

Remote Operated Master Switch via Infrared Technology

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Abstract—

The main object of Home automation is to provide a wireless communication link of home appliances to the remote user. The main objective of this work is to make such a system which controls the home appliances remotely. In modern days, we must use various high-tech machineries and equipment's to get our jobs done and make the life easier. Smart home is one of these types of system equipped with home appliances which we wish to control smartly from remote location. Some products are commercially available which allow home appliance controlling through t.v remote which is undoubtedly emerging. But it lacks the true sense of real mobility and security, making the remote home appliance controlling a limited term than it is supposed to be. In search of a true remote and adequately secure solution to be really effective and practicable, Infrared technology is better than any other solutions for small purpose. In this paper we introduce a new mechanism so that the ordinary services of the devices that utilize the internet for home automation from remote location can be leveraged to communicate with and control the home appliances and make our homes a really smart one i.e. A unique remote control circuit is used to permit the automatic control of switches and switchboards from a remote location that does not require any internet network as well as mobile network or battery. The remote control circuit of this invention permits such control with only one low-power control wire per switch. The remote transmits a tone using an infrared light-emitting diode. This tone is decoded by a receiver having a TSHOP, since the receiver only switches via relay when the tone is received.

Keywords—infrared, light emitting diode, TSHOP, decode, and rely

I. INTRODUCTION

Home automation is not a new concept in today's world, it is used to provide convenience for user to remotely control and monitor the appliances and it provides a better use of electricity. The efficient use of electricity makes the HOME automation to play an important role in daily life. As by the growth of PC (personal computers), internet, mobile phone and wireless technology makes it easy for a user to remotely access and controls the appliances. A lot of research has been done and many solutions have been proposed to remotely access the HOME appliances. Some of them used internet, wireless technology to communicate and control home appliances, others used Bluetooth and GSM technology for controlling the home appliances but all techniques is not efficiently useful because some require a mobile device or internet which is not economic for domestic uses as well as it required a network so these devices is not properly work when there is no network or signal strength weak. Proposed method reduces the wiring and complexity of the system. It has no limitation of network, coverage and any GSM network; it provides portability to the system. It is mainly focused on the elderly people, disables and for the people who are unable to stand up or face difficulties in speaking. It is affordable to everyone, cheap and easy to install. As there is no wired communication between the remote user and appliances control module and the electronic devices used to control are easily available making it a cost effective solution.

In these research paper, A circuit is designed to switch on/off any home or industrial appliance by using the TV/DVD remote controller. The circuit can be operated up to a distance of 5-10 metre depending on the remote used. The circuit consists of a step-down transformer X1 (6V-0-6V, 250mA secondary), 5V regulator 7805 (IC1), two 5V, 1 change-over (C/O) relay, a timer NE555 IC (IC2), an IR receiver module (IRX1 TSOP1738) and some discrete components. The circuit is connected to any of the home appliances (lamp, fan, radio, etc) to make the appliance turn on/off from a TV, VCD, VCR, Air Conditioner or DVD remote control. The circuit can be activated from up to 10 meters. It is very easy to build and can be assembled on a general-purpose PCB. Remote control facilitates the operation of fan regulators around the home or office from a distance.

The "Home Intelligence" system is based on the use of a network of sensors and intelligent circuitry attached to the domestic appliances and distributed by the different rooms in a home space. We can save our time, energy and affords to take actions on switch over of all the room appliances. They probably depend upon somebody to help them out so that they would relax for a while; the important thing is that the elderly and disabled persons just to wait for getting the service. Home appliances to control through radio waves around your home automatically it are not an imagination now this dream is come to an existence. The paper presented here is a research work on the radio waves to control power line devices using embedded system. In this research work we considered the power line devices as the home appliances.

II. HYPOTHESIS

The idea behind to control the home appliances wirelessly and existed in terms of infrared control but, to control it with the radio waves was the assumption that to convert this in to the reality in small scale. The garage door opener is the best examples to understand this. The theoretical concept to be converts this in to the real time utilization.

III. RELATED WORK

All of related work are based on different technology as using Bluetooth, Wi-Fi, GSM, an use a different types of software as MATLAB, visual studio to design the IDE but in our research paper it is so simple there is no use of microcontroller & its interfacing it simply based of the decade counter IC so no worry about cost and other different issues.as shown below :

[1] is about controlling home appliances through a microcomputer, author discusses two different approaches to control the home appliances; approaches are timer option and voice command. The timer option provides control based on timer, and the voice command provide control by using voice commands to control the appliances. This system uses a PC and PC parallel port to control the appliances, and the software interface is developed on the VB 6.0. This is used to convert voice command in to text and provide the operation to control and monitor the appliances.

[2] Proposed a system that control home appliances through infra-red remote controller and power line communication by developing a home based server, this system help user to check the status of their appliances form anywhere through the cellular network and internet.

[3] Proposed a GSM based system for controlling the Appliances for the people who are not at home, this is done remotely through SMS over GSM network using AT commands and on receiver the GSM modem is interfaced with the PC, the home appliances control system is developed on the PC to monitor and control. In the proposed solution they use PC parallel port which is further interfaced with the rely circuit to provide control over the appliances. This system also provides a feedback by simply SMS to user which also helps when there is any security breach in the home.

[4] Proposed a solution of home appliances control using Bluetooth based remote control to access the control of home appliances within home, author developed a remote control with a Keypad which is interface to a microcontroller and this is interfaced to Bluetooth module to provide wireless interface for the remote to communicate with the appliances control module. When the key is pressed the controller send the command regarding the pressed key via Bluetooth medium and on the receiver end receiver receive the command and apply the corresponding action.

IV. COMPONENT DESCRIPTION & IR RAYS

- a) **IC CD4017:** The 4017B is an integrated circuit which has been designed to count pulses. It has 16 pins and looks like any other 16 pin integrated circuit. They can be used in timing circuits and are often used to switch on and off LEDs or motors or other circuits. The 4017B is most useful when combined with a timer such as a 555 based circuit.

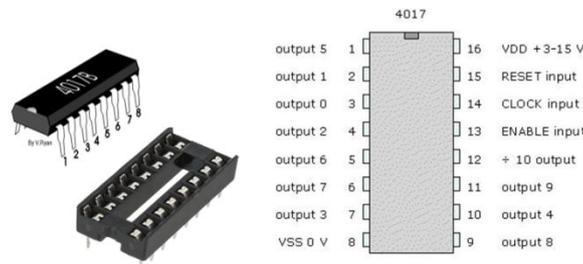


Fig. 1 decade counter IC 4017B pins

- b) **IR TSOP 1738:** The TSOP 1738 is a member of IR remote control receiver series. This IR sensor module consists of a PIN diode and a pre amplifier which are embedded into a single package. The output of TSOP is active low and it gives +5V in off state. When IR waves, from a source, with a frequency of 38 kHz incident on it, its output goes low. It has three terminals as positive negative & output. TSOP1738 detects only 38KHz modulated IR light (ideally). TSOP1738 is a very popular and commonly used infrared sensor. It is commonly used remote control system applications.
- c) **SPDT Relay:** SPDT represent Single Pole Double Throw Relay. A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts the lever and changes the switch contacts. There are 5 Pins in a relay. Two pins A and B are two ends of a coil that are kept inside the relay. The coil is wound on a small rod that gets magnetized whenever current passes through it. COM/POLE is always connected to NC(Normally connected) pin. As current is passed through the coil A, B, the pole gets connected to NO(Normally Open) pin of the relay.

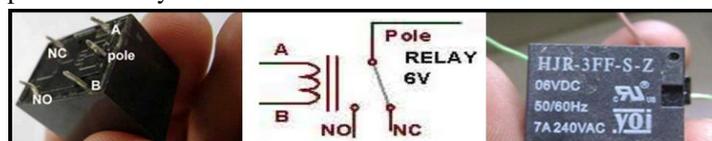


Fig. 2 SPDT Relay

- d) **Infrared Rays:** Infrared (IR) light is electromagnetic radiation with longer wavelengths than those of visible light, extending from the nominal red edge of the visible spectrum at 700 nanometers (nm) to 1 mm. as by The I.R transmitter the light signals are pulse width modulated and are contained in the 38 KHz frequency. Infrared radiation is the region of the electromagnetic spectrum between microwaves and visible light. Infrared band of the electromagnet corresponds to 430THz to 300GHz and a wavelength of 980nm.

Table 1

Name	Wavelength	Frequency (HZ)	Photon Energy (ev)
Infrared	700nm – 1mm	430 THz- 300GHz	1.24 mev – 1.7 ev

V. BLOCK DIAGRAM & WORKING

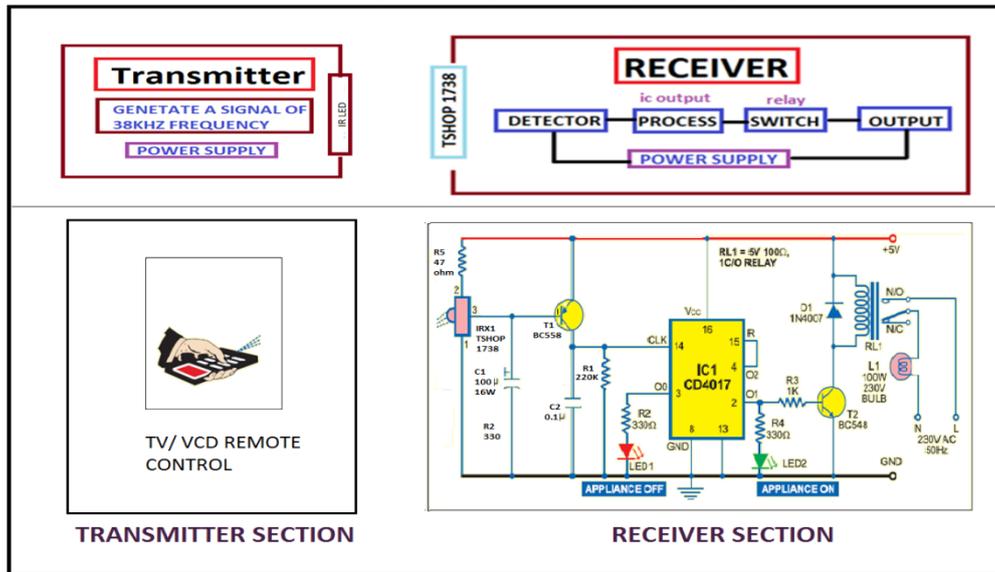


Fig. 3 Block diagram & circuit diagrams.

Connect this circuit to any of your home appliances (lamp, fan, radio, etc) to make the appliance turn on/off from a TV, VCD or DVD remote control. The circuit can be activated from up to 10 metres. The 38 kHz infrared (IR) rays generated by the remote control are received by IR receiver module TSOP1738 of the circuit. Pin 1 of TSOP1738 is connected to ground, pin 2 is connected to the power supply through resistor R5 and the output is taken from pin 3. The output signal is amplified by transistor T1(BC558).The amplified signal is fed to clock pin 14 of decade counter IC CD4017 (IC1). Pin 8 of IC1 is grounded, pin 16 is connected to Vcc and pin 3 is connected to LED1 (red), which glows to indicate that the appliance is „off.“ The output of IC1 is taken from its pin 2. LED2 (green) connected to pin 2 is used to indicate the „on“ state of the appliance. Transistor T2 (BC548) connected to pin 2 of IC1 drives relay RL1. Diode 1N4007 (D1) acts as a freewheeling diode. The appliance to be controlled is connected between the pole of the relay and neutral terminal of mains. It gets connected to live terminal of AC mains via normally opened (N/O) contact, when the relay energises. Using remote control for home appliances is a great choice. They can be used to on and off the appliances like TV, AC, DVD player, motor etc. with the help of our TV remote. LED's can be used to on and off. IF LED1 is glowing, it means device is off and if LED2 glows than the device connected is on. This is a low cost simple remote control circuit is based on the CD4017 counter IC which receives trigger pulse from IR sensor and switch on the relay. Since, the device is connected to relay it is also switched on. Upon receiving the second pulse motor become off. You can control your toy car from 5 meters range.

This is a simple remote control circuit based on infrared sensor IC TSOP1738. TSOP1738 contains photo detector and pre-amplifier both in onepackage. It is a three terminal device. Pin 1 is for ground, Pin 2 is for power supply and pin 3 is used as output. Pin diagram of TSOP1738 is shown below. Take care while connecting the pins of TSOP1738. Wrong lead connection of TSOP1738 may lead to sensor damage. It takes clock signal from the clock input and turn on the 10 output in sequence each time when it receives clock input pulses. It is the most popular IC and is extremely useful in project like Light Chaser, Matrix Die. Assemble the circuit as shown in circuit diagram and apply power supply. When you press the remote, 38 KHz infrared rays (IR) is generated through remote control (which used as transmitter) and these rays are received by TSOP1738 which act as receiver in our circuit. Then these weak signals at output pin 3 of TSOP1738 are amplified by transistorT1. Now, these amplified signals are fed into the clock input pin 14 of IC2. Therefore when you press any button on of the remote, clock input pin 14 goes high which provides a clock pulse for the working of IC2. Here after receiving the clock input CD4017 starts its counter from zero (as it has inbuilt counter) and it advances one by one each time pin 14 goes high. Like first we get output from pin 3 that is Q0 and LED1 will glow. When you press the button again from remote, pin 2 of IC2 will become high and LED2 will glow. Indicating that device is on. You have to connect a relay at the outputs. One end of relay should be connected to collector of transistor T2 and another end of relay should be connected to supply.

VI. LAYOUT & HARDWARE DESIGN

A) Layout design :

EAGLE (for: Easily Applicable Graphical Layout Editor) by Cad Soft Computer is a flexible, expandable and scriptable EDA application with schematic capture editor, PCB layout editor, auto-router and CAM and BOM tools is used for Layout design. Once the layout design is completed then print out its mirror image in the glossy paper and further process as shown in the hardware design.

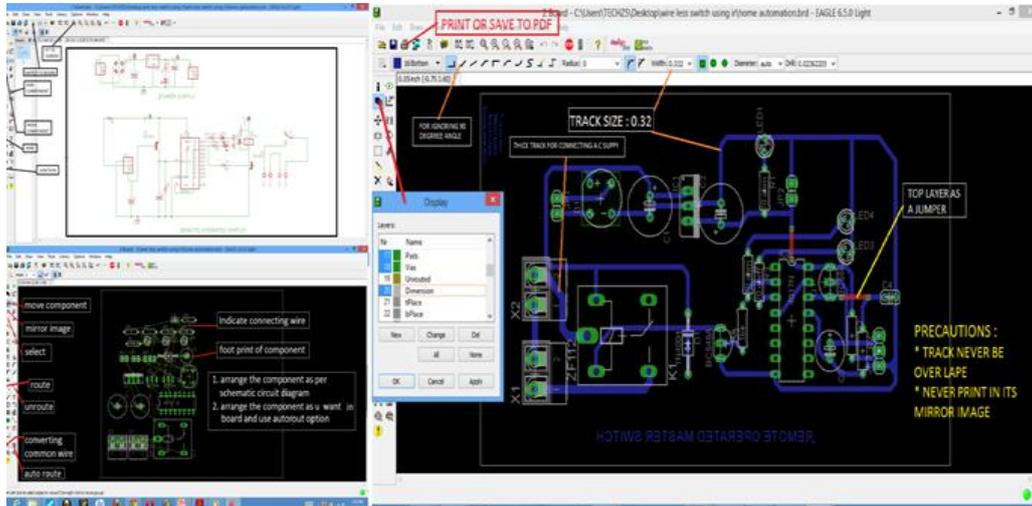


Fig. 4 Layout design from EAGLE software.

B) Hardware design

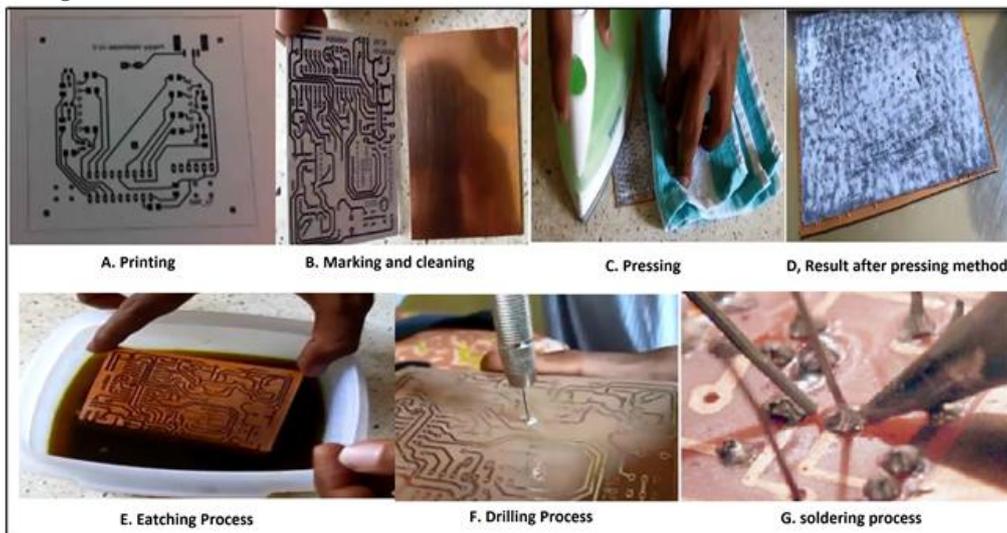


Fig. 5 various process in hardware Design .

VII. RESULT



Fig. 6 designed hardware for remote operated master switch.

- When press any key from transmitter toward receiver the device in working state.
- Again press any key transmitter the device is in off state.

VIII. ADVANTAGE & ITS APPLICATION

- 1) The circuit is absolutely free from ambient light.
- 2) It's providing control range at about 10 meter.
- 3) Noise pulses do not have any effect on the circuit.
- 4) It can use for electrical switching.
- 5) Where high risk of short circuit. Also for test circuit based on high power or A.C supply.

IX. ADVANTAGE & ITS APPLICATION

This research paper is to demonstrate the remote controlled operation of home appliances has been successfully implemented and favourable results have been obtained. This is a commercially viable product and its application is widespread these days with almost all home appliances. As a result of which several operations can be performed on a single appliance, as in the case of television. The product finds great scope futuristically, as part of an environment where man restricts his motion and performs his day-to-day activities on a remote controlled basis.

X. FUTURE IMPLEMENTATION

- 1) It can easily be converted into a multi-channel remote control system. By connection more relay at the output pin of IC4017.
- 2) By connecting relay at output pin 1, 2, 3, 4, 5, 6,7,9,10,11 we can switch alternately device. Because we use decade counter I.C.
- 3) By using microcontroller we can switch the device by pressing key different keys for different operation example press key 1 to switch fan, key 2 for light.
- 4) It can also implement by mobile keys by using decoder I.C or Bluetooth module or R.F module.

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