

Automatic Control of Home Appliances Using Wireless RF Remote Controller

M. Narayanan¹, M. Ashok Kumar², A. Ranjith Kumar³, K. Raja⁴

^{1,2,3,4} Department of EEE

^{1,2,3,4} INFO Institute of Engineering, Coimbatore, Tamilnadu, India

Abstract-With the increase in electrical loads, energy saving play a very vital role both domestic and industrial applications. Energy saving can be achieved not only going for star rated appliances and using recent techniques to control voltage or current, speed or torque but also turning off unnecessary electrical loads such as fan, light loads, etc with minimum human moves. Hence RF based wireless technique is presented here which controls up to 10 loads ubiquitously within a distance of 45 meters automatically through a remote. PIC 16F877A microcontroller is used in RF transceiver module along with encoder and decoder to enable automatic control of electrical loads.

Keywords-PIC Microcontroller, Radio Frequency and Electrical Load

I. INTRODUCTION

Every industry and companies aims to produce products or their services at the maximum productivity possible along with best energy efficient and savings method possible. Energy savings over few decades has been an important term without which a product cannot move out of the industry. The load which is very common in any company or industry is light load, fan, air conditioner, heating load, etc. Energy savings in these loads which are continuously used helps to reduce our energy bill.

Increasing productivity is possible by utilizing the man power to the best means possible. It is done in many industries by using automation techniques to control the loads around us automatically using wireless remote and therefore reducing the unnecessary tiring moves and time. Here in this paper control of electrical loads using radio frequency (RF) signal through wireless remote is presented.

Now-a-days applications such as television, home theatre, air conditioner, garage door openers uses RF technology using remote controllers [4]. Cell phones, walkie-talkies, WiFi setups and cordless phones are all transmitting radio signals at varying frequencies [3]. Home automation can be also done through other techniques like Infrared, GSM, Bluetooth, Mobile phone, Zigbee, etc .

Many systems exist that use a combination of the methodologies to compensate for the drawbacks of each. The only thing that may affect such systems is the cost of the systems and the possibility of redundancy [10].

The 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 [3] whereas infrared uses “line of sight”.

II. BLOCK DIAGRAM

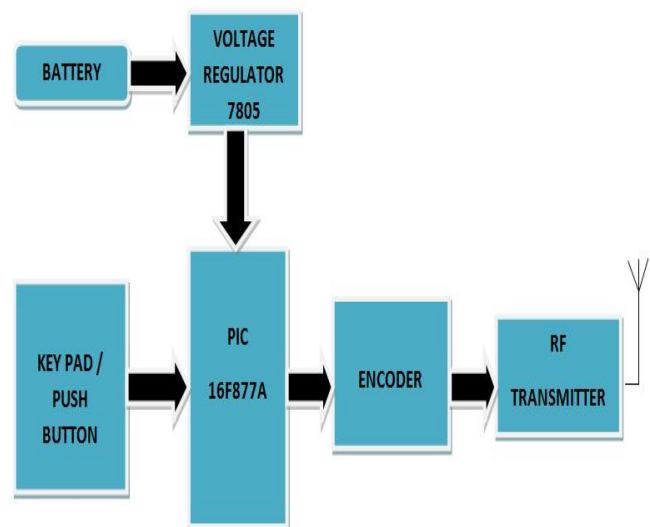


Fig 1: RF Transmitter Module

The RF module consists of RF transmitter and RF receiver. The RF transmitter block diagram is shown above and the modules associated with it are: PIC 16F877A, Encoder, RF transmitter, Battery, Voltage regulator, Key pad / Push button. The data is transmitted via RF transmitter which is placed alongside of microcontroller. An Encoder is used between microcontroller and RF transmitter which encodes parallel data bits into serial data for RF transmission [11].

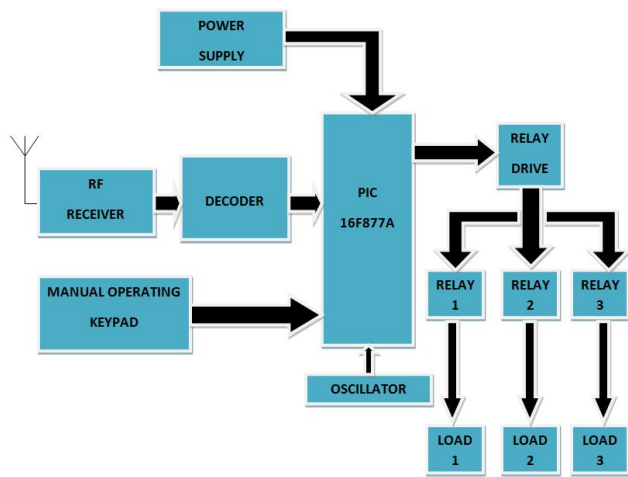


Fig 2: RF Receiver Module

The RF receiver block diagram is shown above and the modules associated with it are PIC16F877A, Decoder, RF receiver, Relay drive, loads, manual operating keypad and oscillator. The Decoder receive the serial address and data from its corresponding encoder, transmitted by a carrier using an RF transmission medium and gives output to the output pins after processing the data [11].

III. CIRCUIT DIAGRAM

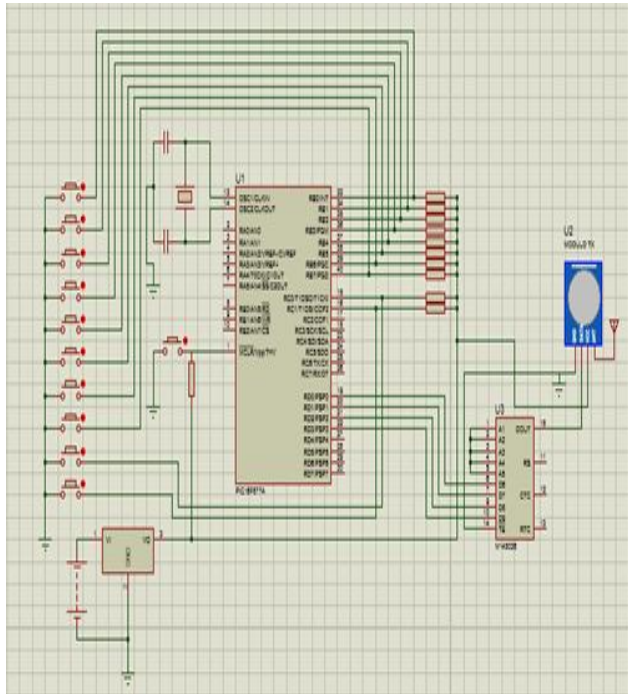


Fig 3 : Transmitter module circuit diagram

The RF transceiver module proteus circuit diagram is shown above. PIC16F877a is used in these modules and 10 loads are connected via relays.

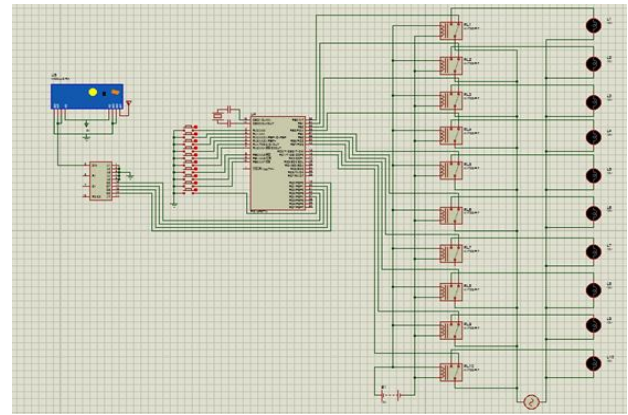


Fig 4: Receiver module circuit diagram

IV. COMPONENT SPECIFICATION

Table I: Component specification

COMPONENTS	RANGE
PIC microcontroller IC	16F877A
Encoder IC	HT-12E
Decoder IC	HT-12D
Voltage regulator (adapter)	12V/2A
Voltage Regulator	LM-7805
RF Transmitter	433 MHz
RF Receiver	433 MHz
Crystal oscillator	20MHz
PIC microcontroller drive	12V/2A
Relay drive	10 Channel
Manual Operating switches	Mounting type
Capacitor	100mf/16V, 22PF, 104PF
Resistor	10K
Battery	9V
Push Button	Micro Type
Jumper Wires	As Required
GP Board	1mm
Antenna	-

V. EXPERIMENTAL SETUP

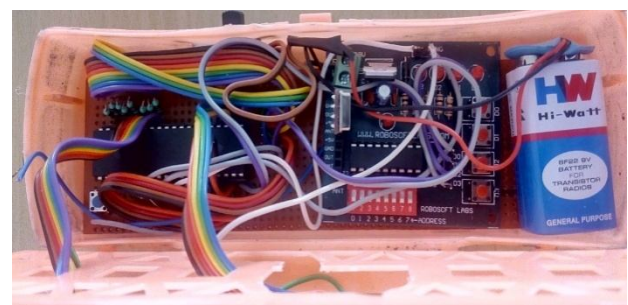


Fig 5: RF transmitter module

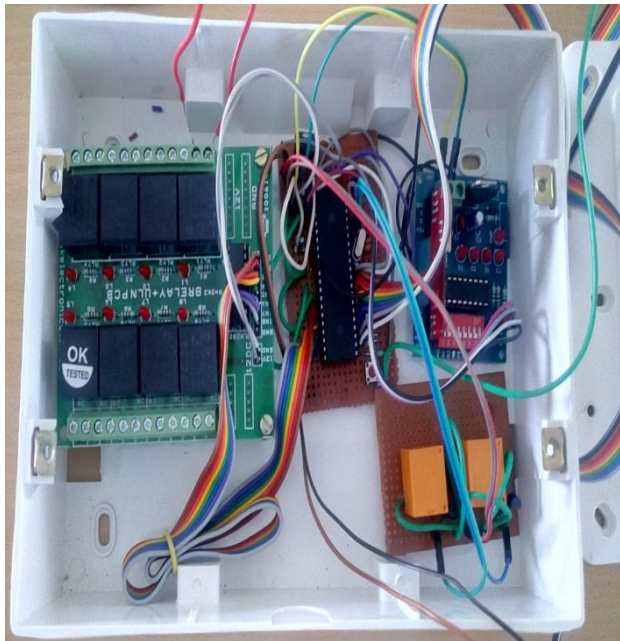


Fig 6: RF receiver module

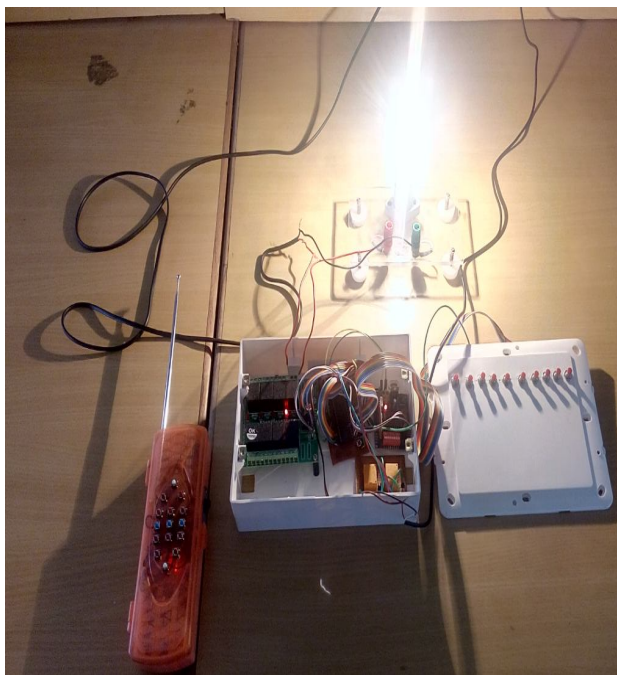


Fig 7: Experimental setup

The Table II shows the 4-bit transmitted logic and the switched mode status of the electrical loads. Here transmitted logic for 10 loads is shown. However a maximum of 15 loads can be controlled with high accuracy. To turn OFF the load the same 4 bit is transmitted i.e. the same key is pressed once again to turn off the respective load. Pressing 1 in the remote, controls load 1, pressing 2 controls load 2 and so on.

Any desired load can be turned on and off by pressing same key on the transmitter remote [11].

Table II: Transmitter logic

Keypad No	D3	D2	D1	D0	Load 1	Load 2	Load 3	Load 4	Load 5	Load 6	Load 7	Load 8	Load 9	Load 10
1	0	0	0	1	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
2	0	0	1	0	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3	0	0	1	1	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
4	0	1	0	0	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
5	0	1	0	1	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF	OFF
6	0	1	1	0	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF	OFF
7	0	1	1	1	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	OFF
8	1	0	0	0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF
9	1	0	0	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF
10	1	0	1	0	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON

V. CONCLUSION

In this paper control of electrical loads using RF technology and PIC16F877a is presented. A maximum of 10 loads within a distance of 45m can be controlled. It can be extended up to 15 loads with safe and reliable operation. Physically challenged people, children, aged people can use this remote controller in home safely.

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