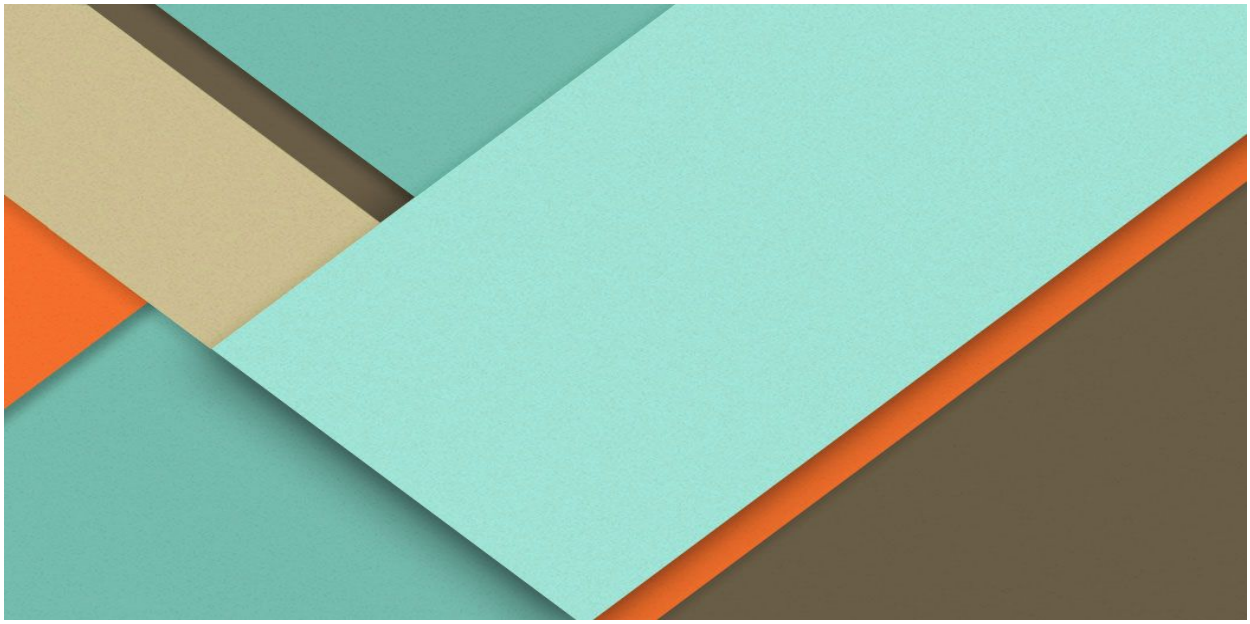

Secure RF Remote Controller

25.11.2017

EEP 308 : Communication Engineering
Indian Institute of Technology, Ropar

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Overview

Nowadays, the world is continuously progressing towards automation and wireless technology. Scientists and tech enthusiasts are continuously working to improve the performances of various such devices.

The crust of many such technologies is the communication technique implemented while developing that particular device or technology. The type of communication implemented mainly affects the efficiency and speed of the working devices.

Also many times it becomes necessary to maintain the confidentiality of the information being transmitted from source to the destination. Hence it also calls for a secured data transmission either over transmission lines or wirelessly.

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Goals

To built a radio frequency based secure remote controller which can be used to control various home appliances.

Hardware Requirements

1. HT12E Encoder IC
2. HT12D Decoder IC
3. RF 434 MHz transmitter and receiver Module
4. Antennas
5. Push buttons
6. LEDs

Circuit Diagram

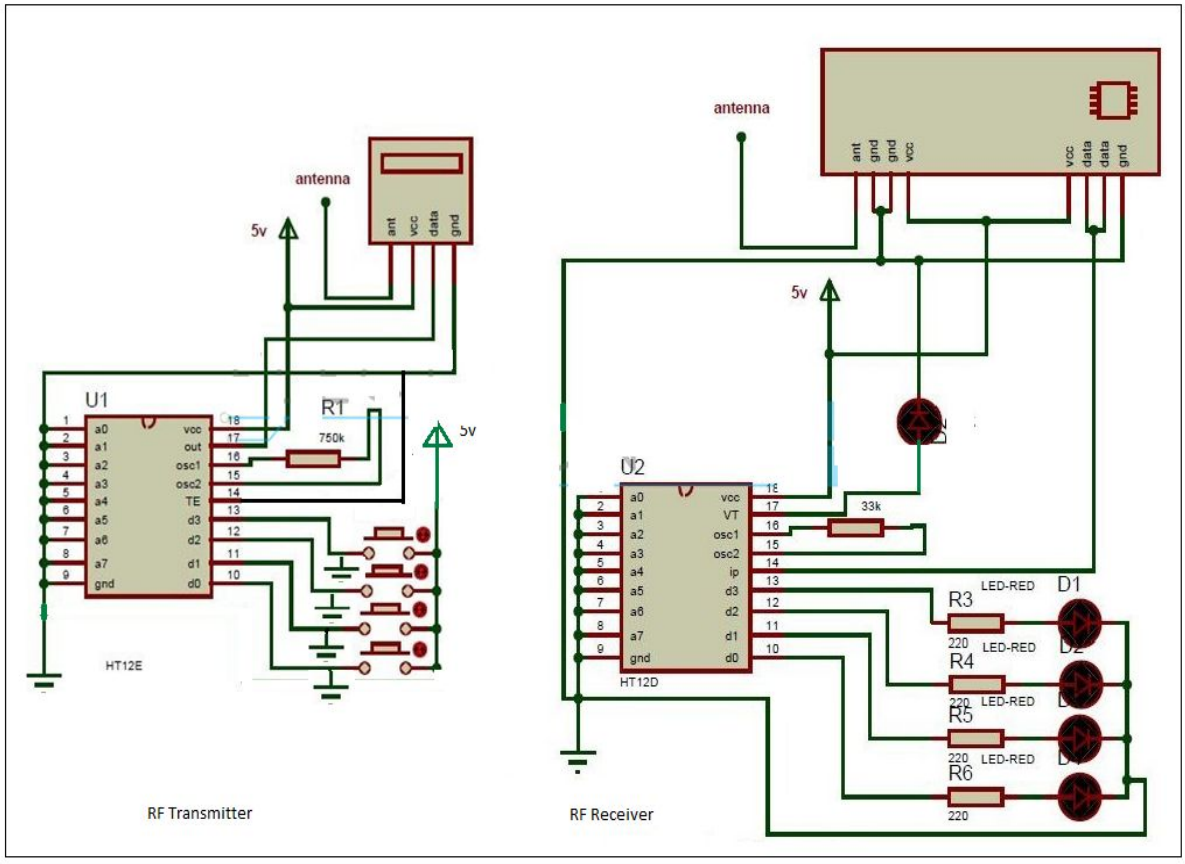

Fig. 1 Circuit Diagram for RF Remote Controller

Working

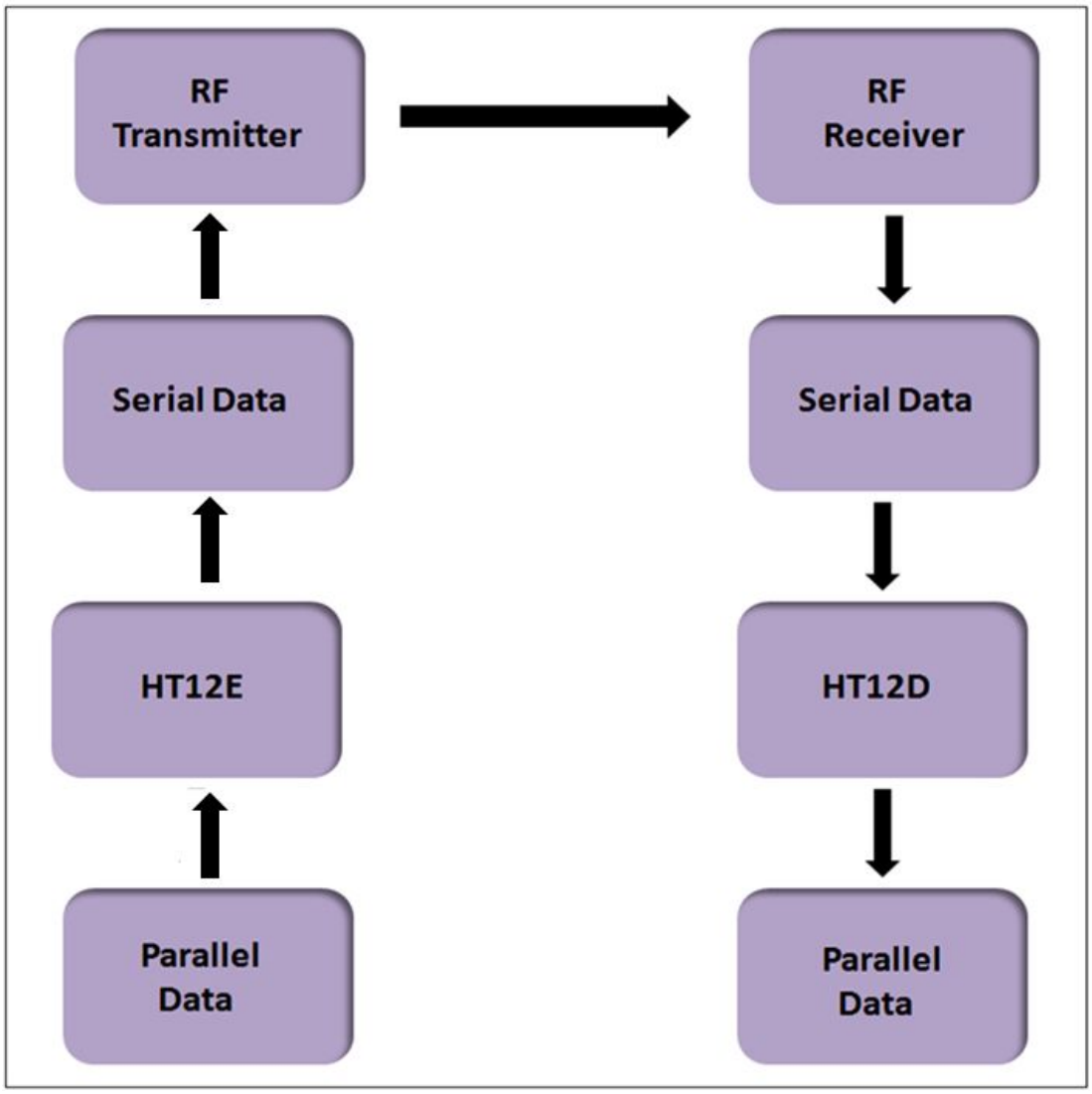

Fig. 2 : Data Flow during the transmission

As shown in the flow diagram above, the data transmission takes place via radio frequency transmitter and receiver module. The data gets parallelly transmitted from the push buttons. This data is transmitted in terms of logic levels. When high voltage is applied to the data pin (logic-1) binary data 1 gets transmitted. Similarly when low voltage or ground is applied to the data pin (logic-0) binary data 0 gets transmitted.

This parallel data is then fed to HT12E encoder IC which converts the parallel data into serial data. This conversion is necessary because transmitting data parallelly at radio frequencies is a tedious job. Serial data transmission is comparatively easy and efficient.

The serial data from the encoder is fed to the radio frequency transmitter which works at 434Mhz frequency. This transmitter transmits the data to the radio frequency receiver module which also works at 434Mhz. This received data is then converted into parallel data

using HT12D decoder IC which is then sent to the specific appliances that are connected in the circuitry. When a logic -1 bit is received at the appliance end the appliance turns ON and it turns OFF when a logic-0 is received.

The address pins in the encoder and decoder IC helps us to secure the data transmission from transmitter to the receiver. Only when the combination of these 8 address bits matches for the transmitter as well as receiver, the data transmission and reception happens smoothly. This address bits must be configured before the transmission begins. If any one of the bits fail to match, the transmission will not take place.

The RF 434Mhz transmitter Receiver Module makes use of ASK modulation. Below are some of the images of input and output signals at encoder and decoder data input pins respectively.

Fig. 3 : Varied time scale input and output of encoder and decoder

Problems Faced

- The selection of oscillating resistors for the encoder and decoder IC was challenging.

  Resolved : The HT12E and HT12D work operate only when the frequency of oscillation of the decoder IC is 50 times the frequency of the encoder IC. To obtain this frequency we connected a 750MΩ resistor as oscillatory resistor for encoder and connected a 47kΩ potentiometer which was varied in order to achieve the required frequency.

- To check whether the IC is receiving the correct data from the transmitter was challenging.

  Resolved : Since the transmission was secure due to the address bits at both the encoder and decoder ends it was difficult at first to determine whether the data transmission at RF module point was faulty or the security key for the transmitter and receiver didn't match properly. This issue was resolved by connecting an LED at the validating pin of the IC which would glow if the transmitter corresponding to that security key configuration was given a supply indicating that the authenticated transmitter is transmitting the data.

- During the implementation, the breadboard issues were found.

Resolved : After finding out that the circuit is correctly implemented yet not functioning and testing all the ICs and modules gave a positive result, this indicated to us that the breadboard was faulty. So we changed the breadboard

Benefits

- RF transmission has longer range as compared to IR.
- Unlike IR, RF waves can propagate even through the obstacles present between the transmitter and the receiver.
- The range of RF module increases by increasing the supply voltage to the module. However the supply voltage higher than 10 volts is usually avoided.

References

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- http://robokits.download/datasheets/HT12E.pdf
- http://robokits.download/datasheets/HT12D.pdf
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