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FREQUENCY MODULATION (FM) BASED REMOTE SWITCHING SYSTEM

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Abstract:

To Control a particular electrical home as well as industrial equipment through a wireless remote control switch, even if there is an obstacle in between destination and remote switch.

The channel remote control based on frequency modulation using only a single switch in hand. We can control number of channel or system through it, from several kilo meters within its range.

With the help of F. M. based remote switching system we can control electrical and mechanical system up to 5 Amps. The system operating frequency range in between 88 MHz to 108 MHz Remote control signal will transmit through FM transmitter from one end and the other end FM receiver receives the signal and control particular equipment from the distance place.

This circuit implemented for home appliances, offices, small scale industries and many more equipments which can operate from distance.

KEY WORDS:

Frequency Modulation , industrial equipment , frequency modulation , electrical and mechanical.

INTRODUCTION

Remote control is a device which controls the operation of any mechanical, electrical and electronics device from the distance place. Most of the audio, video and daily house hold systems or industrial system controlled by remote control.

The remote control used in day today's life that are infra-red (IR) based. If there is an obstacle in between destination and remote then the IR based remote cannot work and also the range of operation is very less for IR.

Instead of this if we use frequency modulation technique for remote control switch then the moving person can operate any system from several kilo meters even if there is an obstacle in between destination and remote.

The whole circuit requires DC supply voltage that are supplying through regulator.

TRANSMITTER SECTION:--

It consists of FM transmitter which produces FM waves in the range of 88 MHz to 108 MHz FM transmitter is preferred over amplitude modulation (AM) and pulse modulation (PM) because it provides greater protection from noise for lowest modulating frequency. Two of the most notable advantages are the provision of guard band between adjacent transmissions and the use of pre-emphasis and de-emphasis.

In this section dual tone multi frequency generator generates different channel frequencies. These

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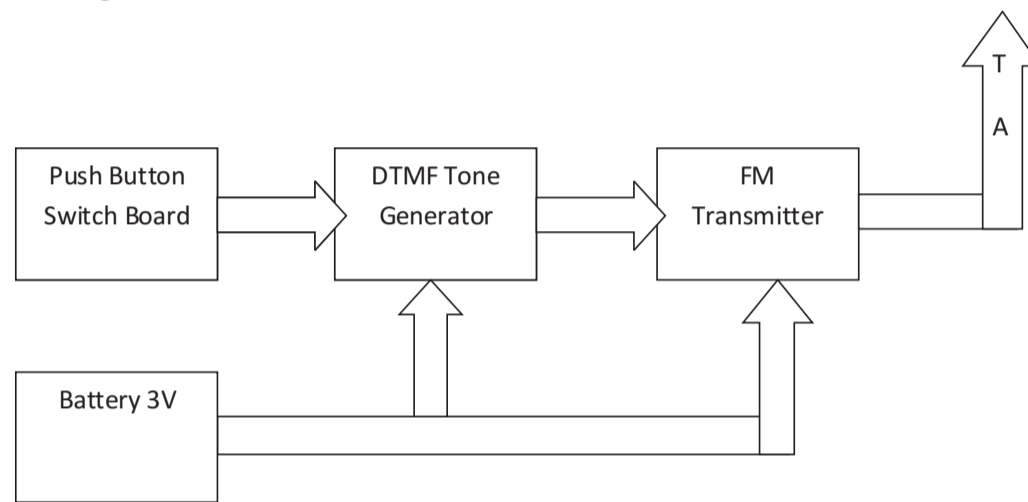
modulating frequencies are modulated by the FM signal. Then this modulating frequencies modulated signal feed to the antenna, antenna transmitted the modulated signal.

The receiver de- modulates the signal and provides the modulating signal to control section so that the particular load is operated.

COMPLETE STRUCTURE OF TRANSMITTER SECTION:--

The transmitter section consists of switch boards, dual tone frequency generator, FM transmitter and battery etc.

Block Diagram of FM transmitter



DTMF (Dual-Tone Multi frequency generator):--

The power supply required for the dual tone multi frequency generator is 3V DC provides twelve tones. This tone generally used in telephones.

Following table gives the complete idea about different tones.

	Column 1 (1209 Hz)	Column 2 (1336 Hz)	Column 3 (1447 Hz)
Row 1 (697 Hz)	1	2	3
Row 2 (770 Hz)	4	5	6
Row 3 (852 Hz)	7	8	9
Row 4 (941 Hz)	*	0	#

In DTMF telephones the numbers are transmitted using different tone frequency pairs called rows and columns. A normal telephone has 12 buttons arranged in three columns and four rows, each rows and columns in the keypad matrix activated a specific frequency tone. When a key is pressed different frequency tones corresponding to the combination of row and column are generated. For ex. Pressings 8 will generate a corresponding combination of row and column frequencies of 852 Hz and 1336 Hz respectively. Similarly by pressing different keys different corresponding combinations of frequencies are generated and thus we control or operate number of loads (N- channel loads) from distance place.

Transmitter:--

The frequency generated at dual tone multi frequency generator provides to the microphone. A

FREQUENCY MODULATION (FM) BASED REMOTE SWITCHING SYSTEM

microphone is a device which convert sound wave into electrical waves. When dual tone generator generates tone the varying air pressure generates electrical signal which corresponds in to the original signal. The carrier frequency is obtained from variable LC tank oscillator. The variation in either capacitance or the inductance is made proportional to the voltage supplied by the modulating circuit which results in true FM wave.

The voltage at the base transistor will vary the junction capacitance which will vary the frequency of oscillation and hence the frequency of un modulated signal i. e. carrier signal. Power supply required for the FM transmitter is 3V DC.

The modulated signal fed to the antenna that radiates the FM signal. The tank circuit generates FM signal has frequency 90 MHz, there are different types of transmitters for different application related to their distance clarity. There are two main types of transmitter according to the way of modulation.

- A.FM transmitter
- B.AM transmitter

AM transmitter is generally used for video transmission and sound transmission. FM transmitter is used for this system because it is well and good with within this specified range.

Receiver Section:-- FM receiver divided in to three parts.

- A.FM receiver
- B.Control section
- C.Relay section

FM receiver:--

FM receiver is a super heterodyne receiver. It is very much similar to AM receiver. Operating frequency is very high in FM and there is need for limiting and de- emphasis in FM demodulation method. Typically frequency range for receiver operation in between 88 to 108 MHz frequency band are an IF 10.7 MHz and a bandwidth of 200 KHz.

Control section:--

The demodulated signal is then goes to BCD generator. The BCD generator generates the signal as per the channel frequencies. The BCD coded signals are then connected to the BCD to decimal converter it converts the BCD code to the decimal code respectively.

The pulse i. e. decimal code signal is fed to the input of the OR gate circuits the particular OR gate enabled as per the output of the decimal generator. The output of the OR gate circuits provide to the D-Type flip flop then that particular or selected D-Type flip flop operated and then output fed to the LED driver, to drive the LED as well as the relay circuit.

Relay section:--

In this section there are relays mounted on PCB such that they are used for switching loads. Actually receiver section is interfaced with digital section and digital section is interfaced with relay section, further the relay circuit is interfaced with the loads like fan, tubes, machines and pumps.

Whenever the signal is transmitted through a transmitter receiver receives the signal and due to this a particular relay gets operated due to which a corresponding load is activated.

FM receiver:--

The receiver detects the transmitted signal with the help of remote transmitter for particular channel selection.

There are two main types of receivers

- A.TRF receiver
- B.Super heterodyne receiver

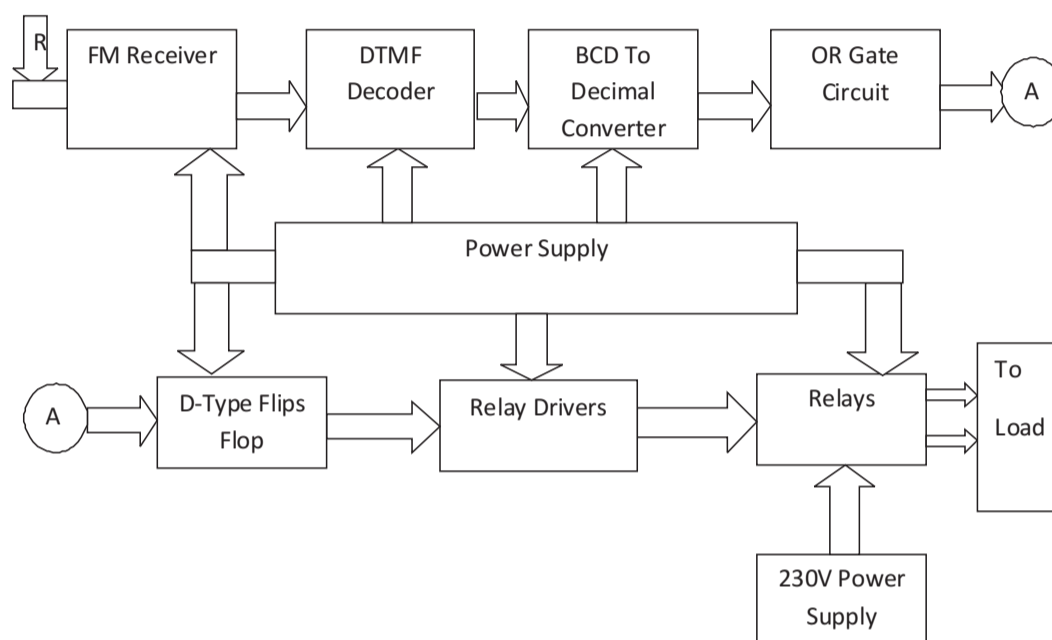
The TRF receivers were used till Second World War but later on it becomes absolute due to complexity in RF stage. The FM receiver is used as a super heterodyne receiver for this system. It consists of RF amplifier, mixer, local oscillator, IF amplifier, limiter, discriminator, de-emphasis and then AF and power amplifier.

FREQUENCY MODULATION (FM) BASED REMOTE SWITCHING SYSTEM

The basic difference between FM and AM receiver are as follows

1. Generally much higher operating frequency.
2. Need for limiting and de-emphasis in FM.
3. Totally different methods of demodulation.
4. Different method to obtaining AGC.

Block Diagram of FM receiver



DTMF Decoder:--

DTMF decoder is AC coupled to telephone line and keeps on sending tone frequencies. As soon as a valid DTMF digit is detected it sets a STD signal high interrupt the micro controller. DTMF detector also requires a 3.58 MHz crystal forecast saving the output of micro controller. Micro controller then reads the incoming data signal by making output enable.

Control Section:--

The output of FM receiver that is modulated signal/tone connected to the BCD code generator. BCD code generator generates code according to the particular channel frequency coming through the demodulator to generator. The A-B-C-D output of BCD code generator is connected to the A-B-C-D input of the IC BCD to decimal generator.

The output of BCD to decimal generator connected to the input of the IC OR gate. The high pulse output to OR gate from BCD to decimal generator enable the OR gate. So that the pulse output from the OR gate connected to the D-Type flip flop.

The D-Type flip flop has only one input refer to as D input or data input. It is clear that output Q_{n+1} at the clock pulse equally the input D_n before the clock pulse. This is equivalent to saving that the input data appears at output at the end of the clock pulse.

The output Q of the D-Type flip flop initially low (0). The Q output so that is high (1). The output Q is connected to the D input. So that at the arriving of clock pulse the D-Type flip flop enable. At the end of clock pulse the output goes to high state (1) and if already high output Q then Q goes to low state (0). The 0 or 1 output connected to D input so that after clock end the output of the D-Type flip flop goes low. In this way the D-Type flip flop act as a toggle switch.

The output of the D-Type flip flop (high/low) connected to the LED driver the LED driver glows the LED as the particular input specified. The output of the LED driver is also connected to the relay circuit. Thus the particular relay operated the load.

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Power Supply:--

1.5V two cell for in series to satisfy 3V requirement for receiver circuit. The main supply 230V AC is connected to the relay circuit as well as provides to the receiver through step down transformer, rectifier and regulator. The relay circuit has the input 230V 50Hz so that relay operated the load. The receiver IC required 15V DC and relay circuit requires 12V DC. The bridge rectifier provides 12V DC through the transformer. Regulator IC 7805 gives 5V DC supply to the other IC.

Load:--

We can divide the loads connected for controlling purpose in to two groups' heavy loads and light loads.

A.Heavy load:- The machines of any work such as fabrication workshop as well as small scale industries comes under this category. The common machines are drilling, welding, lath, CNC and cutting machines etc.

B.Domestic or light load:- The light loads can be categorized as follows. Water pump, tape, television, fridge and mixer etc.

Merits/Advantages:--

- 1.FM based remote control can operate from the range much larger than the ordinary remote based on IR.
- 2.This remote has the capacity of operating even in the presence of obstacles.
- 3.With only single switch in hand a number of channels can be operated from several kilo meters just by cascading the ICs.
4. The designing in compact and hence needs a little space.
- 5.Power consumption is quite low.
- 6.Display LEDs are provided for visual indication of each channel.
- 7.Fault finding is an easy job because totally digital circuitry is used.
- 8.Easy to design.

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