

RF based Remote Control for Home Electrical Appliances

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Abstract: This work presented here is to controlled independent home electrical appliances through RF based remote system. From any place without any line of sight around the house, RF based wireless remote control system can change the state of the electrical appliances either in on state or off state. The controlling circuit is built around RF transmitter and RF Receiver modules which are operating at 434 MHz along with encoder IC HT12E and decoder IC HT12D with few passive components. The four different channels at the encoder are used as input switches and the four channels at the decoder output are connected to the appliances through a relay. Here the transmission technique is amplitude shift keying (ASK) and the circuit is powered with 9 V. The main objective of this work is to build the circuit without any programming skill and to make it work without line of sight requirement using the RF technology.

Keywords: IC HT12E, IC HT12D, RF transmitter, RF receiver, relay, ASK.

I. INTRODUCTION

With the advancement of technology, number of equipments and modern household appliances increases to make life easier and comfort. Operating them manually is a tedious job and again hectic sometimes. If one can control devices like TV, fan, light or a music system with a remote from a distance place just by pressing the button, life will become simpler. Home automation is becoming very common these days as technology advances to reduce manual work. To switch on or off the devices one has to move to the switch board which is inconvenient even for an able person. If all this manual work is replaced by a single remote control even the aged and disable person can do the task like a normal person. Much related work has been reported for the same function by different groups with different approaches. Multiple home devices switch can be control with a designed system using microcontroller as heart of the circuit with android based mobile phone. Here the mode of controlling devices is by sending command wirelessly through Bluetooth [1]. IR remote control has a very wide application in the field of electronics. IR based remote control for controlling multiple home appliances with microcontroller is also reported for the same function [2], [3]. Another approach is by GSM based for home automation. This is done by sending short sms code from a mobile handset. Here it has a wider coverage area. So to control any house hold appliances from a distance place within the network area coverage sending a short sms code will either ON or OFF the devices at home [4], [5]. All these work is carried out for the same function in a different way by using different technology. Some use Bluetooth technology other use GSM technology or IR technology. Each technology has its own advantages and disadvantages over the other but they all serve the common purpose to replace manual work. The main objective of this work is to create another system to control multiple appliances by using RF technology. One of the main advantages of RF based remote control is that it can operate the appliances without the requirement of line of sight within its specified range efficiently. Figure.1 shows the basic overall design system

to control four independent home appliances like TV, music system, room light and fan through a remote with four switches.

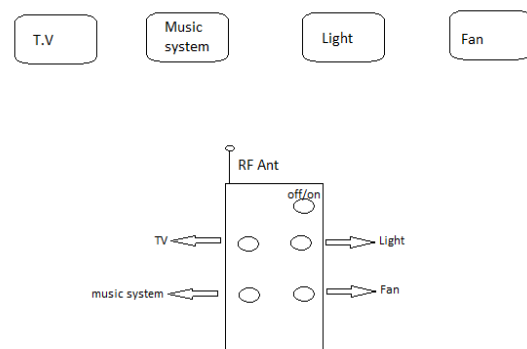


Figure.1 controlling four appliances with RF remote control

The transmitter part is built with two basic components i.e with encoder IC HT12E and RF transmitter module which operate at 434 MHz as shown in Figure. 2. The encoder IC has four ports which are used as four input button for controlling the appliances. And at the receiver side it consists of decoder IC HT12D and RF receiver module. The four output port of the decoder IC is connected to the appliances to be control through a relay as shown in Figure. 3. When a button is pressed the corresponding output port will be active which in turn will active the relay and control the appliance. The input pin when remain open has 1.8V but when close it is connected to ground as shown in Fig. 4

II. CIRCUIT IMPLEMENTATION

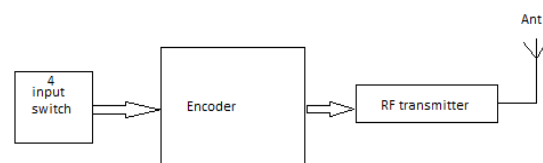


Figure.2 Remote control transmitter at block level

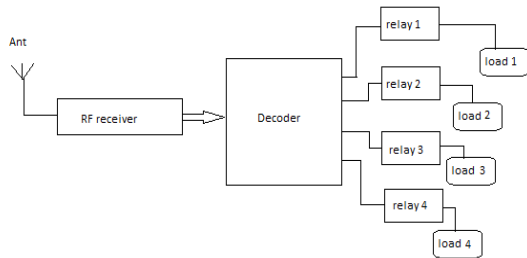


Figure.3 Receiver section with load to be controlled

The modulation technique at the transmitter follows ASK (amplitude shift keying) which is operating at 434 MHz. The input data pin at the transmitter module accepts data serially and transmits it through Radio frequency which is again picked up by the transmitter module placing at a distance. The system is a point to point communication between two nodes and follows a simplex configuration. This Rx/Tx module is used with two IC's i.e encoder and decoder each having four dedicated port which is configured as input channel and output channel. The encoder IC HT12E converts the parallel data from the four input switches into serial data and fed the data through pin 17 into the input data pin 2 of the transmitter module. The signals are transmitted serially through the antenna of RF transmitter. In order to enable the transmission, pin 14 should be connected to active low state. The detail pin configuration of the encoder IC is shown in Figure. 7. These set of transmitted data is received by the transmitter module and then fed in serially to the decoder IC HT12D through the data input pin 14. This decoder converts the serial data back into parallel data and outputted at the four output port through D0 to D3. The function of each pin of the decoder IC is shown in Figure. 6. Each of the input switches is configured to control a corresponding relay through which a load is connected as shown in Figure. 5. Similar connection is made for light, music system and fan through transistor which is acting as a switch and will activate the relay when it is turn on by the output bit of 1.8V from the decoder.

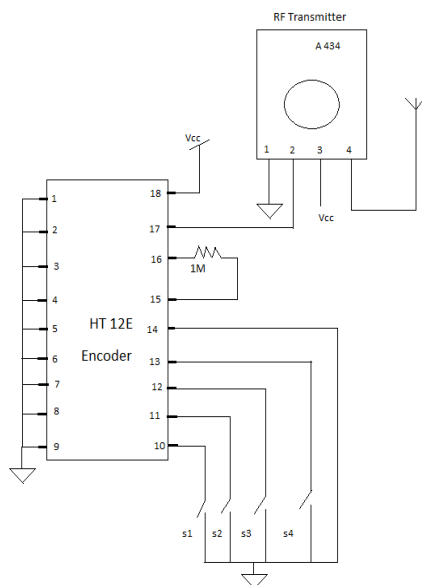


Figure. 4 Circuit connection of Remote RF transmitter

HT 12E and HT 12D are encoder and decoder IC's which has a wide application in switching and operates at RF frequency wirelessly. These IC's can transmit and receive 12 bits of parallel data serially. The 12 bits data is consists of 8 bits address line and 4 bits data. Multiple receivers can be address with single transmitter by configuring different address line and moreover these address line can be use to give 8 bits security code for data transmission. Here all the address lines of both IC's are connected to ground to match both the transmitter and receiver such that the data send reached at the configured destination.

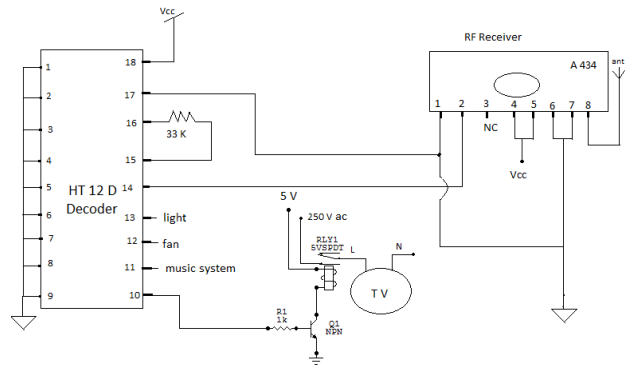


Figure. 5 RF Receiver with load connection

pin no.	name	function
1	A0	INPUT 8 PIN ADDRESS PINS
2	A1	
3	A2	
4	A3	
5	A4	
6	A5	
7	A6	
8	A7	
9	GND	0V, GROUND
10	D0	4 BIT DATA/ADDRESS PINS FOR OUTPUT
11	D1	
12	D2	
13	D3	
14	I/P	SERIAL DATA INPUT
15	OSC 2	OSCILLATOR OUTPUT
16	OSC 1	OSCILLATOR INPUT
17	VT	VALID TRANSMISSION
18	VCC	SUPPLY VOLTAGE

Figure. 6 pin description of IC HT 12D

pin no.	name	function
1	A0	INPUT 8 PIN ADDRESS PINS
2	A1	
3	A2	
4	A3	
5	A4	
6	A5	
7	A6	
8	A7	
9	GND	0V, GROUND
10	AD8	4 BIT DATA/ADDRESS PINS FOR INPUT
11	AD9	
12	AD10	
13	AD11	
14	TE	TRANSMISSION ENABLE
15	OSC 2	OSCILLATOR OUTPUT
16	OSC 1	OSCILLATOR INPUT
17	Dout	DATA OUT
18	VCC	SUPPLY VOLTAGE

Figure. 7 pin description of IC HT 12E

Transmission through Radio Frequency has many advantages over infra red transmission. RF signal can travel a longer range hence its coverage area for operating is larger and moreover the transmitter and receiver need not

be in line of sight. As RF frequency signal is strong, it is more reliable than IR transmission. The RF modules which is used in this work comprises of transmitter and receiver which operate at 434 Mhz. The data transmission of RF follow amplitude shift keying which varies in the amplitude of carrier wave. The serial data transmission takes place between pin 2 in each module as shown in Figure 4 & 5. The system is designed and model to control four load i.e two LEDs and two AC bulbs as shown in Fig. 8 & 9.

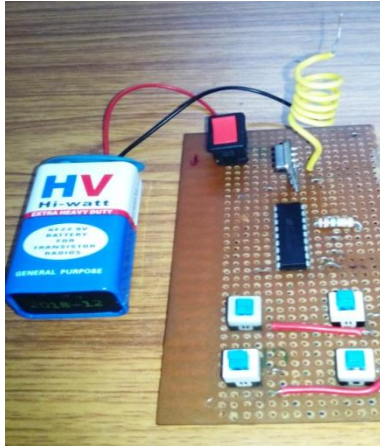


Fig. 8 RF transmitter remote control

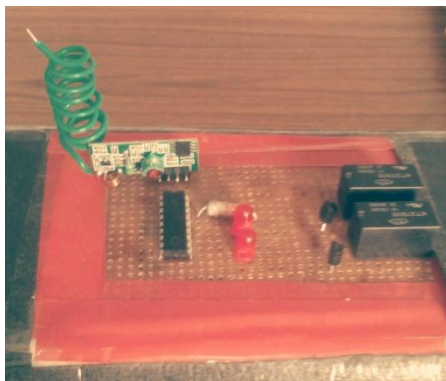


Fig. 9 RF receiver module with load connected

IV. CONCLUSION

The gift of technology to mankind is to make life simpler. In this work, a remote control for multiple home appliances is designed, presented and implemented as shown in Fig 8 and Fig 9. The design is durable, robust and sturdy which is built with an available compact IC's and RF module. From any place around the house any four appliances can be control at will without the requirement of line of sight. The relay action which is connected to the load to be controlled is operated with radio frequency which transmits only when a switch is pressed. Multiple devices can be control using different receiver with different addressing mode using single remote. The transmitter circuit is power with 9V with circuit current of 9.6mA and power consumption of 86.4mW.

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