

# FIBER BASED LASER TRANSMISSION TO CONTROL LOAD VOICE AND DTMF COMMUNICATION IN COAL MINE

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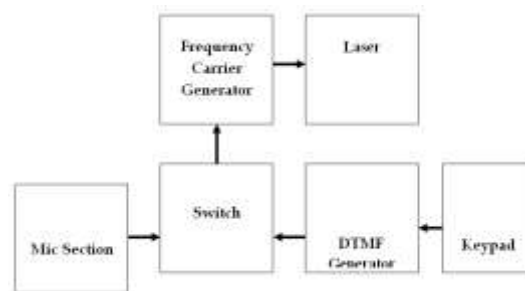
## ABSTRACT

The project "Voice and DTMF Communication Using Laser" is useful system for indoor voice and DTMF transmission. In this system voice signal is converted as voltage signal using condenser mic. By using IC 555 carrier frequency is generating up to 10 KHz. The voltage signal from condenser mic and carrier frequency is fed to mixer unit. The mixer units drive the laser source. Based on the signal strength laser intensity is modulated. The same way DTMF is fed to mixer unit to drive the laser source. In receiver end, LDR based opto device is used to receive the laser signal. The intensity variation of laser is converted as voltage variation by using voltage divider circuit. The voice signal is observed through amplifier and speaker. The DTMF signal is observed using DTMF decoder circuit. By using this circuit's arrangement we can send the signal indoor application.

**Keywords:** Laser Dtmf, Laser Voice Circuit, Transmitter, Receiver

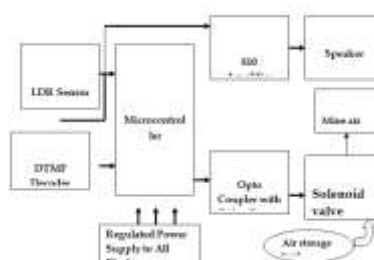
## I.INTRODUCTION

### Transmitter



**Figure 1: Block Diagram of Transmitter**

### 1.1.RECEIVER



**Figure 2: Block Diagram of Receiver**

## 1.2 LASER DETECTOR

This block consists of LDR based voltage divider circuit. The light intensity variations produce potential variation at the junction of voltage divider circuit. The potential variation is latch o next amplify stage.

## 1.3 TWO STAGE AMPLIFIERS

This block consists of transistor BC 548-based two-stage amplifier. This two-stage amplifier amplifies the very low level signal into reasonable level of voltage. The output of this stage is fed to audio amplifier.

## 1.4 PRE AUDIO AMPLIFIES

This block consists of IC 810 based pre amplifier circuit. This amplify stage amplify the very low audio signal into available level. The output is fed to speaker.

## II. SPEAKER

This block consists of 8-Ohm speaker to produce audio output to audio level.

### 2.1 IC 555 BASED MODULATOR CIRCUIT

This block consists of IC 555 based, square wave generator to generate square wave in the frequency range of 10 to 15 KHz. In this circuit IC 555 is wired as an astable circuit. By adjusting the timing components we can adjust frequency of square wave.

### 2.2 DTMF GENERATOR CIRCUIT

This block consists of IC 91214B based DTMF generator circuit. By using matrix key arrangement we can generate 12 different DTMF signal. Each rows and columns have different frequency to generate different signal.

### 2.3 DTMF TO BCD DECODER

This block consists of IC 8870-based DTMF to BCD decoder. It has the pins for receiving DTMF signal and produce BCD values. There is also acknowledgement pin for indicating signal receiving. Basically this block is used to convert DTMF into BCD system.

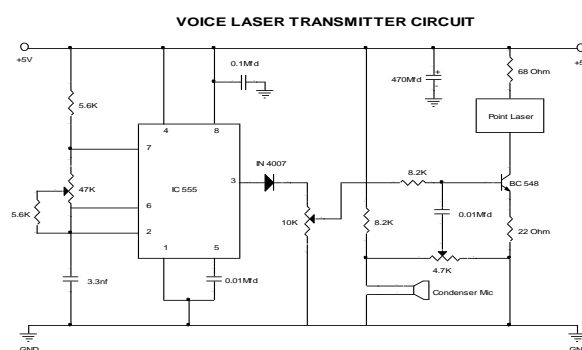
### 2.4 BCD TO SEVEN-SEGMENT DRIVER

This block consists of IC 4511-based BCD to seven-segment driver. The output pins are capable to drive common cathode display. For every BCD value it produce seven segment code.

### 2.5 Display

This block consists of common cathode display. It is formed using eight LED's. The LED's are arranged in number 8 shapes. The required decimal number is formed based on Seven-segment code

## III. VOICE LASER CIRCUIT



**Figure 3: Voice Laser of Transmitter Circuit**

### 3.1. Circuit Description & Operation

The circuit is designed to transmit the voice signal through laser rays. Here IC 555 based circuit provide 10 to 15 KHz carrier frequency to carry the voice signal for long distance through laser. The frequency adjustment is done by adjusting 47K preset. By using condenser mic setup, our voice signal is converted into electrical signal. The 8.2K-Ohm resistor and condenser mic from the voltage divider circuit. Depending upon the voice variation, the potential at voltage divider also vary. This potential variation is directly proportional to voice signal. The carrier frequency and voice signal are fed to transistor based mixer unit. The base current of transistor BC548 is varied with potential variation of voice signal. The point laser is connected at collector side. The intensity of point laser is depending upon the current flow through laser. The laser current is controlled by base current of transistor BC548, so the intensity of point laser is controlled by voice variation (i.e.) voice variations is directly proportional to the laser intensity.

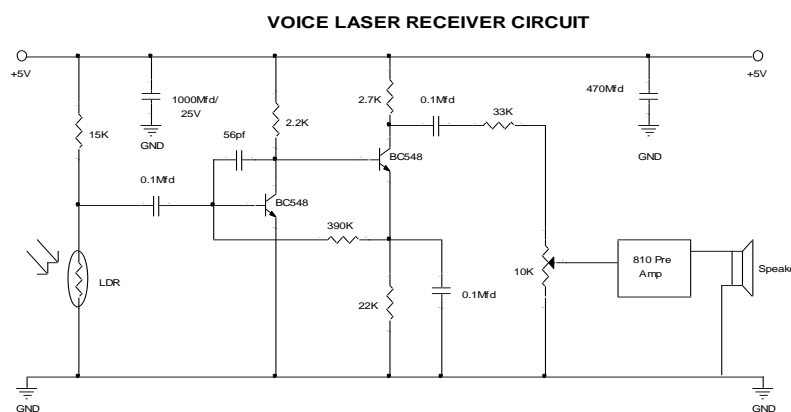


Figure 4: Voice Laser of Receiver Circuit

### 3.2.Circuit Description & Description

The laser voice receiver circuit consists of photo detector, two stage transistor amplifier audio pre amplifier and speaker. Here LDR is act as laser detector. The resistor 15K and LDR from voltage divider circuit. Depending upon laser intensity potential at voltage divider function is varied. The potential variation is directly proportional to the voice signal strength variation. This signal is fed to two stage transistor BC 548 based amplifiers. The 0.1Mfd capacitor allow voice signal any block DC voltage (i.e.) it acts as DC blocking capacitor. The signal application by two stage amplifier is not, so the output of two stage amplifiers is fed to IC 810 based pre – audio amplifier through 10K Pot. By adjusting 10 K resistors we can control the input signal level of audio pre amplifier. The audio output is observed at 8Ω speaker.

## IV.LASER BASED DTMF CIRCUIT

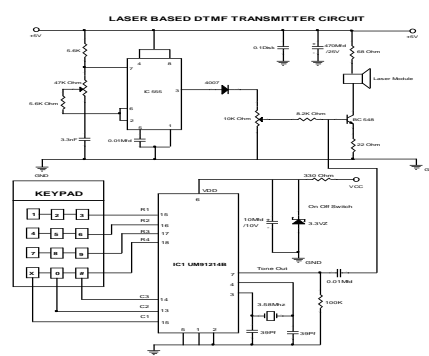


Figure 5: Voice Laser of DTMF Transmitter Circuit

## V. CIRCUIT DESCRIPTION & OPERATION

The circuit consists of IC 91214B based DTMF generator circuit and modulator with mixer circuit. The dual tone multi frequency is generated using IC 91214B, which produce seven different frequency for four rows and three columns. The frequency range is in between 800Hz to 1500Hz. The base oscillation is done by 3.58 MHz crystal. This IC is powered by 3V power source, which is designed using 3.3V zener diode based regulator circuit.

The DTMF system is specially designed for telecommunication number dialing purpose. So the frequency range of DTMF signal is in audio frequency. The DTMF output is available at tone out pin by multiplying four-row and three-column frequency. By using different combination of row and column 12 different DTMF signal are generated. To select rows and columns, keys are arranged in matrix form. The different DTMF signals are generated by pressing different key.

When pass a particular key one of the row and column engaged and produce different frequency. The DTMF signal & 10 to 15 KHz carrier signal is fed to mixer unit. Depending upon the signal strength the laser intensity is varied.

The IC 555 circuit is used to generate 10 to 15 KHz square wave for modulating the DTMF signal. The LASER intensity is controlled by the base current of mixer transistor BC548. The DTMF signal & carrier signal control the base current of mixer unit consequently control laser current.

## VI. MERITS

1. The signal transmission without wire reduces the wiring cost.
2. Reduce the manual risk.
3. We can design this circuit using easily available electronics components.
4. The cost of the system is comparatively less than RF signal transmission system.

## VII. LIMITATION

1. The laser path should be clear if there is any obstacle the signal communication affected.
2. The critical alignment of signal path is somewhat difficult.
3. In laser communication distance is limited depending upon the strength of laser signal.

## VII.CONCLUSION

The voice & DTMF signal communication through laser is working very well. Both signals are received in receiver end with minimum noise level. The noise is due to external atmospheric lighting condition. It may be reduced by covered arrangement. To produce clarity in the voice signal the amplifier section is also designed with carefully.

In further this system may be developed by using DSP based high-end electronics.

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