An Efficient and Smart Fan Using IR Communication

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***Abstract*— This article proposes an efficient and smart fan using infra red (IR) communication. The smart fan consists of IR remote, decade counter, IR receiver, relay driver and regulator. The speed of the fan can be controlled using any remote control which is used to operate TV, VCR and DVD player. IR light emitting diode (LED) in the remote transmits an IR beam of 38 kHz which is picked up by IR receiver TSOP1738 in the receiver circuit to perform the respective operation, either to increase or decrease the speed of the fan. The beam decoded by decade counter CD4017 is given to relay driver circuit and voltage regulator. The speed of the fan is controlled for every button press of the remote key. Speed levels are indicated with the help of LED. This smart fan is very useful for the disabled and elderly peoples. The smart fan requires no separate remote to control the fan speed. Moreover any key can be used to control the speed of the fan.**

***Keywords*: Smart Fan; IR Remote; IR Receiver; Remote controlled Fan; Decade Counter; IR based fan.**

I. INTRODUCTION

Fan is an important and mandatory electrical appliance in our day to day life, irrespective of whether it is for domestic or commercial purpose. In the present scenario the fan speed is basically controlled by a regulator which consists of wire wound resistor and capacitors. The wire wound resistor generates more heat when the fan is in ON condition for hours together. This process contributes to energy loss in the form of heat. In real time based on the ambiance, the user wants to regulate the speed of the fan depending on the environmental conditions. Hence there is a frequent necessity for the user to alter the speed of the fan, which is accomplished by manual intervention. But in highly commercial and busy situations, remote fan controlling is preferred to avoid unnecessary use of time and energy. In order to cater the need, in this paper the speed of the fan is controlled by remote. If it is desired to control the fan speed, the remote is focused to IR receiver circuit and any key is pressed to vary the fan speed [1]. For first time press of key, fan speed is at 1 level (very low speed). For second press of key, fan speed is at 2^{nd} level (low speed). For third press of key, fan speed is at 3^{rd} level (medium speed). For fourth press of key, fan speed is at 4^{th} level. For fifth press of key, fan is at 5^{th} level (High speed). For sixth press of key, fan is off condition. It means that the counter is reset. After which the reset counter starts the first counting of pulse to first level and so on. Therefore the fan speed is increased based on the count of IR rays.

The IR receiver receives electromagnetic wave at 38 kHz frequency from the remote. Frequency Below or higher than 38 kHz is not received by receiver. The working range of IR circuit is 5-10 meters based on the power level of the remote control [2]. Electromagnetic relays are used to switch the speed of the fan with the help of regulator. In this paper, 5 relays are used for five speeds. The proposed design for remote fan control is independent of microcontroller and hence can be employed in apartments, industries, colleges and hospitals. The rest of the paper is organized as follows: Section 2 presents a brief review on electrical appliance control using IR communication, Section 3 gives the block representation of the proposed efficient and smart fan using IR, Section 4 deals with the hardware implementation of the system, Section 5 outlines the scope for future work and Section 6 provides the conclusion.

II. BLOCK REPRESENTATION

The block representation of the proposed Smart Fan using IR communication remote block is given in Figure 1. The keypad in a remote consists of more than one key [3][4]. When we press any one of the key, timer circuit provides 38 kHz frequency output. This 38 kHz frequency of output signal is given to IR led which emits light at the same frequency. Astable multivibrator which consists of IC 555, Resistor and Capacitors is used in timer circuit. Using this resistor and capacitor, the output frequency is calculated using the formula f=1/T. where T is Total time period and f is Frequency. IR LED can emit light up to 6 meters.

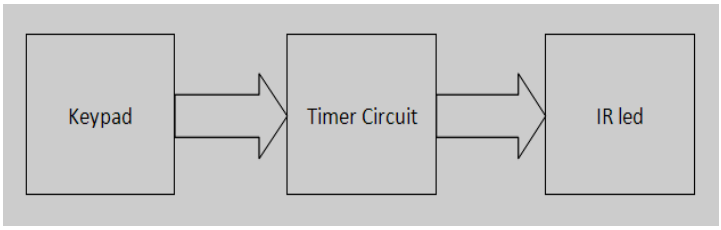

Fig.1. Block representation of the Remote circuit

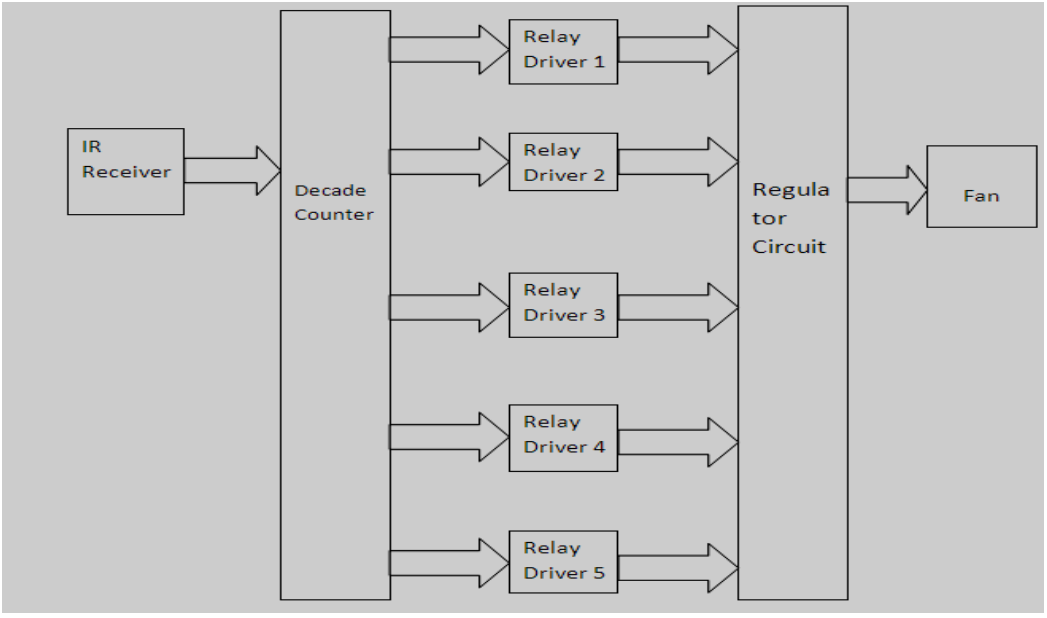

Fig.2. Block representation of the Receiver circuit

The block representation of the proposed Smart Fan using IR communication Receiver block is shown in Figure 2. IR receiver passes the received signal to decade counter which counts the pulse and activates the relay based on the pulse. Output of relay is given to regulator circuit which consists of resistors and capacitors to control the speed of the fan.

III. HARDWARE IMPLEMENTATION

The hardware realization of the proposed Smart Fan using IR communication is detailed below. The vital components used in the implementation of the proposed smart fan are TV remote, IR receiver, decade counter, IC 7805 regulator, transistor, freewheeling diode and AC voltage regulator circuit.

a) TV Remote

The TV Remote consists of Keypad, Multivibrator and IR LED. In multivibrator circuit, IC 555 is used to generate 38 kHz frequency and IR LED is used to transmit the IR beam with 38 kHz. A 3 V battery is used to power the TV remote. A TV Remote can also be replaced by AC Remote, Audio player Remote and DVD player remote control. TV Remote is shown in Figure 3.

Fig.3. TV Remote

b) IR Receiver

In this article a TSOP1738 IR receiver which contains an inbuilt amplifier for amplify the pulse from the IR transmitter [5]. This receiver consists of three pins namely GND, Vs and OUT. Connect the 5 V to Vs, 0V to GND and OUT pin is used for taking output of receiver. Initially the output of receiver is high. When the receiver receives the signal, its output goes low. IR receiver TSOP1738 is shown in Figure 4.

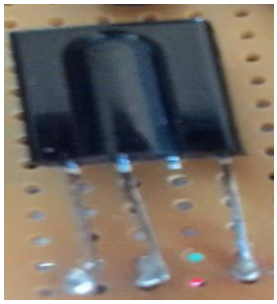

Fig.4. IR Receiver TSOP1738

c) Decade counter

The proposed smart fan system uses CD4017 Integrated chip (IC) as decade counter [6]. It is a Complementary Metal Oxide Semiconductor (CMOS) decade counter cum decoder circuit which counts from 0 to 10 and its outputs are decoded. Power supply of this IC is 16^{th} pin and its supply voltage range is 3V to 15V. Pin 15 is used to reset the counter and it is used to initialize the count to 0. This IC is area efficient because it consists of 16 pins and it comes Dual in-line package. The proposed system uses 6 counts of this IC to regulate the fan in 6 different speed levels. Decade counter CD4017 is shown in Figure 5.

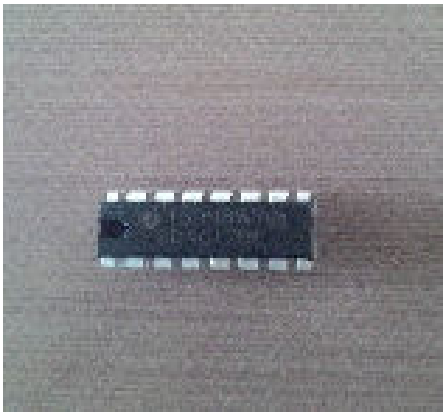

Fig.5. Decade Counter CD4017

d) Flowchart

The basic flow diagram of an Efficient and Smart fan using IR Communication is shown in Figure 6.

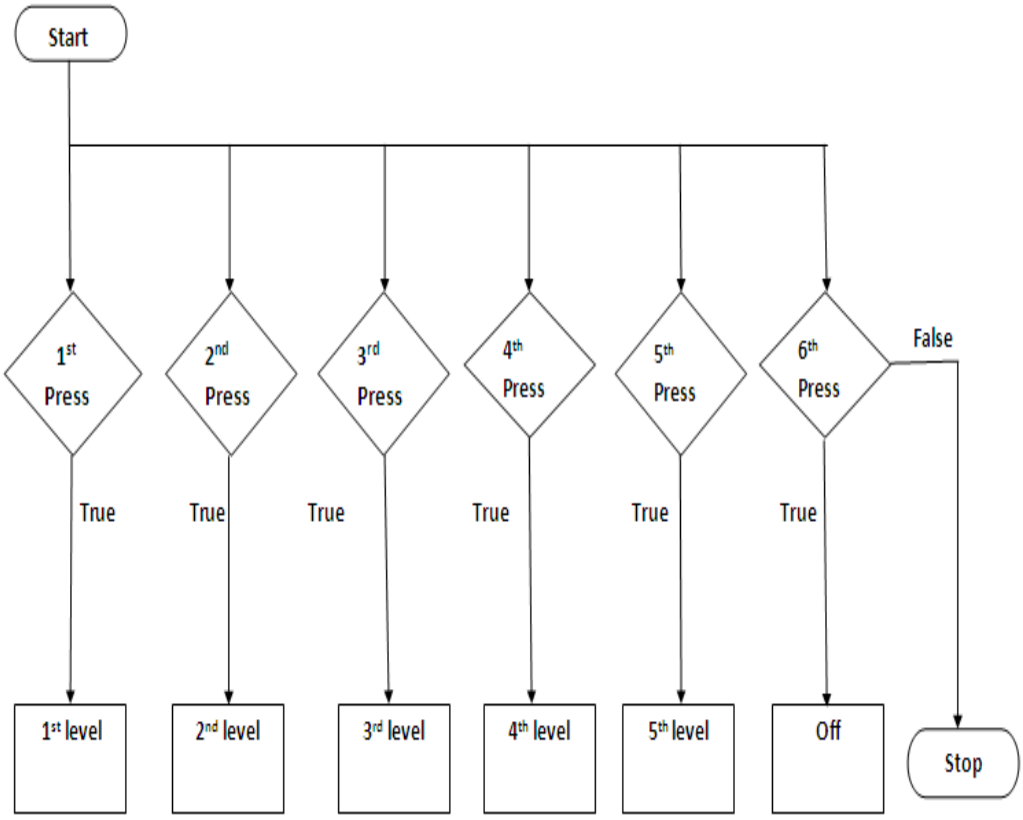

Fig.6. Flowchart for Efficient and Smart fan using IR Communication

e) IC 7805

A direct current (DC) voltage regulator IC 7805 is used. It consists of 3 pins namely INPUT, GND and OUTPUT. Unregulated DC input is given to first pin of this IC. This IC maintains a constant and regulated output irrespective of the variation in the input with a maximum input voltage of 35V. It can provide constant 5V at the output for higher voltage input up to a threshold limit of 35V. If the input

voltage is nearer to 7.5V then it does not need any heat sink. If the input voltage exceeds 7.5V, then heat is liberated in IC. So heat sink is used to conduct the heat in order to avoid the regulator IC from damage due to excess heat. IC 7805 is a series of 78XX. From the name the last two digits 05 denotes the amount of voltage that it regulates. IC 7805 is shown in Figure 7.

Fig.7. IC 7805

f) Transistor

Transistor means internal resistance of a transistor transfer from one value to another value depending upon the biasing voltage. Transistor is a semiconductor device used for switching purpose [8]. In this paper we are using NPN transistor for the relay driver circuit. Transistor BC547 consists of Emitter, Collector and Base terminals. This transistor is also used as a current amplifier circuits. When the output of decade counter goes to high, the transistor starts conducting. It means that the transistor is in forward bias condition and it allows the current from collector to emitter. Emitter base forward bias voltage of transistor is 0.6V. Below this voltage transistor does not conduct even when the collector voltage is applied. Transistor is shown in Figure 8.

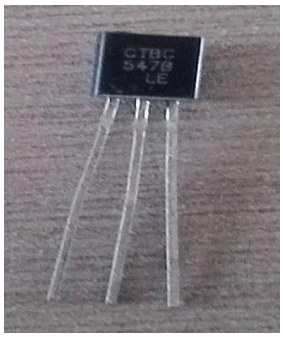

Fig.8. Transistor

g) Relay

In this paper a 5V electromagnetic Relay is used for driving a fan. Relay consists of 5 terminals namely COIL 1, COIL 2, normally closed (NC), Normally Open (NO) and common (C). C pin is connected to AC voltage regulator resistor and NO is connected to Fan [9]. Relay coils COIL 1 is connected to 5V and COIL 2 is connected to transistor collector. Initially C pin and NC pins are in closed condition. When the transistor is switched on relay coil is energized. Now the pins C and NO are closed and NC is in open condition. So the voltage from AC voltage regulator is goes to fan. Electromagnetic relay is shown in Figure 9.

Fig.9. Relay

h) Freewheeling Diode

In this article Diode 1N4007 is used as freewheeling diode [10]. This diode is also called as snubber diode, communicating diode, fly back diode, clamp diode or catch diode. This diode is used to eliminate the sudden voltage change across the inductive load. Without this diode, the sudden voltage change can damage the circuit. Freewheeling diode is shown in Figure 10.

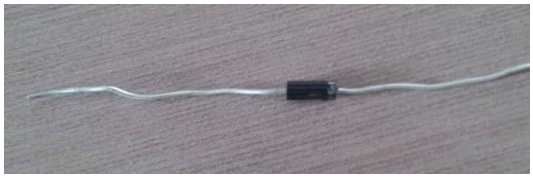

Fig.10. Freewheeling Diode

i) AC Voltage Regulator Circuit

In this article we are using commercial AC Voltage regulator. It consists of resistors and capacitors. Common pins of 5 relays are connected to these regulator resistors. Main function of this regulator is drop the AC voltage based on resistance value. So output of AC regulator is controlled and given to the fan. Fan rotation is proportional to output of AC voltage regulator. AC voltage regulator is shown in Figure 11.

Fig.11. AC Voltage Regulator

j) Speed Indicator

The following figures indicates that the fan speed level with the help of LED. Fan off condition is shown in Figure 12; Fan level 1 speed is shown in Figure 13; Fan level 2 speed is shown in Figure 14; Fan level 3 speed is shown in Figure 15; Fan level 4 speed is shown in Figure 16; Fan level 5 speed is shown in Figure 17.

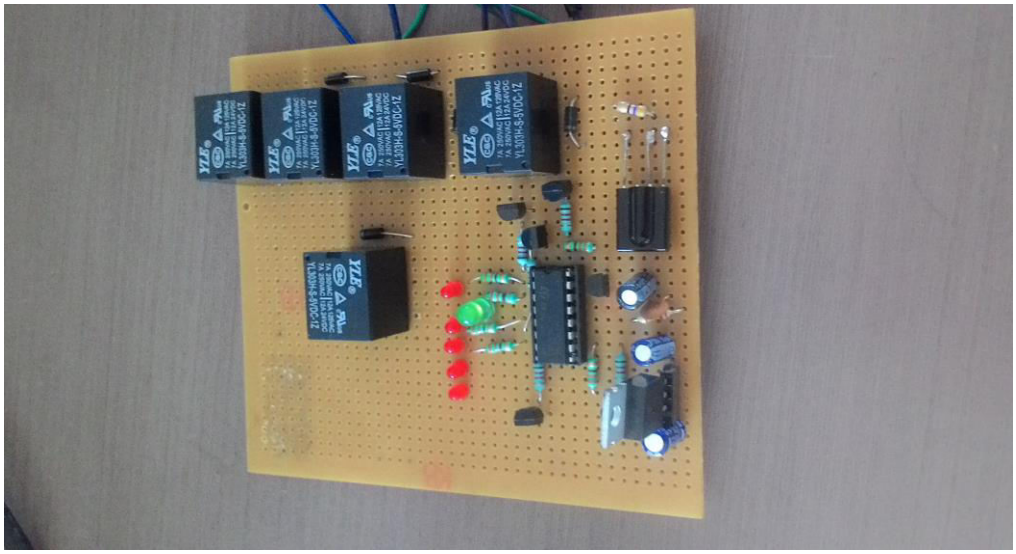

Fig.12. Fan off condition

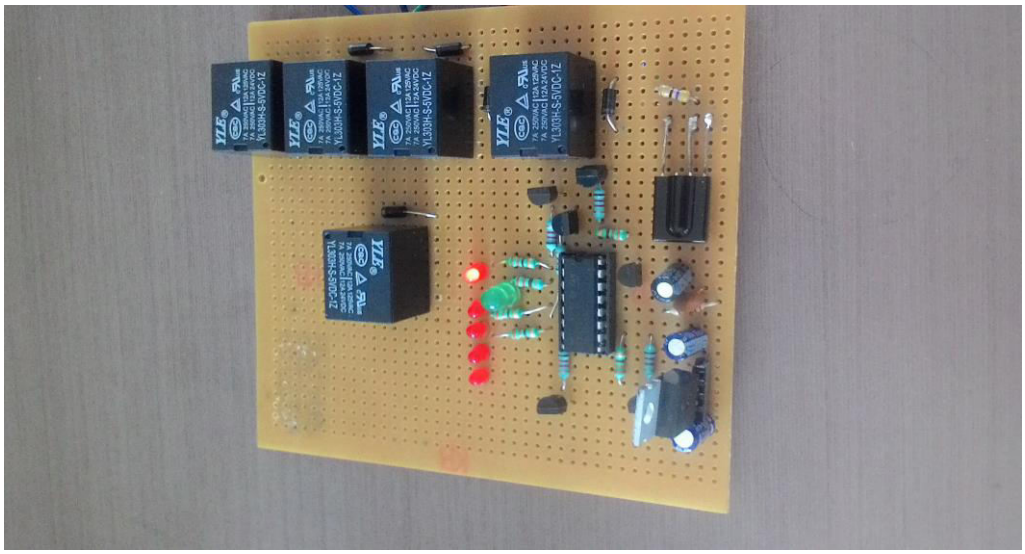

Fig.13. Fan level 1st speed

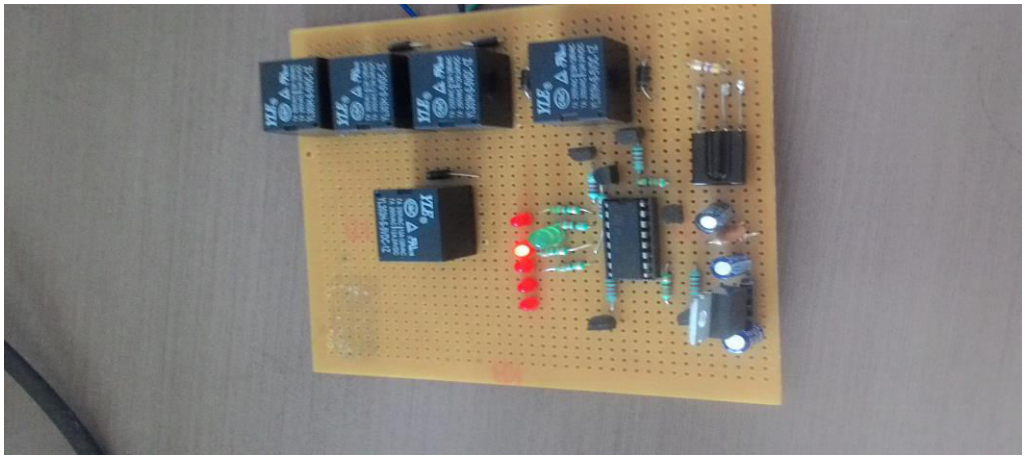

Fig.14. Fan level 2nd speed

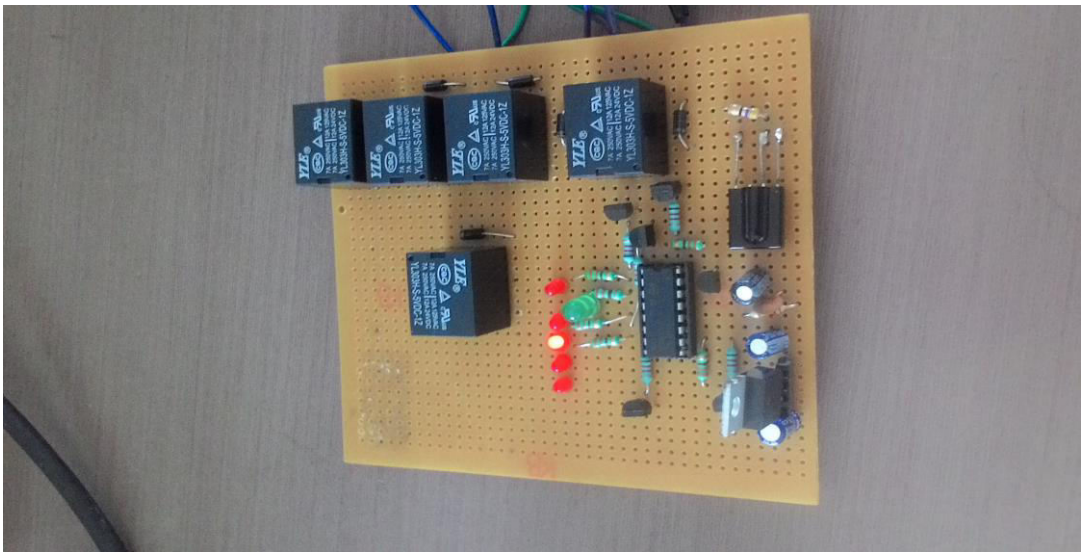

Fig.15. Fan level 3rd speed

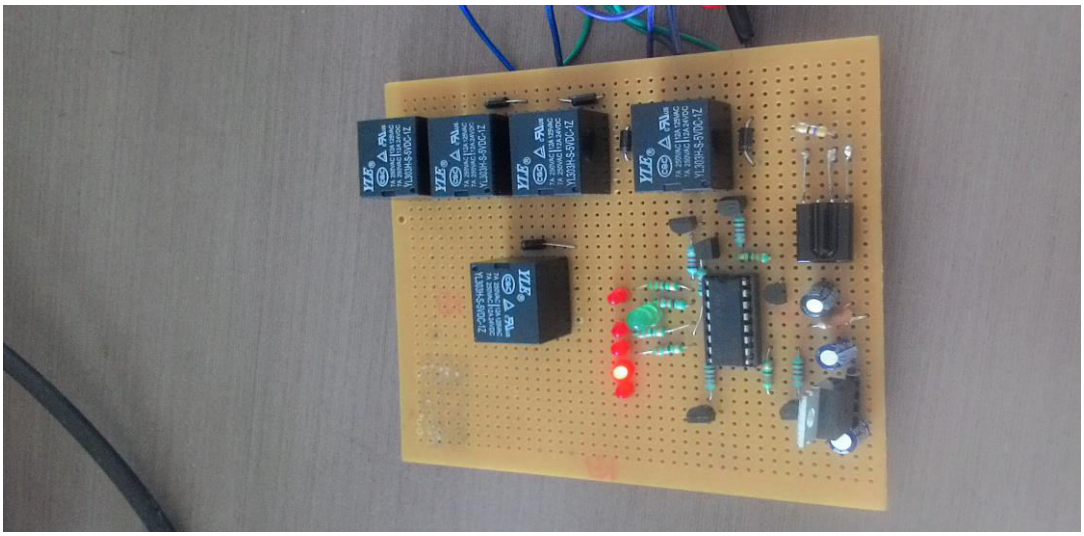

Fig.16. Fan level 4th speed

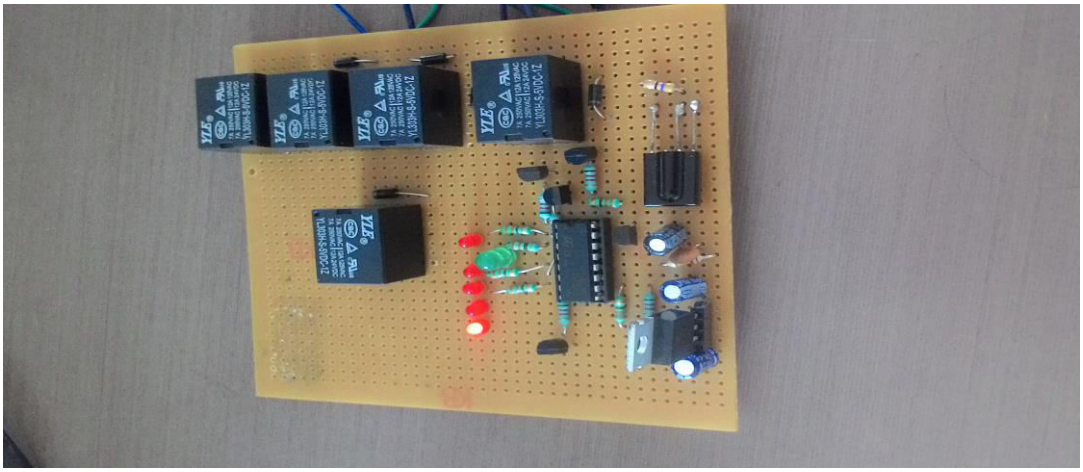

Fig.17. Fan level 5th speed

IV. CONCLUSION

The article proposes a user friendly smart fan using IR communication. It saves the time to change the fan speed from remote area. This concept is very useful for disabled and older peoples because no need to move near the commercial regulator for varying the fan speed. This circuit is placed nearer to the fan or in a convenient place. In order to change the speed of the fan, just focus the remote to this receiver circuit and press the key. The idea proposed in this article can be used in Industries, hospitals, apartments and restaurant.

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REFERENCES

[1] Dipankar Som, Pritam Bose (2013), "Design and Construction of a Remote Controlled Fan Regulator", *International Journal of Engineering Research & Technology,* Vol.2, Issue.6, ISSN: 2278-0181, pp.1028-1033.

[2] Er. Pawan Sharma, Er. Deepika joshi, Er. Honey Raghuvanshi, Er. Lokesh Yogi (2015), "Remote Operated Master Switch via Infrared Technology", *International Journal of Emerging Research in Management and Technology,* Vol.4, Issue.5, ISSN:2278-9359, pp.102-106.

[3] Apoorva Bharambe, Divya Chanekar, Divya Naik, Prof.A.B.Vitekar (2015), "Automatic Hand Guesture Based Remote Control for Home Appliances", *International Journal of Advanced Research in Computer Science and Software Engineering,* Vol.5, Issue.2, ISSN:2277 128X, pp.567-571.

[4] Joydeep Roy, Joyanta Kumar Roy (2014), "Design of Smart Universal Remote using Mobile for Home Automation", *IOSR Journal of Computer Engineering,* Vol.16, Issue.5,e-ISSN:2278-0661, pp.73-80.

[5] Shahruk Osman,Tapan Kumar Chakraborty, Ariful islam, Nazhibur Rahman (2014), "Design and Implementation of Remote Controlled Fan Regulator", *International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering*,Vol.3, Issue.9,ISSN:2320-3765, pp.11682-11688.

[6] Rahul Mishra, Shahidraza, Zulquarnain, RachnaArya, Prashant Kumar (2013), " Development of Automatic person Detection system to control AC Fan & Room lights", *International Journal of Innovative Research in Science, Engineering and Technology*,Vol.2, Issue.3,ISSN:2319-8753, pp.587-589.

[7] Joyita Tasnia Islam, Shibly Sadik (2016), "AVR Microcontroller based remote controlled Embedded system to regulate AC Fan or dim AC light with power level, temperature and humidity display", *International Journal of Advanced Research in Electronics and Communication Engineering,* Vol.5, Issue.10,ISSN: 2278-909X, pp.2428-2432.

[8] Samiran Maiti, Pabitra Kumar Nandi (2014), "IR Remote control Signal Decoder for Home Automation", *International Journal of Engineering Science and Innovative Technology*, Vol.3, Issue.3, ISSN:2319-5967, pp.262-268.

[9] N K Kaphungkui (2015), "RF based Remote control for Home Electrical Appliances", *International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering,* Vol.3, Issue.7, ISSN:321-2004,DOI:10.17148/IJIREEICE.2015.3709, pp.42-44.

[10] Kannapiran S, Dr.Arvind Chakrapani (2016), "A Novel Home Automation System using Bluetooth and Arduino", *International Journal of Advances in Computer and Electronics Engineering,* Vol.1, Issue.5, ISSN: 2456-3935, pp.41-44.

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