

Design Exploration of a Microcontroller Based RF Remote Control 13amps Wall Socket

Aru, Okereke Eze ,Ihekweaba Gozie, Opara, F.K.

Department of Computer Engineering, Michael Okpara University of Agriculture, Umudike, Umuahia, Abia State, Nigeria

Department of Electrical/Electronic Engineering, Federal University of Technology, Owerri, Imo State, Nigeria

Abstract: *This research work presents the design and implementation of a microcontroller based RF remote control 13Amp wall socket. The project is designed to control electronic devices that are connected to an ac power supply through the RF remote wall socket by turning the wall socket ON/OFF using the RF remote control whose operation is independent of the direction/positioned, unlike the Infra red remote control which uses " line of sight" . The project consists of the 89c52 microcontroller interfaced with " KYL-500S" micro power wireless transceiver data module and connected with an electromagnetic relay which turns the switch OFF with open contact and turns it ON with closed contact. The remote control transmits radio frequency signals which are received by the receiver of the wall socket and decoded by the microcontroller which now turns the relay ON or OFF.*

Key Words: *microcontroller, input switch, RF transmitter, RF receiver, etc.*

I. Introduction

The recent developments in technology which permit the use of radio frequency(RF) technology such as Bluetooth, and radio spectrum have enabled different devices to have capabilities of communicating with each other. Radio frequency(RF) is a new technology, which has at its center, the goal of eliminating wired communication among electronic devices. Instead of connecting with wires, every appliance has small RF transmitters/receivers. The radio frequency used (2.4GHz) is so high that the range of transmission will be small (about 30 feet). This is important because the range is so small, that it can be used in apartments without much interference to your neighbors or from them. These are few reasons that make Bluetooth technology ideal for home automation. This analogy motivated the idea behind this work.

Radio frequency(RF) remote control is today's fact, where things are being controlled non-directionally, breaking barriers, [not being affected by an object in front of the receiving device] and usually do the basic tasks of turning on/off certain devices and beyond, either remotely or in close proximity. Radio frequency remote control lowers the human stress in adjusting or moving around, just to operate a simple digital electronic device to the lowest degree possible but does not completely eliminate it. The concept of remote controlling of household devices over the radio frequency spectrum from any direction, any time in the world today is a reality. Assume a system where from the office desk, the user could operate another system in different offices independent of the direction or position.

An RF remote control wall socket focuses on controlling home electronic devices whether you are inside or outside your room. RF remote control wall socket gives an individual the ability to remotely or automatically control things around the home without moving from place to place. A home appliance is a device or instrument designed to perform a specific function, especially an electrical device, such as a refrigerator, for household use.

II. System Design.

This work utilizes RF transmitter and receiver module to control a 13Amp socket. In other words, we can turn the socket ON/OFF from any remote location. To demonstrate the efficiency of the system, an electro-mechanical relay switch is used to connect the required socket to an AC source. The system is design in such a way as to send and receives data serially.

System Block Diagram.

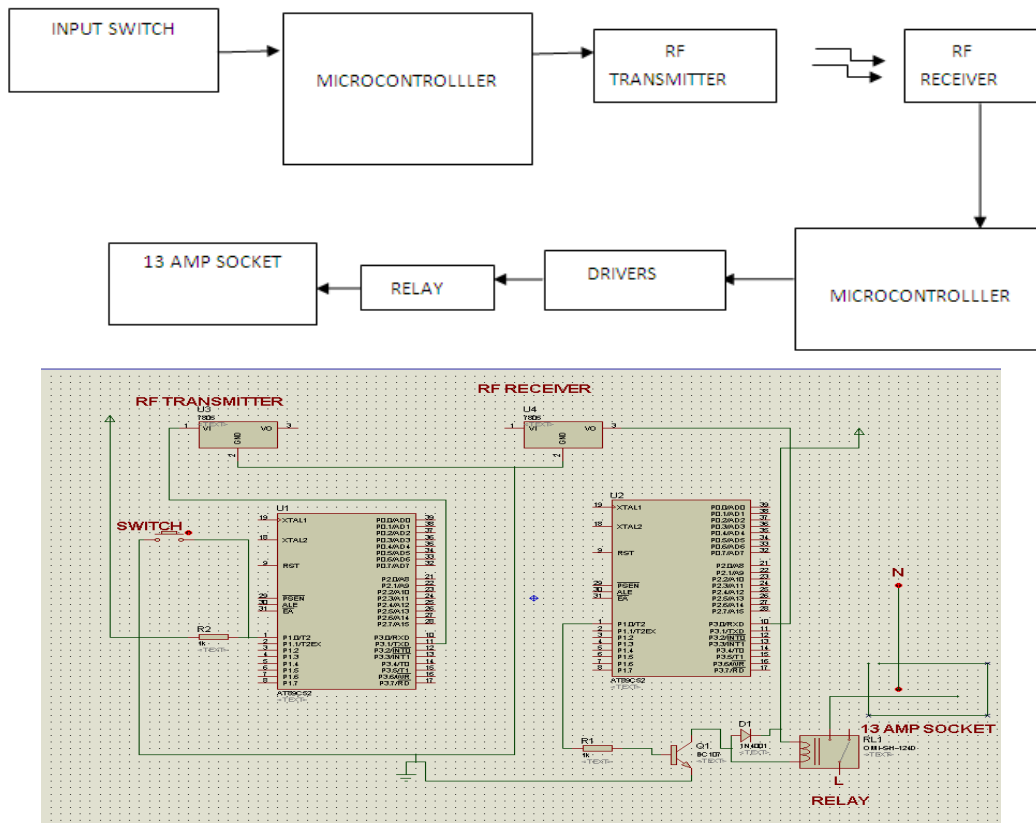


Fig. 2 System circuit diagram

III. Power Consumption/ Requirement

The factory default setting is +5V (3.3-3.6V will inform when placing the order).By using better ripple factor, KYL-500S transceivers can also share power supply with other equipment. If possible, a voltage-stabilizing chip with 5V voltage is more recommended as the only power supply than Switch power supply. But if only switch power supply available, the jam by switch pulse to the transceivers should be avoided. In addition, the reliable grounding must be used if there is other device in the system equipment. In case of failing to connect with the ground, it can form its own grounding but must be absolutely separated from the municipal electric supply.

How RF Remote Control Works

- A radio-frequency remote control, or RF remote, uses radio waves to transmit a signal to an electronic device. RF remotes are very common; they're used in devices such as garage door openers, remote control toys and remote car-entry key, remote wall sockets, etc.
- An RF remote encodes commands in binary form. The commands are sent via the radio waves to devices on the receiving end -- say, a DVD player -- that decode the commands and send them to the right place (volume up/down, etc.). A useful feature of RF remotes that sets them apart from infrared (IR) remotes is they can transmit signals up to 100 feet (30.5 meters) and can travel through walls and furniture. IR remotes, however, can only go 30 feet (9 meters) and need line of sight. Instead of sending out light signals, an RF remote transmits radio waves that correspond to the binary command for the button you're pushing. A radio receiver on the controlled device receives the signal and decodes it. The problem with RF remotes is the sheer number of radio signals flying through the air at any given time. Cell phones, walkie-talkies, WiFi setups and cordless phones are all transmitting radio signals at varying frequencies. RF remotes address the interference issue by transmitting at specific radio frequencies and by embedding digital address codes in the radio signal. This lets the radio receiver on the intended device know when to respond to the signal and when to ignore it.

IV. Power Supplies

In this work, the power supply is designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. For this work, below is the block breakdown of the 5V regulated power supply.

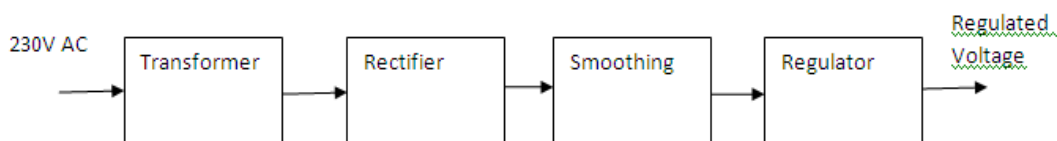


Fig3. Block diagram of a regulated power supply

Each of the blocks is described in more detail below:

- Transformer - steps down high voltage AC mains to low voltage AC.
- Rectifier - converts AC to DC, but the DC output is varying.
- Smoothing - smoothes the DC from varying greatly to a small ripple.
- Regulator - eliminates ripple by setting DC output to a fixed voltage.

Power supplies made from these blocks are described below with a circuit diagram and a graph of their output:

- Transformer only
- Transformer + Rectifier
- Transformer + Rectifier + Smoothing
- Transformer + Rectifier + Smoothing + Regulator

1] Transformer Only

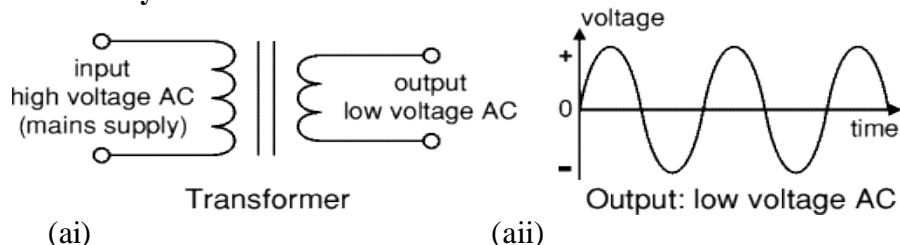


Fig 4. (ai) a transformer (a ii) output voltage wave form of the transformer

The low voltage AC output is suitable for lamps, heaters and special AC motors. It is not suitable for electronic circuits unless they include a rectifier and a smoothing capacitor.

2] TRANSFORMER + RECTIFIER

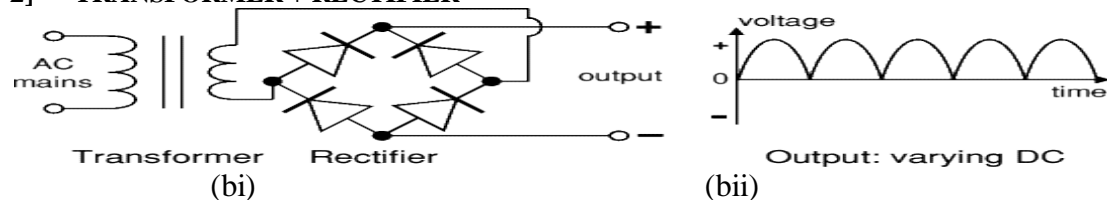


Fig 4 (bi) Transformer + Rectifier circuit (b ii) output wave form of (bi)

The varying DC output is suitable for lamps, heaters and standard motors. It is not suitable for electronic circuits unless they include a smoothing capacitor.

3] TRANSFORMER + RECTIFIER + SMOOTHING

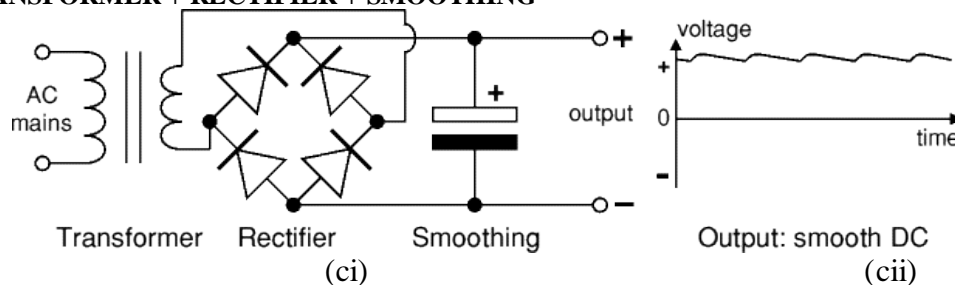


Fig 4.7 (ci) Full wave bridge rectification + filtering capacitor (cii) waveform of (ci)
 The smooth DC output has a small ripple and that is why it suitable for this circuit designs.

4] TRANSFORMER + RECTIFIER + SMOOTHING + REGULATOR

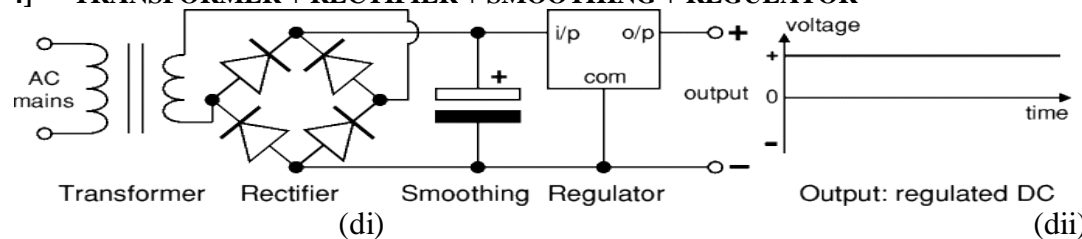


Fig 4 (di) power supply circuit (b) output voltage or waveform of (dii)

The regulated DC output is very smooth with no ripple. It is suitable for all electronic circuits.

V. Conclusion.

RF remote wall socket is one of the most common real-world digital wireless gadgets that help to determine the state of our electronic devices, either ON or OFF. Many electronic devices used in both homes and offices depend on wall sockets to plug in, and get connected the power source. Some electronic devices do not have a power switch to switch them ON/OFF such as electric boiling ring. Such equipment depends only on the wall socket to switch them ON/OFF at desired times. This have demonstrated the importance of the wall socket. This is the reason why the RF remote wall socket is implemented to replace the old wall sockets and add more functionality to wall sockets and to make it more flexible since the user does not need to move from place to place trying to switch ON/OFF. The signal transmitted by the remote is strong enough to penetrate through the walls and pass through other obstacles. It can also operate from a distance of about 100 meters and above, and therefore better and more flexible to use, since it is non-directional, unlike the Infrared remote controls that use line of site to function. This work provides a more flexible and functional alternative to the current commercial systems in controlling electronic devices in use, both in homes, offices, laboratory and in industrial places. The method employed in the whole process of designing this project can best be described as sequential approach to construction of an electronic circuit, which is same as the hardware. Thus, it will increase the accuracy and control of electronic appliances as opposed to the use of the old commercial wall socket.

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Aru, Okereke Eze is a lecturer in the Department of Computer Engineering, Michael Okpara University of Agriculture, Umuahia, Abia State, Nigeria. His research Interests include Electronics/Computerized Surveillance Systems, Computer/Electronics Hardware design and maintenance, digital systems design using microcontrollers and other computer related subjects.

Dr. Ihekweaba, Gozie is the Head, Department of Computer Engineering, Michael Okpara University of Agriculture, Umuahia, Abia State, Nigeria. Her research interests include Computer Hardware design and maintenance, Security system design, expert systems etc.

Dr. Opara, F.K. is the Head, Department of Electrical/Electronics Engineering, Federal University of Technology, Owerri, Imo State, Nigeria. His research interests include Computer Hardware design and maintenance, Electronic and Communication Systems, Electronic Security system designs etc.