

INTEGRATION OF WIRELESS TECHNOLOGY TO CONTROL HOME APPLIANCES

¹S.Vimal Raj, ¹Abishake A, ²Aravind Balaji S, ³Dheeraj G.V, ⁴Narendra Prasath S

¹Associate Professor, ^{1,2,3,4} UG Scholar,

Department of Electrical and Electronics Engineering,
Sri Krishna College of Technology, Coimbatore, Tamilnadu, India

Abstract: This work presented here is to develop a product to control independent home electrical appliances through RF and IOT based remote system and also manual control in a single product. From any place without any line of sight around the house RF based wireless remote control system can change the state of electrical appliances from on or off state. The controlling circuit is build around RF transmitter and receiver modules which are operating at two different frequencies (434 and 512 MHz) according to our application. Each module consists of encoder IC HT12E and decoder IC HT12D with few passive components. The four different channels at the encoder are used as input switches and four channels at the decoder are used as output and connected to the contactor through relay. IOT is connected to one of the RF modules. IOT is remotely operated using mobile app. The main objective of the work is to build a product without any programming skill and to make it work without line of sight requirement using RF technology.

1. Introduction

With the advancement of technology, number of equipments and modern household appliances increases to make life easier, comfort and secure. Operating them manually is a tedious job. If one can control these appliances with a remote from a distance place just by pressing the button, life will become simpler. Automation is becoming very common in these days as technology advances to reduce manual work. To switch on or off the devices one has to move the switch board which is inconvenient even for an able person. If all these manual work is replaced by a single remote control even the aged person and disabled person can do the task like a normal person. Multiple home devices switch can be controlled with a system using microcontroller with android based mobile phone. So to control any household appliances there might be different technologies and each of them has its own advantages and disadvantages. But all serve the common purpose to replace the manual work. But in this project our main objective is to create a system to control multiple appliances using RF technology which

doesn't need the help of microcontroller and arduino. Here the mode of controlling devices is by sending command wirelessly.

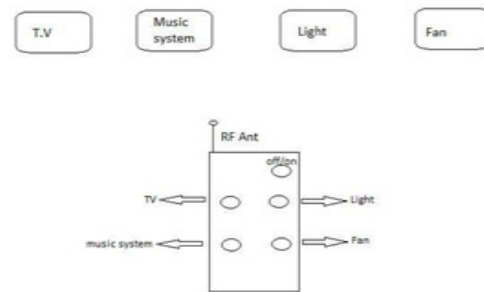


Figure 1. controlling four appliances with RF remote control

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.

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.

2. Circuit Implementation

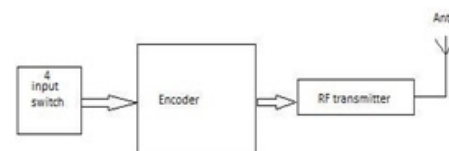


Figure 2. Remote control transmitter at block level

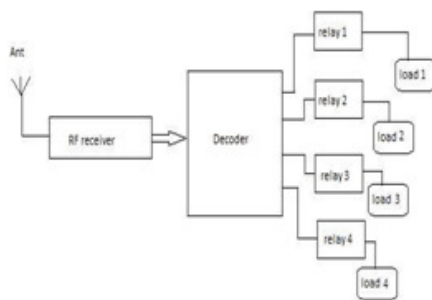


Figure 3. Receiver section with load to be controlled

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.

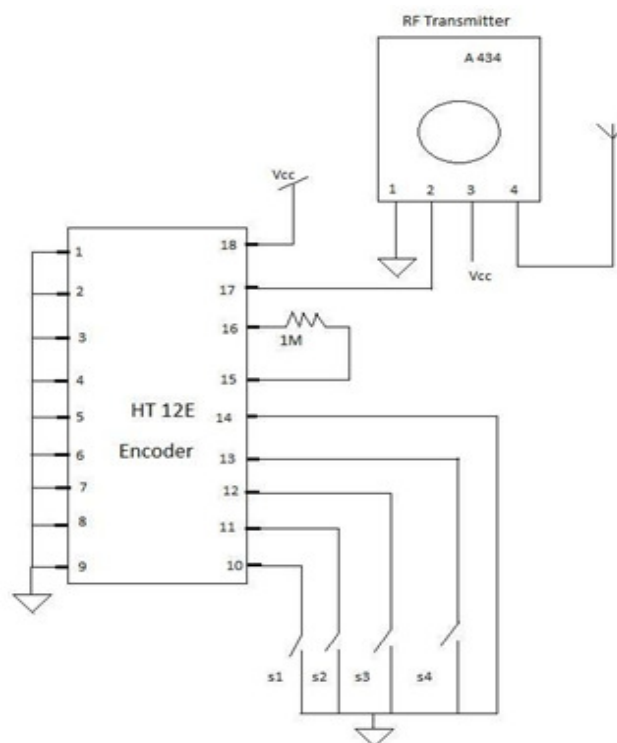


Figure 4. Circuit connection of Remote RF transmitter

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.

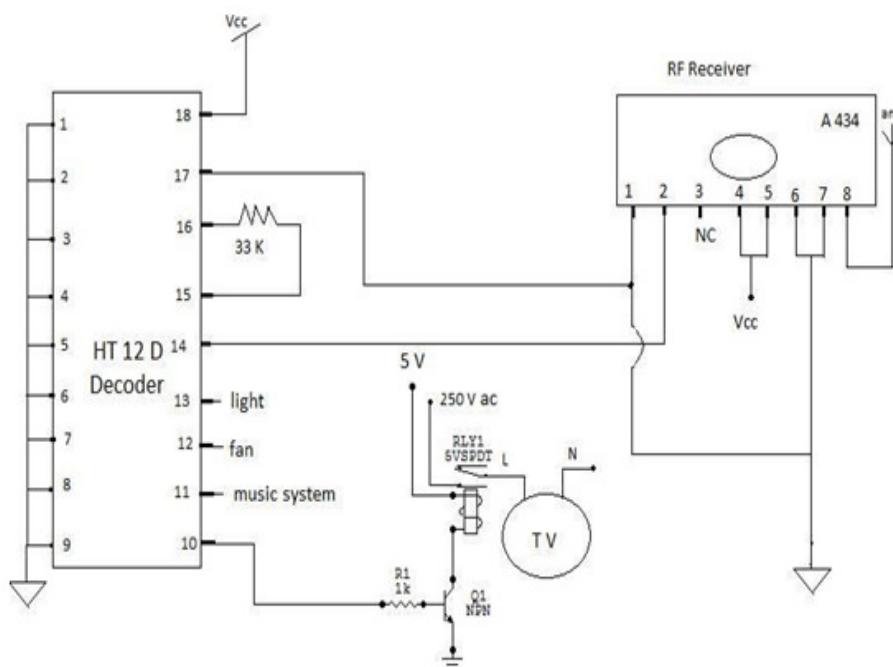


Figure 5. RF Receiver with load connection

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 in one module and other four loads in other module.

IOT installed in the product controls one of the RF module. It can switch off or on that corresponding module by means of mobile app. The command is transmitted wirelessly with the help of internet. And the power reading is displayed in the mobile app at any time. MFM(Multi-Function Meter) is a digital energy meter. It provides the details of voltage, current, power and energy consumed in a LCD display. The readings are recorded on both manual and auto mode of operation.

In case of failure of remote control system, the manual mode of operation can be enabled with the help of the DPDT switch in our product. The manual operation is done by providing separate push buttons for each load. So all the loads can be controlled like the remote control system. The circuit is implemented by connecting the push buttons to the respective loads through individual contactors to ensure safety. The active load can be identified by the indicator provided for each load in the front side of the panel. Indication will work on both manual and auto mode of operation of the product.



Figure 8. RF receiver

3. 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. The design is durable, robust and sturdy which is built with an available compact IC's, IOT and RF module. This design combines both the technology of RF and IOT also with manual control which is new. From any place around the house any eight appliances can be controlled 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. This product can be used for both industrial and domestic purpose.

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