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Microcontroller Based Wireless Controlling of Electrical Appliances using RF Technology

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Abstract

Now-a-days there is lot of devices operated by a RF remote control at houses, televisions, AC's, VCR's, heating systems etc., In addition the expected wide spread of technology at home will reveal a new world of opportunities. The main objective of this project is to use radio frequency band. The appliances are controlled by the RF transmitter by pressing a specific switch on the transmitter and it produces specific signals which propagate through air. This project makes use of transmitter (TX-2B module) and receiver (RX-2B module). At 433MHz that is available at low cost hence making it very compact. The RF based control proves to be more advantageous compared to IR based control that limits he operating range to only few meters of distance. This is designed with AC supply, Rectification circuit, and transmitter with remote, receiver circuit and relays mainly. By using the remote, we can control the switches and receiving circuit. The rectified voltage is regulated by regulated by LM 7805 to 5V. The receiving circuit is used for operating of relay switches which are used to select electrical appliance for operation. This project can be implemented for commercial & business offices by using long range RF transmitter and receiver.
Keywords: Microcontroller, Receiver (RX-2B), Relays, Transformer, Transmitter (TX-2B)

I. INTRODUCTION

Wireless communication has become an important feature for commercial products and a popular research topic within the last ten years. There are now more mobile phone subscriptions than wired-line subscriptions. Lately, one area of commercial interest has been low-cost, low-power, and short-distance wireless communication used for personal wireless networks." Technology advancements are providing smaller and more cost effective devices for integrating computational processing, wireless communication, and a host of other functionalities. These embedded communications devices will be integrated into applications ranging from homeland security to industry automation and monitoring. Wireless communication, as the term implies, allows information to be exchanged between two devices without the use of wire or cable. A wireless keyboard sends information to the computer without the use of a keyboard cable; a cellular telephone sends information to another telephone without the use of a telephone cable. Changing television channels, opening and closing a garage door, and transferring a file from one computer to another can all be accomplished using wireless technology. In all such cases, information is being transmitted and received using electromagnetic energy, also referred to as electromagnetic radiation. One of the most familiar sources of electromagnetic radiation is the sun; other common sources include TV and radio signals, light bulbs and microwaves.

II. RADIO FREQUENCY-ITS NECESSITY

Radio frequency is a frequency or rate of oscillation within the range of about 3Hz to 300 GHz. This range corresponds to frequency of alternating current electrical signals used to produce and detect radio waves. Since most of this range is beyond the vibration rate the most mechanical systems can respond to, RF usually refers to oscillations in electrical circuits. RF is widely used because it does not require any line of sight, less distortions and no interference. Examples include, Cordless and cellular telephone, radio and television broadcast stations, satellite communications systems, and two-way radio services all operate in the RF spectrum. Many types of wireless devices make use of RF fields. Some wireless devices operate at IR or visible-light frequencies, whose electromagnetic wavelengths are shorter than those of RF fields. Electrical currents that oscillate at RF have special properties not shared by direct current signals:

1) One such property is the ease with which it can ionize air to create a conductive path through air. This property is exploited by high frequency units.
2) Another special property is an electromagnetic force that drives the RF current to the surface of conductors, known as the skin effect.

III. BLOCK DIAGRAM

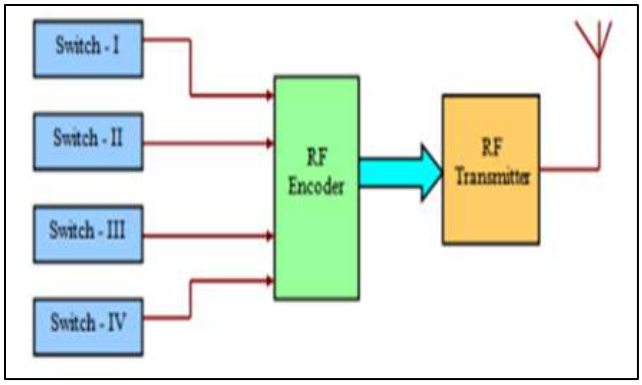

Fig. 1: RF Transmitter

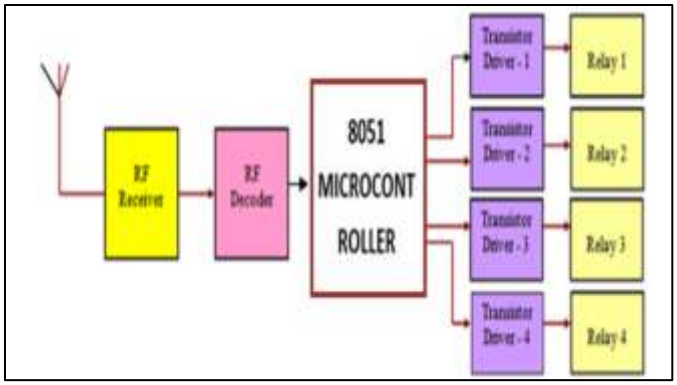

Fig. 2: Control circuit with RF receiver

IV. CIRCUIT DIAGRAM

Firstly, the required operating voltage for Microcontroller 89S51 is 5V. Hence the 5V D.C. power supply is needed by the same. This regulated 5V is generated by first stepping down the 230V to 12V by the step-down transformer. In the Power supply the step downed a.c. voltage is being rectified by the Bridge Rectifier. The rectified A.C voltage is now filtered using a 'C' filter. Now the rectified, filtered D.C. voltage is fed to the Voltage Regulator (i.e., LM7805). This voltage regulator allows us to have a Regulated Voltage of 5V DC. The rectified filtered and regulated voltage is again filtered for ripples using an electrolytic capacitor 100µF. Now the output from the first section is fed to 40th pin of 89S51 microcontroller to supply operating voltage and to relay circuitry.

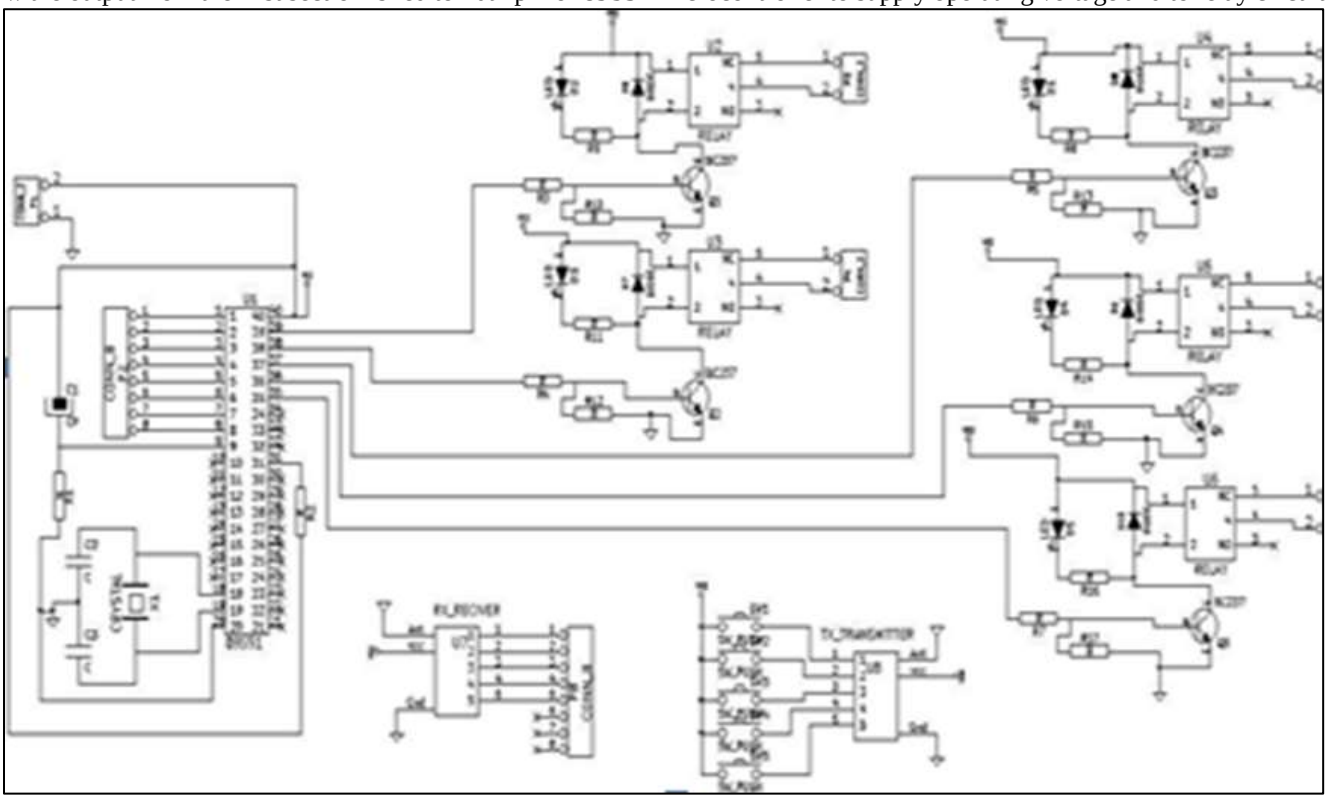

Fig. 3: Circuit Diagram

The microcontroller 89S51 with Pull up resistors at Port0 and crystal oscillator of 11.0592 MHz crystal in conjunction with couple of capacitors is placed at 18th & 19th pins of 89S51 to make it work (execute) properly. RF receiver (RX-2B) is connected to 1st, 2nd, 3rd, 4th pins of Port1. 4 relays are connected to 39th, 38th, 37th, 36th pins of port0.

The operating voltage required to drive the circuit is 5V with an increase in current driving capability. Hence the required power supply is taken from the same supply and fed to relay circuitry. When all channels (4 channels) of transmitter (TX-2B) is in operating condition, it will send the signals to receiver circuit through RF media. When receiver activated by the signal, it will starts operating at respective channel connected by the microcontroller. When Transmitter channel-1 is in active mode for the first time, then correspondingly channel-1 of receiver will get activated which is connected to microcontroller pin. when microcontroller

is turned on the automatically respective electric appliance will be in active mode. When we use the same transmitter channel (switch off) again, the respective electrical appliance will turn off. So, from the circuit diagram, we can observe that same transmitter-receiver operation is applicable for 4 channels and 4 electrical appliances.

This project makes use of the transmitter and receiver at 433MHz that is available at low cost hence making it very simple. The Radio Frequency based control proves to be more advantageous compared to the Infrared Red based control that limits the operating range to only a few meters of distance.

A. Atmel Microcontroller

SERIES: 89C51 Family, TECHNOLOGY: CMOS
The major Features of 8-bit Micro controller ATMEL 89C51:

- 8 Bit CPU optimized for control applications
- Extensive Boolean processing (Single - bit Logic) Capabilities.
- On - Chip Flash Program Memory
- On - Chip Data RAM
- Bi-directional and Individually Addressable I/O Lines
- Multiple 16-Bit Timer/Counters
- Full Duplex UART
- Multiple Source / Vector / Priority Interrupt Structure
- On - Chip Oscillator and Clock circuitry.
- On - Chip EEPROM
- SPI Serial Bus Interface
- Watch Dog Timer

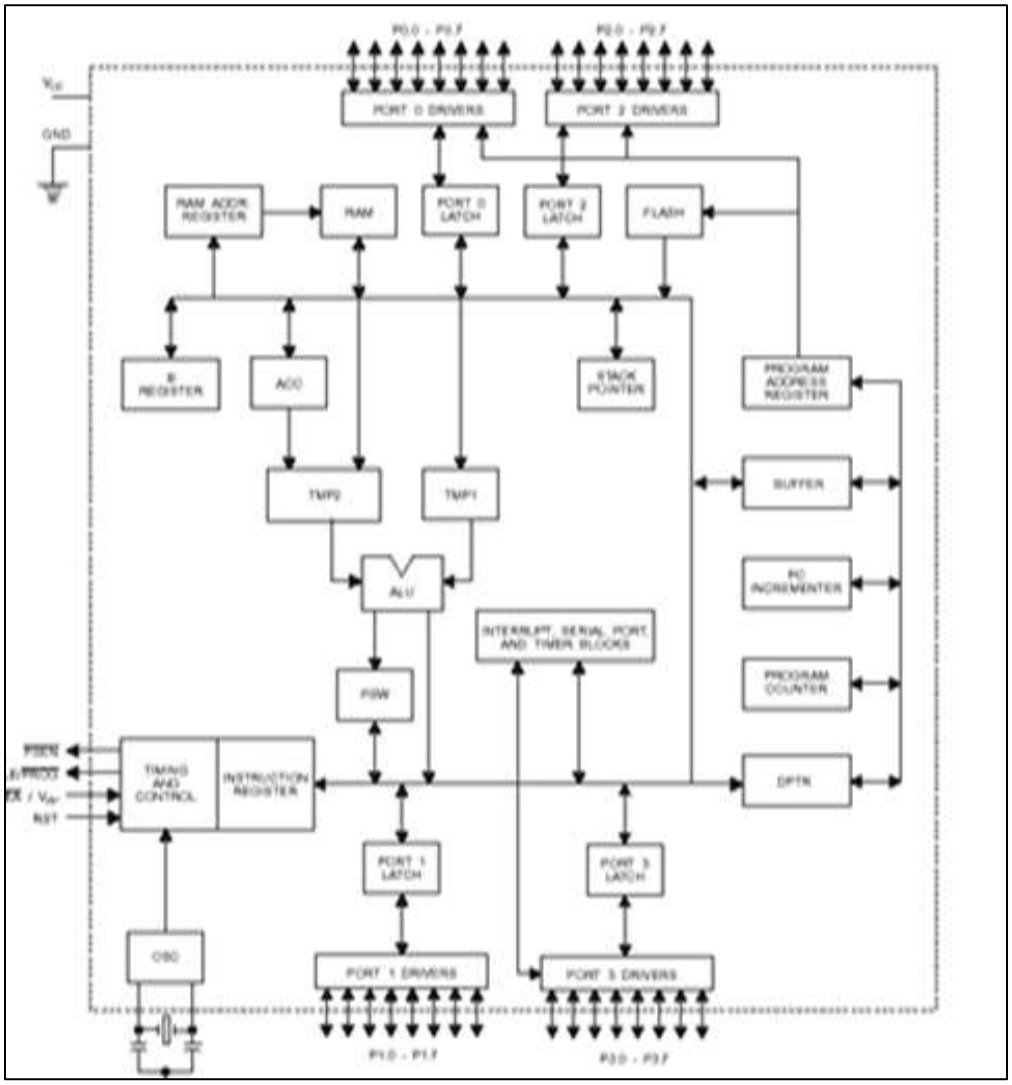

Fig. 4: Architecture of AT89C51 microcontroller

B. RF Transmitter

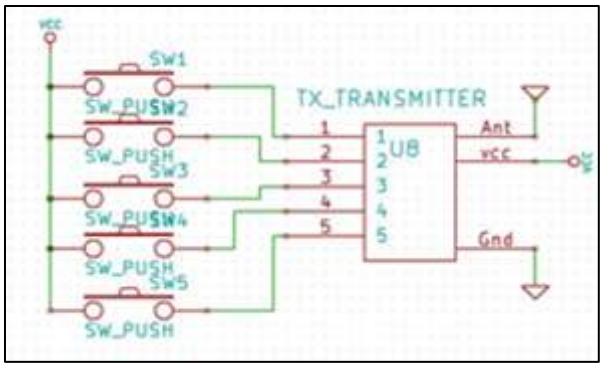

Fig. 5: RF Transmitter

A radio transmitter is an electronic device which, when connected to an antenna, produces an electromagnetic signal such as in radio and television broadcasting, two way communications or radar. Heating devices, such as a microwave oven, although of similar design, are not usually called transmitters, in that they use the electromagnetic energy locally rather than transmitting it to another location.

C. RF Receiver

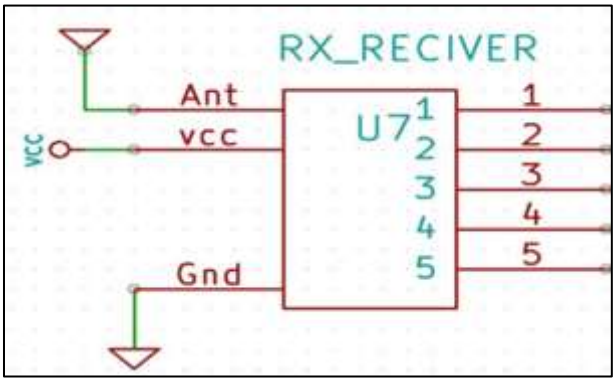

Fig. 6: RF Receiver

Radio receiver design includes the electronic design of different components of a radio receiver which processes the radio frequency signal from an antenna in order to produce usable information such as audio. This article only concentrates on the historical configurations leading up to and including the modern super heterodyne receiver design. The complexity of a modern receiver and the possible range of circuitry and methods employed are more generally covered in electronics and communications engineering. The term radio receiver is understood in this article to mean any device which is intended to receive a radio signal in order to generate useful information from the signal, most notably a recreation of the so-called baseband signal (such as audio) which modulated the radio signal at the time of transmission in a communications or broadcast system.

V. WORKING OF CIRCUIT

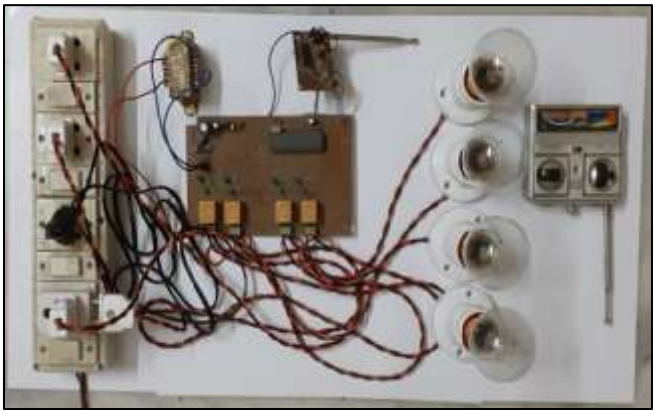

Fig. 7: Circuit is in OFF condition

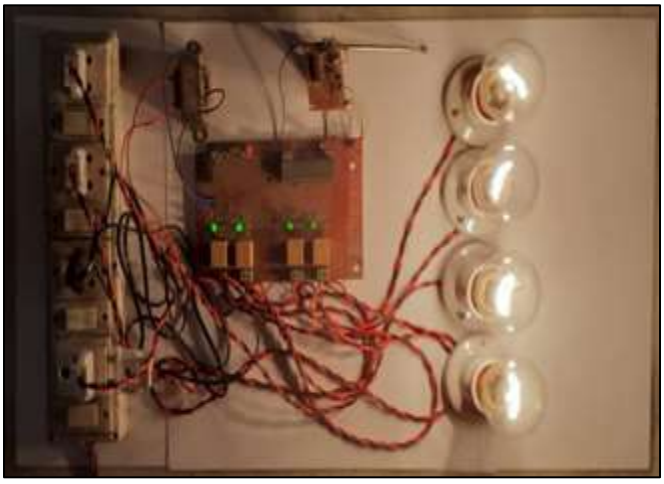

Fig. 7: Circuit is ON condition

VI. CONCLUSION

Micro controller based electrical appliances is very useful for commercial and industrial purpose by the above working model with RF technology and Wireless technology. This can be extended in future by high power applications like different microcontrollers as per requirement because of proper coordination between Receiver and Transmitter with the regulated power LM7805.

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