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IoT Based Infrared Remote Controlled AC Fan Regulator

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ABSTRACT
This paper presents the design and implementation of an infrared remote controlled ac fan regulator. The regulator consists of IR sensor, monostable multi vibrator, decade counter, transformer, comparator, opto-isolator and TRIAC. The user will be able to operate the regulator with any remote control used for TV, VCR, Air-Conditioner, DVD player etc. The remote transmits a beam of light and this light is picked and decoded by the receiver unit. The receiver only activates when it receives the beam of light. Every time when the button is pressed, the speed of the fan is increased smoothly up to ten different speed levels. The fan regulator has been simulated and experimentally tested. It is found that the system works satisfactorily and the experimental results are almost same. Details of each unit are described in the paper.

***KEYWORDS:** Resistance, Capacitor, Dielectric, Diode, LED, Transformer, IC, 555 Timer, P-N junction*

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1. INTRODUCTION

Remote control facilitates the operation of fan regulators around the home or office from a distance. It provides a system that is simple to understand and also to operate, a system that would be cheap and affordable, a reliable and easy to maintain system of remote control and durable system irrespective of usage. It adds more comfort to everyday living by removing the inconvenience of having to move around to operate a fan regulator [1]. The system seeks to develop a system that is cost effective while not under mining the need for efficiency. The first remote control, called "lazy bones" was developed in 1950 by Zenith Electronics Corporation (then known as Zenith Radio Corporation). The device was developed quickly, and it was called "Zenith space command", the remote went into production in the fall of 1956, becoming the first practical wireless remote control device. Today, remote control is a standard on other consumer electronic products, including VCRs, cable and satellite boxes, digital video disc players and home audio players. And the most sophisticated TV sets have remote with as many as 50 buttons. In year 2000, more than 99 percent of all TV set and 100 percent of all VCR and DVD players sold are equipped with remote controls. The average individual these days probably picks up a remote control at least once or twice a day. Basically, a remote control works in the following manner [2]. A button is pressed. This completes a specific connection which produces a Morse code line signal specific to that button. The transistor amplifies the signal and sends it to the LED which translates the signal into infrared light. The sensor on the appliance detects the infrared light and reacts appropriately. The remote control's function is to wait for the user to press a key and then translate that into infrared light signals that are received by the receiving appliance. The carrier frequency of such infrared signals is typically around 36 kHz. Usually, the transmitter part is constructed so that the transmitter oscillator which drives the infrared transmitter LED can be turned on/off by applying a TTL (transistor-transistor logic) voltage on the modulation controlled input. On the receiver side, a photo transistor or photodiode takes up the signals [3]. The approach used in this work is the modular approach where the overall design was broken into functional block diagrams, where each block in the diagram represents a section of the circuit that carries out a specific function. The system was designed using 8 functional blocks, as shown in the block diagram Figure-1

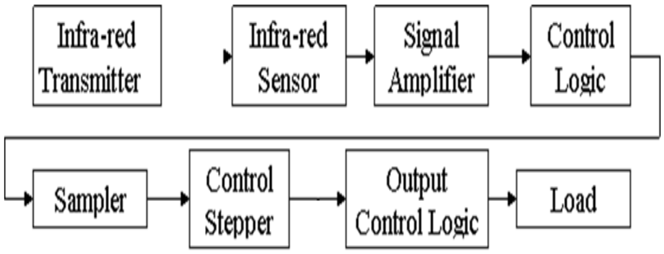


Figure-1: System block diagram

2. Description of Circuit Components

This project is circuit based project. For this reason the project has a big circuit diagram [4]. This circuit diagram contains some circuit components these are Transformer, Diode, Capacitor, Resistor, Transistor, LED, Zener diode, IC, TRIAC, ICs etc. Which are described below.

2.1. Resistor

A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit. Resistors can also be used to provide a specific voltage for an active device such as a transistor. Resistors can be fabricated in a variety of ways. The most common type in electronic devices and systems is the carbon-composition resistor. Fine granulated carbon (graphite) is mixed with clay and hardened. The resistance depends on the proportion of carbon to clay; the higher this ratio, the lower the resistance [5].

Figure-2: Resistor

If some potential difference is applied between the ends of a rod copper and a rod of wood, very different currents result. The characteristics of the conductor that inters here is its resistance we define the resistance of a conductor (often called a resistor) between two points by applying a potential difference V between those points, measuring the current I and dividing. In mathematically it is expressed as,

R=V/I, Where R= Resistance of the conductor. If V is in volts and I is in amperes, the resistance R will be in ohms, according to the German physicist ohm (1787-1854).A conductor said to have a resistance of one ohm if it permits one ampere current to flow through it when a voltage of one volt is impressed across its terminal .in mathematically it is expressed as

1 ohm=1 volt/ 1 ampere

For insulators whose resistance are very high a much bigger unit is used i.e. kilo-ohm or mega ohm are used .On the other hand, in the case of very small resistance, smaller units like mili-ohm or micro-ohm are used. It is denoted by. Depending on the physical properties of the material each conductor will have a different resistance from which it is its length and cross-sectional area and other factors. The resistance of conductor is directly proportional to its length and inversely proportional to its cross sectional area, it depends on the nature of the conductor and depends on the temperature of the conductor. Mathematically we can write R= ρl/A. Where R is the resistance of the conductor, l is the length of the conductor; A is the cross-sectional area of the conductor and is the specific resistance of the conductor is also known as receptivity. When l=1meter and cross-sectional area A=1 meter2, then we can write from the above equation R= p Therefore, specific resistance of a conductor is defined as the resistance between the opposite faces of ammeter cube of that conductor. The unit of specific resistance is ohm meter (Ω-m) [5] [6].

2.1.1. Types of Resistor

The first major categories into which the different types of resistor can be fitted is into whether they are fixed or variable. These different resistor types are used for different applications:

Fixed resistors: Fixed resistors are by far the most widely used type of resistor. They are used in electronics circuits to set the right conditions in a circuit. Their values are determined during the design phase of the circuit, and they should never need to be changed to "adjust" the circuit. There are many different types of resistor which can be used in different circumstances and these different types of resistor are described in further detail below.

Variable resistors: These resistors consist of a fixed resistor element and a slider which taps onto the main resistor element. This gives three connections to the component: two connected to the fixed element, and the third is the slider. In this way the component acts as a variable potential divider if all three connections are used. It is possible to connect to the slider and one end to provide a resistor with variable resistance [7].

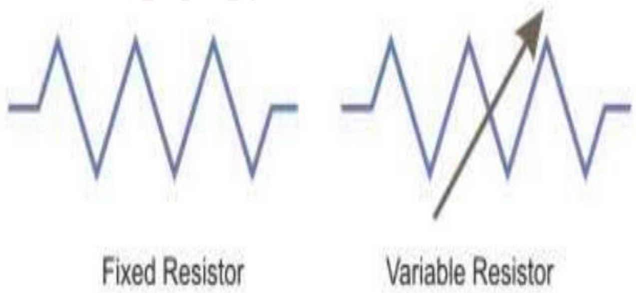


Figure-3: Symbol of fixed resistor & variable Resistor

2.1.2. Methods of Making Resistors

- There are two main methods that are used to make resistors.
- The most common is to just have a bunch of wire wound up inside that little cylinder.
- Known as wire- resistors, they wound depend on the fact that a certain length of a certain piece of wire will have a certain resistance.
- These resistors tend to be very reliable (with low tolerances), but cost more because of the price of metals used in them and the machinery needed to carefully cut and wind the wire.
- The other type of resistor is made of a piece of carbon.
- Known as a composition resistor, they depend on the size of the piece of carbon, and the fact that carbon is a metalloid (has some metal-like properties) that does conduct electricity.
- Because they are made from cheap carbon, composition resistors can cost much less than similar wire-wound resistors. The drawback is that

- The carbon can be cracked while making them, or become cracked in use. They have higher tolerances because of the uncertainty in cutting the carbon.
- In some cases it is necessary to have a circuit with resistors that you can adjust.
- These resistors are known as potentiometers or variable resistors.
- Often they are just a modified version of a wire-wound resistor, although newer versions use advanced electronics instead.
- You've used one if you've ever used a dimmer switch for lights in a room, or played with an electric race car set.
- Most variable resistors are designed so that by turning a dial or sliding a switch, you change the amount of conducting material the current has to go through.
- The more conducting material the current has to go through, the higher the resistance… less material and the resistance is less.

Figure-4: Practical Resistor use in circuits.

2.1.3 Measurement of Resistance

Each color corresponds to a certain digit, progressing from darker to lighter colors, as shown in the chart below.

Color	*Number*	*Multiplier*	*Tolerance*
Black	0	10^0	
Brown	1	10^1	± 1%
Red	2	10^2	± 2%
Orange	3	10^3	
Yellow	4	10^4	
Green	5	10^5	
Blue	6	10^6	
Violet	7	10^7	
Grey	8	10^8	
White	9	10^9	
Gold		10^{-1}	± 5%
Silver		10^{-2}	± 10%
No Color			± 20%

Table-1: Color code calculated table.

A. Theory for series circuit:

Where some having the resistance R_1, R_2, R_3, respectively are joined end to the end as shown in fig. they are said to be connected in series [7]. It can be proved that the equivalent resistance or total resistance between points A and D is equal to the sum of their individual resistance. Being a series circuit it should be remembered that 1. Current is the same through all the three conductor 2.But voltage drop across each is different due to the different resistance and is given by ohm's law 3. Sum of the three voltage drop is equal to the applied voltage across the three conductors

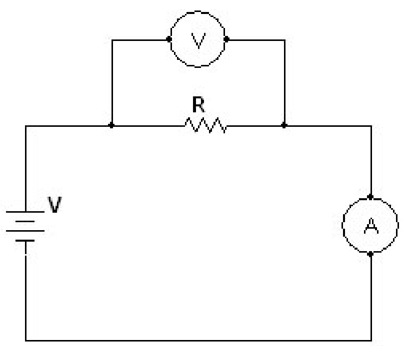
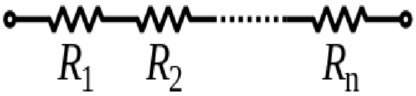


Figure-5: Simple Circuit for Ohm's law

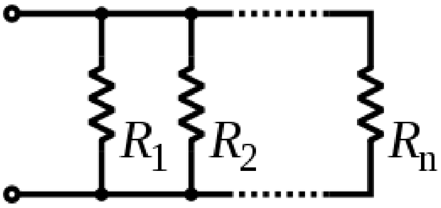


$$R_{eq} = R_1 + R_2 + \cdots + R_n$$

Figure-6: Several resistors in series connection.

B. Theory for parallel circuit:

The parallel circuit is said to be parallel if the one terminal of the resistor are joined in a common point and other is joined in other common point as shown in fig. Three resistances as joined in fig are said to connect in parallel. In case 1. Potential difference across all resistances is the same .2. Current in each resistor is different and is given by ohm's law .3. The total current is the sum of the three separate current. Here equivalent resistance is



$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n}$$

Figure-7: Several resistors in parallel connection.

The parallel equivalent resistance can be represented in equations by two vertical lines "||" (as in geometry) as a simplified notation. Occasionally two slashes "//" are used instead of "||", in case the keyboard or font lacks the vertical line symbol [8]. For the case of two resistors in parallel, this can be calculated using:

$$R_{eq} = R_1 \| R_2 = \frac{R_1 R_2}{R_1 + R_2}$$

As a special case, the resistance of N resistors connected in parallel, each of the same resistance R, is given by R/N .

2.2. Capacitor

A capacitor (originally known as condenser) is a passive two-terminal electrical component used to store energy in an electric field. The forms of practical capacitors vary widely, but all contain at least two electrical conductors separated by a dielectric (insulator); for example, one common construction consists of metal foils separated by a thin layer of insulating film. Capacitors are widely used as parts of electrical circuits in many common electrical devices [9].

Figure-8: Some typical capacitor

Figure-9: Solid-body, resin-dipped 10 µF 35 V tantalum capacitors. The + sign indicates the positive lead.

The property of a capacitor to "store electricity" may be called its capacitance. The capacitance of a capacitor is defined as "the amount of charge required creating a unit p.d. between its plates. Suppose we give Q coulomb of charge to one of the two plates of capacitor and if p.d. of V volts is established the two, then its capacitance is

C = Q/V = charge/potential difference

Hence, capacitance is the charge required per unit potential difference. The basic unit of capacitance is the Farad (F).

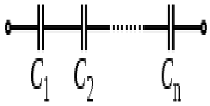
1 farad = 1 coulomb/volt

One farad is actually too large for practical purposes. Hence, much smaller units like

1 µF = 10^{-6} F, 1 nF = 10^{-9} F, 1 µµF or pF = 10^{-12} F.

2.2.1. Capacitance in series connection

Connected in series, the schematic diagram reveals that the separation distance, not the plate area, adds up. The capacitors each store instantaneous charge build-up equal to that of every other capacitor in the series. The total voltage difference from end to end is apportioned to each capacitor according to the inverse of its capacitance. The entire series acts as a capacitor smaller than any of its components.



$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \cdots + \frac{1}{C_n}$$

Figure-10: Several capacitors in series

Capacitors are combined in series to achieve a higher working voltage, for example for smoothing a high voltage power supply. The voltage ratings, which are based on plate separation, add up, if capacitance and leakage currents for each capacitor are identical. In such an application, on occasion series strings are connected in parallel, forming a matrix [10]. The goal is to maximize the energy storage of the network without overloading any capacitor. For high-energy storage with capacitors in series, some safety considerations must be applied to ensure one capacitor failing and leaking current will not apply too much voltage to the other series capacitors.

2.2.2. Capacitance in parallel connection

Capacitors in a parallel configuration each have the same applied voltage. Their capacitances add up. Charge is apportioned among them by size. Using the schematic diagram to visualize parallel plates, it is apparent that each capacitor contributes to the total surface area [11].

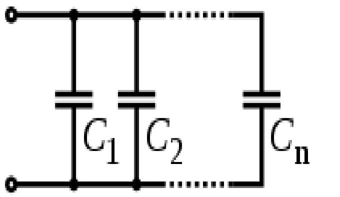
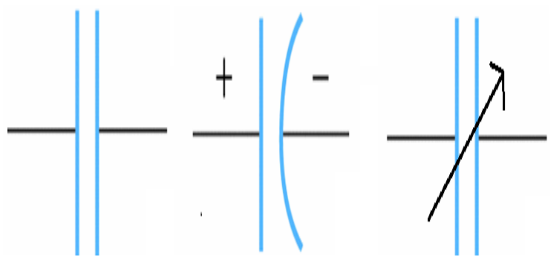


Figure-11: Several capacitors in parallel.

2.2.3. Types of Capacitor

Fixed capacitors are divided into the following groups:

- Fixed Capacitor
- Electrolytic Capacitor and
- Variable Capacitor



(a) (b) (c)

Figure-12: Symbol of (a) Fixed Capacitor, (b) Electrolytic Capacitor and (c) Variable Capacitor.

Figure-12 shows the schematic symbols for both fixed and variable capacitors. The fixed capacitor is used to store electric charge, block dc and pass ac. The electrolytic capacitor has large capacitance. The symbol for an electrolytic capacitor indicates that polarity must be observed when connecting it into a circuit for fixed values only. I use fixed and electrolytic capacitors in this project [12].

2.2.4. Dielectric materials

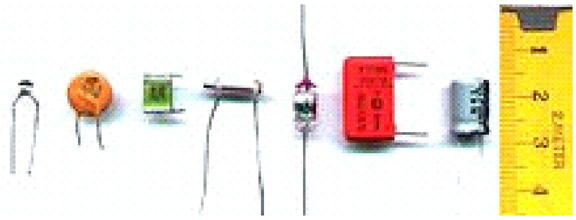


Figure-13: Capacitor materials (From left): multilayer ceramic, ceramic disc, multilayer polyester film, tubular ceramic, polystyrene, metalized polyester film, aluminum electrolytic. Major scale divisions are in centimeters.

2.2.5. Theory of operation

A capacitor consists of two conductors separated by a non-conductive region. The non-conductive region is called the dielectric. In simpler terms, the dielectric is just an electrical insulator. Examples of dielectric media are glass, air, paper, vacuum, and even a semiconductor depletion region chemically identical to the conductors. A capacitor is assumed to be self-contained and isolated, with no net electric charge and no influence from any external electric field [13]. The conductors thus hold equal and opposite charges on their facing surfaces, and the dielectric develops an electric field. In SI units, a capacitance of one farad means that one coulomb of charge on each conductor causes a voltage of one volt across the device.

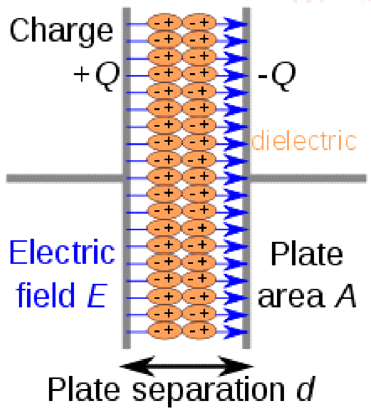


Figure-14: Charge separation in a parallel-plate capacitor causes an internal electric field. A dielectric (orange) reduces the field and increases the capacitance.

The capacitor is a reasonably general model for electric fields within electric circuits. An ideal capacitor is wholly characterized by a constant capacitance C, defined as the ratio of charge ±Q on each conductor to the voltage V between them,

$$C = \frac{q}{v}$$

Sometimes charge build-up affects the capacitor mechanically, causing its capacitance to vary. In this case, capacitance is defined in terms of incremental changes,

$$C = \frac{\mathrm{d}q}{\mathrm{d}v}$$

2.2.6. Energy of electric field

Work must be done by an external influence to "move" charge between the conductors in a capacitor. When the external influence is removed, the charge separation persists in the electric field and energy is stored to be released when the charge is allowed to return to its equilibrium position [14]. The work done in establishing the electric field, and hence the amount of energy stored is,

$$W = \int_0^Q V\mathrm{d}q = \int_0^Q \frac{q}{C}\mathrm{d}q = \frac{1}{2}\frac{Q^2}{C} = \frac{1}{2}CV^2 = \frac{1}{2}VQ$$

Here Q is the charge stored in the capacitor, V is the voltage across the capacitor, and C is the capacitance. In the case of a fluctuating voltage V(t), the stored energy also fluctuates and hence power must flow into or out of the capacitor. This power can be found by taking the time derivative of the stored energy,

$$P = \frac{\mathrm{d}W}{\mathrm{d}t} = \frac{\mathrm{d}}{\mathrm{d}t}\left(\frac{1}{2}CV^2\right) = CV(t)\frac{\mathrm{d}V}{\mathrm{d}t}$$

2.2.7. Current - voltage relation

The current I(t) through any component in an electric circuit is defined as the rate of flow of a charge Q(t) passing through it, but actual charges—electrons—cannot pass through the dielectric layer of a capacitor. Rather, an electron accumulates on the negative plate for each one that leaves the positive plate, resulting in an electron depletion and consequent positive charge on one electrode that is equal and opposite to the accumulated negative charge on the other [15]. Thus the charge on the electrodes is equal to the integral of the current as well as proportional to the voltage, as discussed above. As with any ant derivative, a constant of integration is added to represent the initial voltage V (t_0). This is the integral form of the capacitor equation:

$$V(t) = \frac{Q(t)}{C} = \frac{1}{C}\int_{t_0}^{t} I(\tau)\mathrm{d}\tau + V(t_0)$$

Taking the derivative of this and multiplying by C yields the derivative form:

$$I(t) = \frac{\mathrm{d}Q(t)}{\mathrm{d}t} = C\frac{\mathrm{d}V(t)}{\mathrm{d}t}$$

The dual of the capacitor is the inductor, which stores energy in a magnetic field rather than an electric field. Its current-voltage relation is obtained by exchanging current and voltage in the capacitor equations and replacing C with the inductance L. Following important facts can be deduced from the above relations:

dv=(i/C)dt Integrating the above equation, we get, ∫dv = (1/C)∫i.dt or v = (1/C)∫ i dt.

2.3. P-N Junction Diode

A diode is an electronic component which allows current to flow through it one direction but not the other. A diode main function is to change an ac voltage into a dc voltage. There are different types of diode. The most frequently diodes are 1) Semiconductor diode 2) Zener diode. Both diodes are used in this project [16].

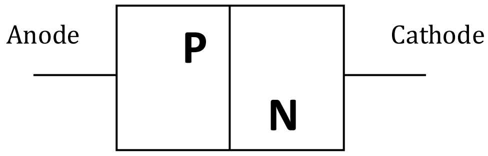


Figure-15: PN-Junction Diode

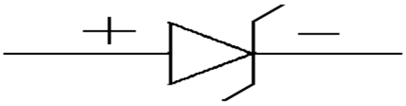


Figure-16: Symbol of Zener diode

2.3.1. Diode Symbol
It should be noted that the arrow in the semiconductor diode symbol points in the same direction as the conventional current flow in the forward bias condition. Fig-17 shows the symbol of the semiconductor diode [17].

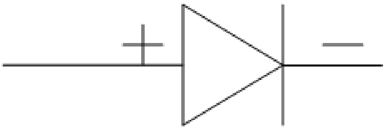


Figure-17: Symbol of Diode

2.3.2. Diode Fabrication
The P-N junction may be produced by any one of the following methods:-
1. Grown junction 2. Alloy junction 3. Diffused junction 4. Epitaxial growth 5. Point contact junction.

2.3.3. Characteristics of Semiconductor Diode (V/I Characteristic):
The static voltage-current characteristic for a low power P-N junction diode is shown in Fig: 18

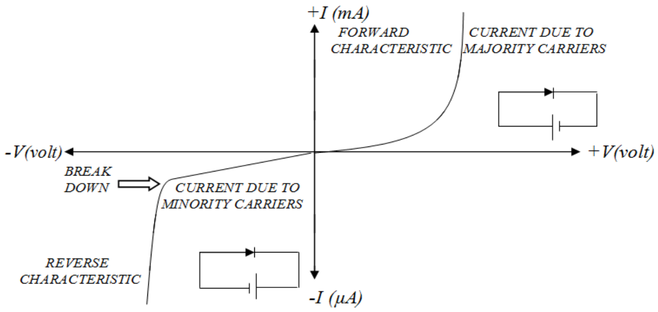


Figure-18: Forward & Reverse Characteristics of diode

2.4. BC548 Transistor
The BC548 transistor is a semiconductor that works to switch electronic signals, and in some cases amplify them. Transistors are one of the most important circuit board components, and replaced vacuum tubes in the mid-20th century, allowing for the true miniaturization of electronics. To the untrained eye, a circuit board simply looks like a green piece of plastic with innumerable small electronic chips, wires and other parts. In reality each component plays a vital role in making a circuit, and electronic devices as a whole, work. BC548 transistors are mainly used in Europe. They are fairly common there, used typically in lower power household electronics such as notebook processors and plasma televisions. In the United States and Canada, a similar transistor is named 2N3904 [18]. Japan's near-equivalent is the 2SC1815. The BC548 can be replaced with similar BC transistors without the danger of burning out or failing.

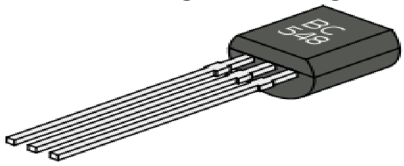


Figure-19: BC548 transistor

2.5. Light - Emitting Diode
A light-emitting diode (LED) is a semiconductor light source. LEDs are used as indicator lamps in many devices and are increasingly used for other lighting. Appearing as practical electronic components in 1962, early LEDs emitted low-intensity red light, but modern versions are available across the visible, ultraviolet, and infrared wavelengths, with very high brightness.

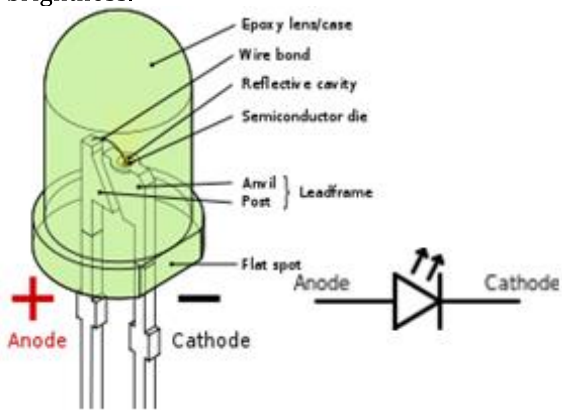


Figure-20: A light-emitting diode and its symbol

2.6. Transformer
A transformer is a static piece of apparatus by means of which electric power in one circuit is transformed into electric power in the same frequency in another circuit. It can raise or lower the voltage in a circuit but with a corresponding decrease or increase in current. The physical basis of a transformer is mutual induction between two circuits linked by common magnetic fluxes. One of the main applications of transformer is to step up or step down an ac voltage. Transformer cannot step up or step down a dc voltage [19]. Fig (20) shows the schematic symbol for transformer. In brief, a transformer is a device transfer's electric power from one circuit to another.

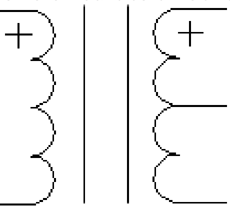


Figure-21: Schematic symbol for transformer

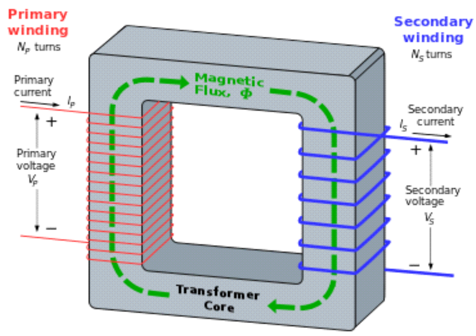


Figure-22: Basic Transformer construction

In transformer the primary and secondary voltage and current are related by the equation,

$V_1/V_2=I_2/I_1=N_1/N_2=K$ ………………… (1)

Where, V1= primary voltage

V_2= secondary voltage, I_1= primary current, I_2= secondary current, N_1= number of turns in primary winding, N_2= number of turns in secondary winding.

2.6.1. Theory of an Ideal Transformer

An ideal transformer is one that has no winding resistance, No leakage flux i.e. the same flux links both the windings, No iron losses i.e. eddy current and hysteresis losses in the core, Consider an ideal transformer on no load i.e. secondary is open circuited as shown in Fig-21 .Under such conditions; the primary is simply a coil of pure inductance. When an alternating voltage V1 is applied to the primary, it draws a small magnetizing current I which lags behind the applied voltage by 90°.This alternating current I produces an alternating flux φ which is proportional to and a phase with it. The alternating flux φ links both the windings and induces e.m.f. E1 in the primary and e.m.f. E2 in the secondary. The primary e.m.f.E1 at every instant, equal to and in opposite V1.Both e.m.f. E1 and E2 lag behind flux φ by 90°.Hoewer,their magnitudes depend open the number of primary and secondary turns [20].

2.6.2. Types of Transformer:

According to voltage, there are two types of transformer a) step up transformer b) step down transformer

From equation (1), we get a constant K. This constant K is known as voltage transformation ratio.

A. If $N_1>N_2$ i.e. K>1, then transformer is called step-down transformer.
B. If $N_2<N_1$ i.e. K<1, then transformer is called step-up transformer.

In this project, step down transformers is used.

2.7. Integrated Circuit

An IC is a complete electronics circuit in which both the active and passive components are fabricated on an extremely tiny single chip of silicon.

2.7.1. IC Component

Active component: Active components are those which have the ability to produce gain. Examples are: Transistor, FET's

Passive component: Passive components or devices are those which do not have this Ability. Examples are resistor, capacitor, and inductors.

2.7.2. Scale of integration

A. SSI (Small scale introgression): The number of circuits contained in one IC package is less than 30(or number of components is less than 50) [21].

B. MSI (medium scale integration): Number of circuits per package is between30 and 100(or number of component is 50 and 500) [21].

C. LSI (large scale integration): Circuit density is between 100 and 100,000(or component density is 500 and 300,000).

D. VLSI (very large **scale integration):** VLSI is a major electronics system constructed on a silicon containing circuits in excess of 100,000 [21].

2.8. Voltage Regulator IC

The 7809 is a voltage regulator integrated circuit(IC) which is widely used in electronic circuits. Voltage regulator circuit can be manually built using parts available in the market but it will take a lot of time to assemble those parts on a PCB. Secondly, the cost of those parts is almost equal to the price of 7809 itself so professionals usually prefer to use 7809 IC instead of making a voltage regulator circuit from scratch [22]. Before start using 7809, it will need to know about the pin structure of IC 7809. Apparently, it looks like a transistor. It has three pins. For a better understanding. An image of 7809 is shown in the Figure- 22.

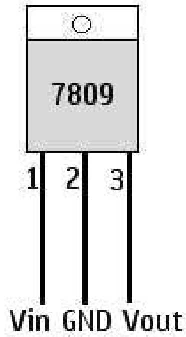


Figure-23: A 7809 IC

2.9. The 555 Timer IC

The 555 timer IC was introduced in the year 1970 by signetic corporation and gave the name SE/NE 555 timer [23]. It is basically a monolithic timing circuit that produces accurate and highly stable time delays or oscillation.

The 555 Timer IC is available as an 8-pin metal can, an 8-pin mini DIP (dual-in-package) or a 14-pin DIP. The pin configuration is shown in the figure - 24 and the block diagram is shown in the figure – 25.

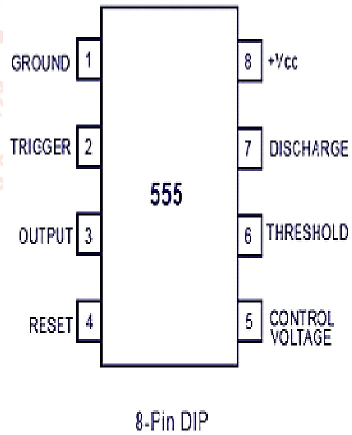


Figure-24: Pin Configuration of a 555 Timer

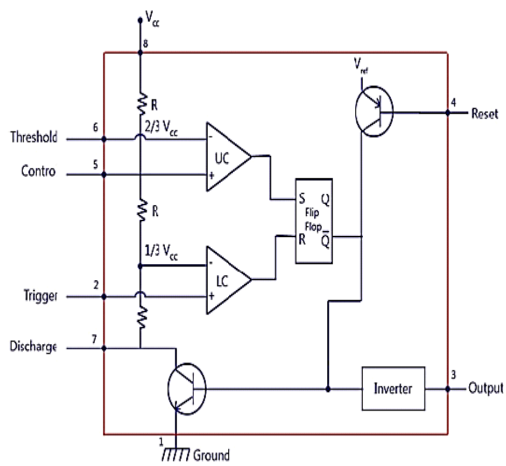


Figure-25: Block Diagram of a 555 Timer

This IC consists of 23 transistors, 2 diodes and 16 resistors. The block diagram of a 555 timer is shown in the above figure. A 555 timer has two comparators, which are basically 2 op-amps), an R-S flip-flop, two transistors and a resistive network. Resistive network consists of three equal resistors and acts as a voltage divider. Comparator 1 compares threshold voltage with a reference voltage + 2/3V_{CC} volts. Comparator 2 compares the trigger voltage with a reference voltage + 1/3 V_{CC} volts.

2.10. The CD4017 IC

Let us now introduce you a new IC named IC 4017. It is a CMOS decade counter cum decoder circuit which can work out of the box for most of our low range counting applications. It can count from zero to ten and its outputs are decoded. This saves a lot of board space and time required to build our circuits when our application demands using a counter followed by a decoder IC. This IC also simplifies the design and makes debugging easy [23].

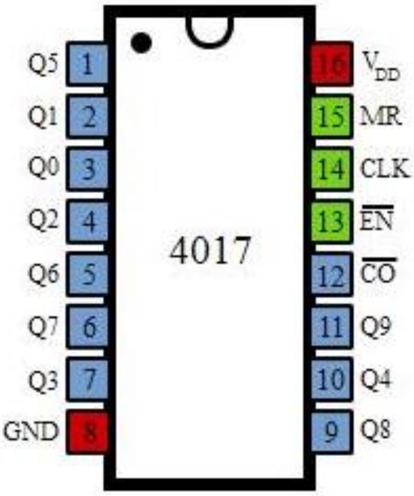


Figure-26: Pin Configuration of a CD4017 Timer

2.11. IR receiver (TSOP1738)

The Infrared signals are widely used in wide range of remote control applications so it is worthy to know about the transmission and receiving the IR signals [12]. Here the above circuit was a simple Infrared receiver circuit constructed using IC 555 and TSOP1738.The TSOP1738 was nothing but a simple IR detector used widely and here it was used for the same detecting purpose and then the signal was fed into the IC 555 which was wired as monostable multivibrator. Let's move in to the working of the above circuit.

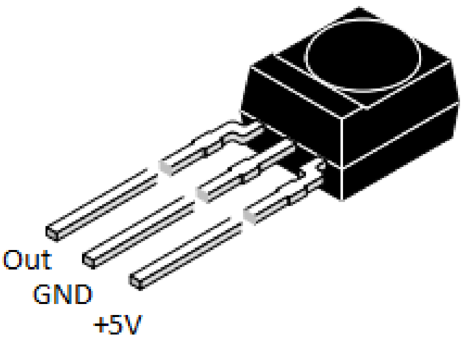


Figure-27: IR receiver (TSOP1738)

2.12. Light-Dependent Resistor (LDR)

A photo resistor or light-dependent resistor (LDR) or photocell is a light-controlled variable resistor. The resistance of a photo resistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photo resistor can be applied in light-sensitive detector circuits, and light- and dark-activated switching circuits [23].

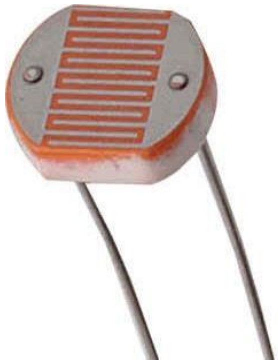


Figure-28: Light-Dependent Resistor (LDR)

2.13. BT 136 TRIAC

TRIAC, from triode for alternating current, is a generic trademark for a three terminal electronic component that conducts current in either direction when triggered. Its formal name is bidirectional triode thermistor or bilateral triode thermistor [13]. A thermistor is analogous to a relay in that a small voltage and current can control a much larger voltage and current. The illustration on the right shows the circuit symbol for a TRIAC where A1 is Anode 1, A2 is Anode 2, and G is Gate. Anode 1 and Anode 2 are normally termed Main Terminal 1 (MT1) and Main Terminal 2 (MT2) respectively.

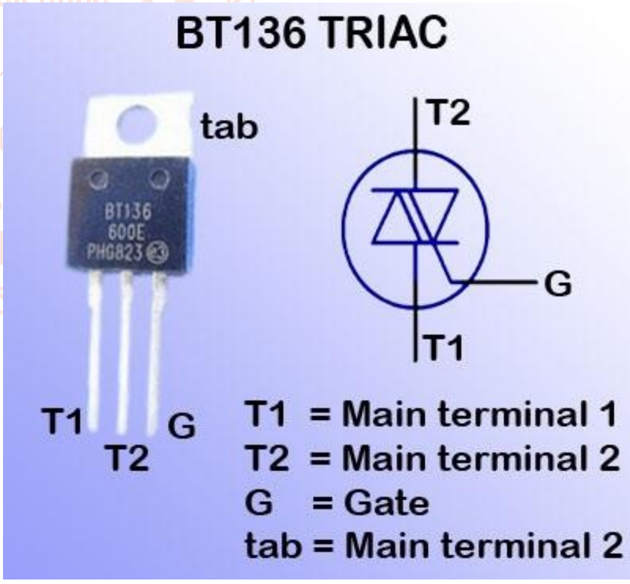


Figure-29: BT 136 TRIAC

3. Circuit Design and Operation

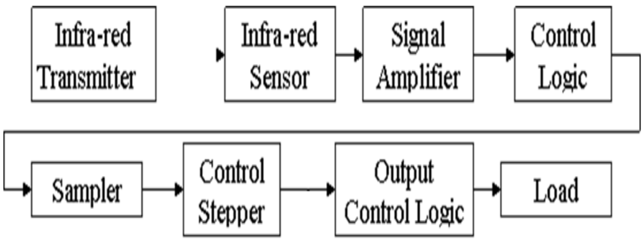


Figure-30: Block diagram of Remote Controlled Fan Regulator

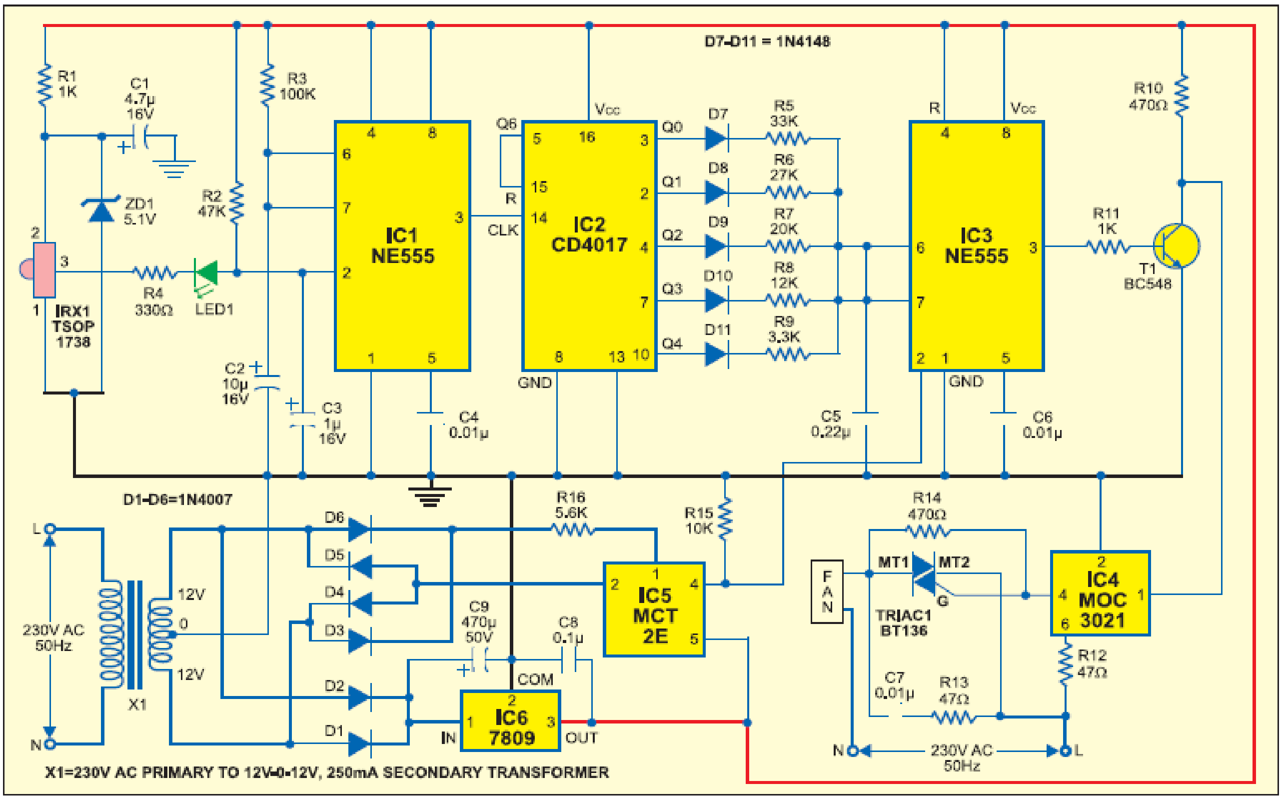


Figure-31: Circuit diagram of Remote Controlled Fan Regulator

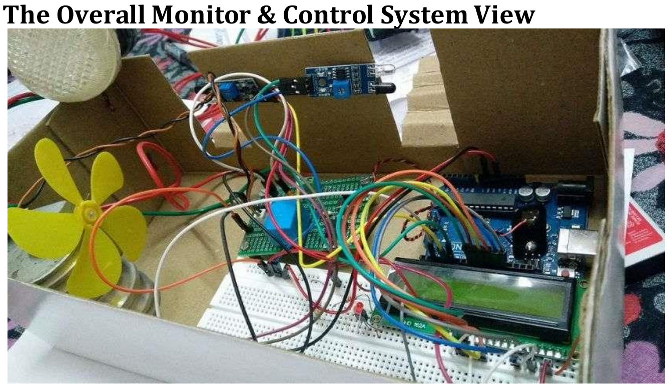
3.1. Circuit Operation

Using this circuit, you can change the speed of the fan from your couch or bed. Infrared receiver module TSOP1738 is used to receive the infrared signal transmitted by remote control. The circuit is powered by regulated 9V. The AC mains are stepped down by transformer X1 to deliver a secondary output of 12V-0-12V. The transformer output is rectified by full-wave rectifier comprising diodes D1 and D2, filtered by capacitor C9 and regulated by 7809 regulator to provide 9V regulated output any button on the remote can be used for controlling the speed of the fan. Pulses from the IR receiver module are applied as a trigger signal to timer NE555 (IC1) via LED1 and resistor R4. IC1 is wired as a monostable multivibrator to delay the clock given to decade counter-cum-driver IC CD4017 (IC2). Out of the ten outputs of decade counter IC2 (Q0 through Q9), only five (Q0 through Q4) are used to control the fan. Q5 output is not used, while Q6 output is used to reset the counter. Another NE555 timer (IC3) is also wired as a monostable multivibrator. Combination of one of the resistors R5 through R9 and capacitor C5 controls the pulse width. The output from IC CD4017 (IC2) is applied to resistors R5 through R9. If Q0 is high capacitor C5 is charged through resistor R5, if Q1 is high capacitor C5 is charged through resistor R6, and so on. Optcoupler MCT2E (IC5) is wired as a zero-crossing detector that supplies trigger pulses to monostable multivibrator IC3 during zero crossing. Opto-isolator MOC3021 (IC4) drives triac BT136. Resistor R13 (47- ohm) and capacitor C7 (0.01µF) combination is used as snubber network for triac1 (BT136) [24]. As the width of the pulse decreases, firing angle of the triac increases and speed of the fan also increases. Thus the speed of the fan increases when we press any button on the remote control. Assemble the circuit on a general-purpose PCB and house it in a small case such that the infrared sensor can easily receive the signal from the remote transmitter.

4. Result and Discussion

To complete the Remote Controlled Fan Regulator project many problem has been experienced. At first when the transformer is connected to the circuit and output is taken from secondary side of the transformer is not accurate for disconnection. Secondly the filter circuit is not act as complete filtering for mismatching RC circuit. These problems are solved by calculating mathematical expression for the good matching of RC circuit. Original circuit components are not so easy for making a good project. For this reasons the equivalent components are chosen from the market. The circuit operation is very easy when we test this project in the laboratory. When any button of the remote is pressed [25], the IR is emits and the IR receiver is received it. The red light indicates the attendance of IR. After receive this signal, the 555 timer create a pulse and send it to 13 no pin of CD1738 IC. After the operation of 4017 IC the output is send to the LDR circuit in which a LED is attend. The intensity of LED is varying the resistance of LDR. For this reason the output op the AC voltage is varies. As a result the speed of the fan is varies [26].

The Overall Monitor & Control System View



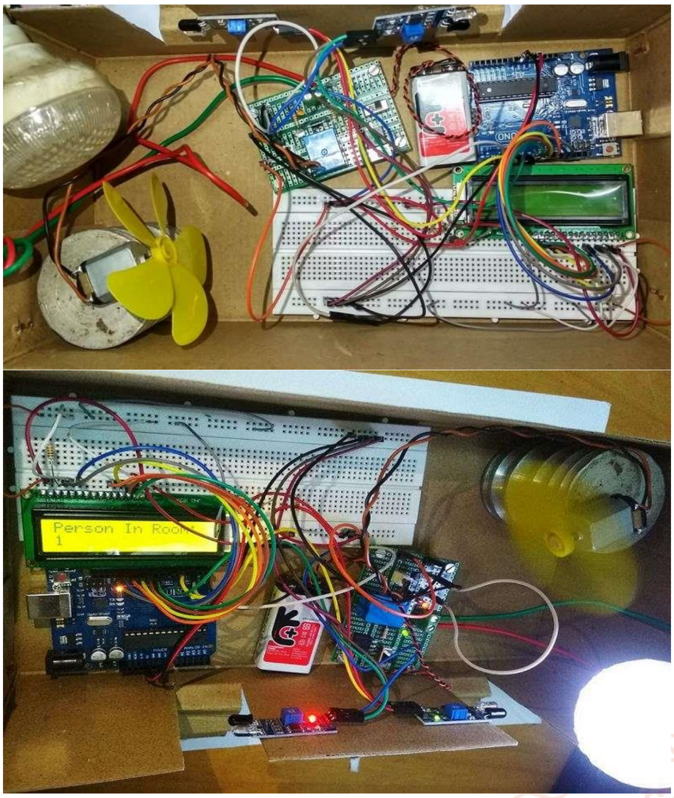


Figure-31: Final implemented system (front view).

5. Conclusion

Now-a-days most of the scientific boons are electronic based. As a result our daily life is fully dependent on electronics and this device helps us to make our life easy and comfortable. It can be used home, office, laboratory, market etc. The components used in this project are available in the market and comparatively low cost. This project is easy to make and easy to operate. The cost of such project is very low. So I hope every interest person make this project and will be take advantage. Through my project is too small but I think it is very essential and comfortable for our daily life. This project easy to make and easy to operate, It is used with a simple remote. To change the speed of the fan from couch or bed it also very helpful.

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