals received by the IR receiver sensor are given in to the multiplexer in order to produce a single output signal. The specification for the Multiplexer used is 74HC151 which is an 8x1 multiplexer. It needs three select inputs at S0 S1 and S2 as per the data sheet. 4 bit JK flip flop asynchronous up counter was developed to provide select inputs for the multiplexer. The clock for the counter was provided from the 555 timer astable multi-vibrator just as the one from the transmitter mode is used to reverse the output from TSOP1738.

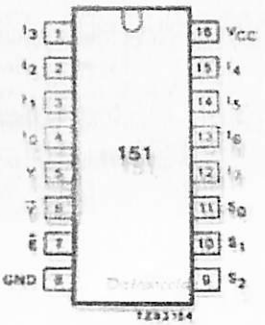



**Fig. 8** 74HC151 multiplexer

## 2.4 Transmission system

In transmission section Benchmark FTRO 110 fiber optical communication link is used. This system consistes of the digital transmitter, the analog/digital receiver and optical fibre to link the transmitter and the receiver. The transmitter transmits the output signal from the multiplexer to the receiver via an optical fibre.

The FOTR-110 transmitter has inbuilt filter, driver, and LED and the FOTR-110 receiver has inbuilt photo detector, I-V converter, amplifier and comparator and Buffer. Power supply of 9 volts is required for the transmitter and ±9 volts for the receiver.

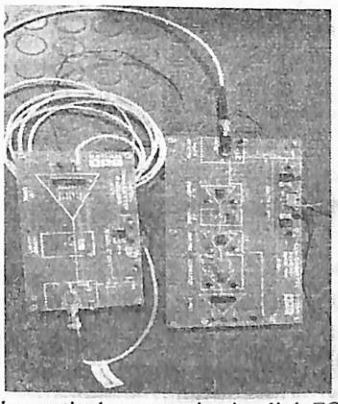


**Fig. 8** Fiber optical communication link FORT- 110

## 2.5 Demultiplexing Unit

The demultiplexer used is 74HC138 which is a high speed 1-to-8 decoder or Demultiplexer. For it to work as 8-output demultiplexer with one input,

one of the active low enable inputs is used as the data input and other enable lines are connected to its active high or low inputs. The three input A0, A1 and A2 are used to provide enable signals using the same counter as the one used for the multiplexer and are connected in accordance to its truth table from the data sheet.

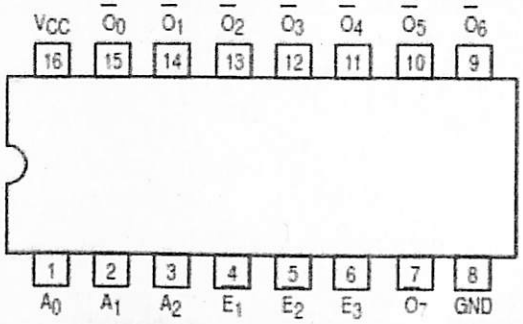



**Fig. 9** 74HC138 demultiplexer.

The output from the demultiplexer is same as the input fed to the multiplexer.

### 2.6 Indicator Station

The output from the demultiplexer are connected to the different LEDs. Each LED stands for differnet parking spaces and will glow in accordance to the parking space it represents when ther is parking space available.

### 2.7 Power supply

Power supply required for system is 5 Volts, which can easily be provided by using 9 volts battery and a 5 volts regulator. But for the system to be more efficient, power supply can be provided from the commercial line. For this power supply needs to be designed.

## 3. SYSTEM TESTING AND ANALYSIS

### 3.1. Testing

The practical testing was not done in an actual parking space but was done in a laboratory due to the distance constraines of the sensor. Three transmitter and receiver pair were place on a table separated by certain distance. When a obstacle was place in between the transmitter and receiver pair the output was observed on a CRO.

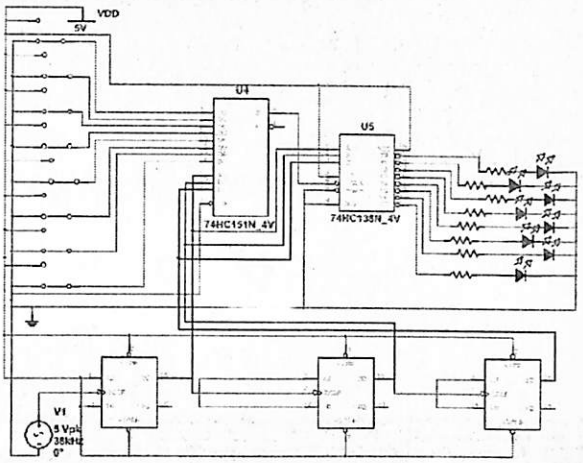



**Fig. 10** complete circuit diagram of the multiplexer and demultiplexer.

When there was a no obstacle the output from the receiver was 5 volts and 0 volts otherwise for all the three transmitter and receiver pair. This output was fed to a multiplexer which multiplexed the three input into a single single and its output was also obsorbed on a CRO. The time period gets divided with addition of an transmitter and receiver to the multiplexer. This singnal is transmitted through an optical fiber and fed to a demultiplexer. The final output is obsorbed from the demultiplexer by conneting it to three different LEDs. Testing was done for different sections and was observerd at each section.

### 3.2 Critical Analysis

The entire system was found to be very sensitive especially the receiver. The receiver had to be given proper power supply and grounding needed to be properly done. TSOP1738 was especially sensitive as it received only 38 kHz from the transmitter. Small change in the infrared frequency from the transmitter changed the functioning of the receiver, it acts as motion detector. A small experiment was conducted to find out the range and the angel of reception by the receiver. Three transmitter and receiver pair were considered: then the distance between them where

gradually changed to find the maximum distance covered. At the maximum distance the maximum angle of coverage was also found for the considered TX-RX pair which was 40°. The output voltage from the receiver was also noted. Maximum distance coverage was 49 cm and the output voltage observed from the CRO was found to be 5 volts. Table below shows the output of the experiment conducted mentioned above.

**Table** Table showing the maximum distance, broad angle elevation of sensor sensitivity.

| Sensors | TX | RX | Distance covered(cm) | Angle ⊖ (degree) |
|---|---|---|---|---|
| Sensor A | TX 1 | RX1 | 45 | 40 |
| Sensor B | TX2 | RX2 | 37 | 15 |
| Sensor C | TX3 | RX3 | 49 | 30 |

**Table** Table showing the output voltage from each sensor

| Sensors | Distance (cm) | Amplitude (V) |
|---|---|---|
| Sensor A | 45 | 5.6 |
| Sensor B | 37 | 5.6 |
| Sensor C | 49 | 5.6 |

## 4. FUTURE WORKS

The following can be carried out as future works:

- Increase the efficiency of the system by working on more number of parking slots.
- Increase the range of the TX-RX pair.
- Design a common power supply for the system.
- Design the power supply in such a way that it can be turned off when not in use in order to save power and energy.
- The transmisstion medium used can be changed to wireless.
- The transmission medium used can be changed to wireless.

## 5. CONCLUSION

Due to tremendous advancement in technology, the prices of vehicles are now economical so that even an average person can buy one. This contributed to the already increasing number of vehicles and hence shortage of parking areas. Every driver tries to park his vehicle properly in the limited available slots ultimately creating chaos at the parking place. Thus, a system to regulate the parking is essential. This project solves the mentioned problem by regulating the number of vehicles that can be parked in an area. This system not only reduces traffic congestions but also makes it easier for the drivers to find a parking slot thereby saving their time and fuel. It also lessens wastage of parking spaces.

This project has given us the knowledge and confidence about how one should implement his thoughts into reality and achieve the desired outcome. Working on this project, we learnt how one should work in a team and how to co-operate with each other. This project greatly enhanced our technical knowledge as well as experience.

## 6. ACKNOWLEDGMENT

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