A

PROJECT REPORT ON

REMOTE CONTROL AIR COOLER

Project work submitted in partial fulfillment for the award of

DIPLOMA IN ELECTRONICS AND COMMUNICATION ENGINEERING

Under the guidance of

Sri K. NAGARAJU M. TECH

and

Sri R. NARESH M. TECH, UGC NET

GOVERNMENT POLYTECHNIC (005), NIZAMABAD

STATE BOARD OF TECHNICAL EDUCATION AND TRAINING

HYDERABAD, TELANGANA

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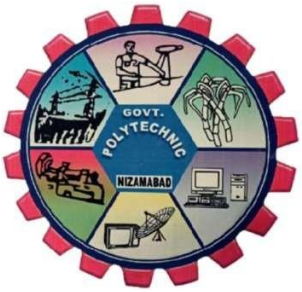
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING



CERTIFICATE

This is to certify that the project entitled

"REMOTE CONTROL AIR COOLER"

is being submitted by:

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19005-EC-011	K. SHIVAKUMAR	19005-EC-062	C. SRAVYA
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In partial fulfillment of the requirement for the award of diploma in "ELECTRONICS AND COMMUNICATION ENGINEERING" during the academic year 2021-2022

GUIDES **EXTERNAL EXAMINAR**

SRI K. NAGARAJU& SRI R. NARESH

HEAD OF THE DEPARTMENT **PRINCIPAL**

SRI M. RAVI KIRAN SRI C. SRI RAM KUMAR

DECLARATION

I hereby declare that, the Project titled "**REMOTE CONTROL AIR COOLER**" is submitted in the Department of Electronics and Communication Engineering at Govt. Polytechnic (005), Nizamabad, affiliated to SBTET, TELANGANA, in partial fulfillment of the award of Diploma in Electronics and Communication Engineering is a bonafide work done by us.

SUBMITTED BY:

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PREFACE

We sincerely thank **Sri C. SRI RAM KUMAR** Principal for providing all the necessary facilities for this project. We sincerely thanks to **Sri M. RAVI KIRAN** Head of Diploma in Electronics and Communication Engineering Section for his time to suggestions and enabled us to do complete the project successfully.

We feel honour to have work under the guidance of **Sri K. NAGARAJU &Sri R. NARESH** lecturers in Electronics and communication Engineering. We are indebted for their valuable suggestions and constructive ideas that enabled us to complete this well in time.

We heartly thanks to our department staff for their involvement and valuable suggestions in completion of our project.

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ABSTRACT

In this changing modern world every day there is new discovery in all fields of technology and science, benefiting the man kind. The new developments and requirements inspired us to think of new improvements in air conditioning Engineering field.

In our project the design of air cooler is slightly modified with an addition of remote control. 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 easy to operate.

Our objective is to design and develop a remote control namely **"REMOTE CONTROL AIR COOLER".**

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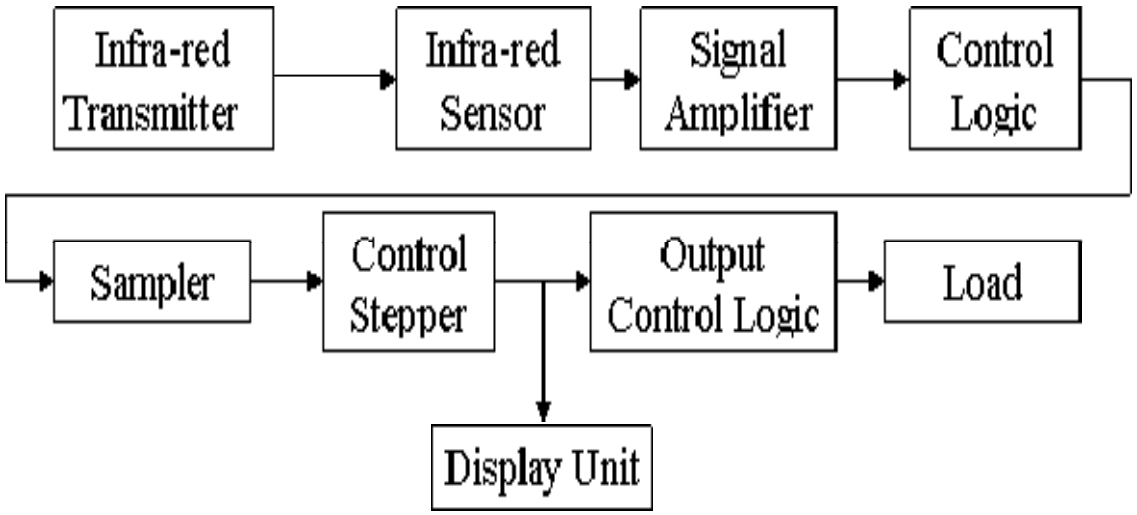
INTRODUCTION

As temperatures start to rise with the onset of long and hot summer, people turn to cooling appliances to keep themselves and their homes and offices cool. Nothing brings more respite on a hot summer day than sitting in an air-cooled room. Air cooler is commonly defined as rejecting heat from an object by flowing air over the surface of the object. Air cooling requires that the air must be cooler than the object or surface from which it is expected to remove that.

So here we propose an air cooler with remote is a lot more easy to use and definitely adds on to the comfort. 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.

The remote control air cooler works if an instruction is pressed on the remote it 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 air cooler detects the infrared light and reacts appropriately.

BLOCK DIAGRAM

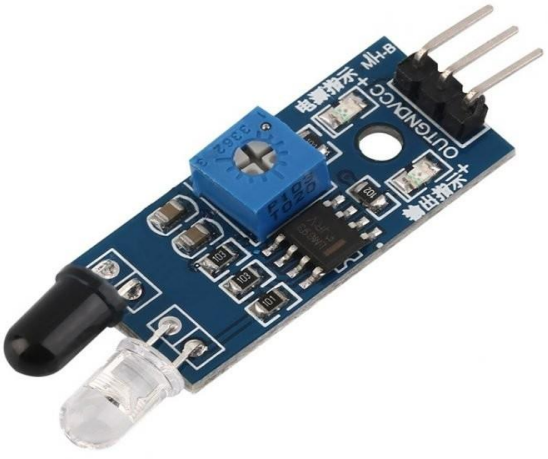


COMPONENTS AND DESCRIPTION

The physical setup of this project, are given below and it is been explained as follows:

1. Infra- red sensor
2. 4060B Oscillator
3. NPN Transistor
4. Cooler body
5. Fan
6. D. C Motor
7. Water Pump
8. Cooling pads

1. Infra- Red Sensor



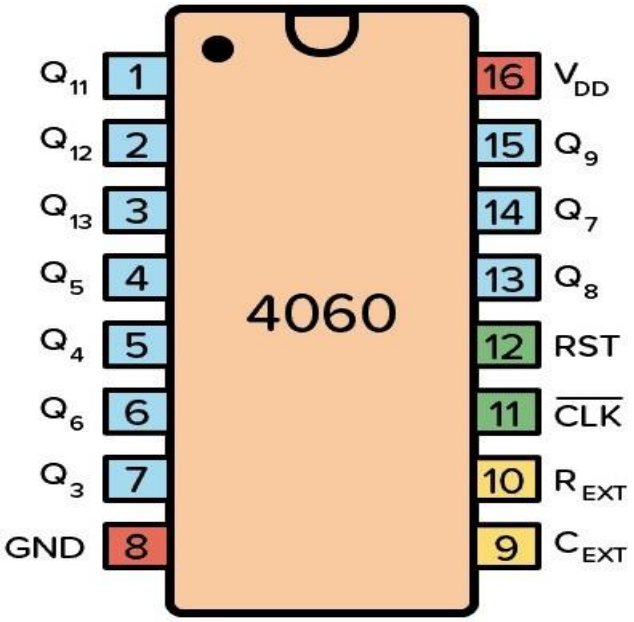
An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. Infrared radiation was accidentally discovered by an astronomer named William

Herchel in 1800. While measuring the temperature of each color of light (separated by a prism), he noticed that the temperature just beyond the red light was highest. IR is invisible to the human eye, as its wavelength is longer than that of visible light (though it is still on the same electromagnetic spectrum). Anything that emits heat gives off infrared radiation. There are two types of infrared sensors: active and passive sensors.

IR SENSOR MODULE FEATURES:

- 5VDC Operating voltage
- I/o pins are 5V and 3.3V compliant
- Range: Up to 20cm
- Adjustable sensing range
- Built-in Ambient light sensor
- 20mA supply current
- Mounting hole

2. 4060B Oscillator



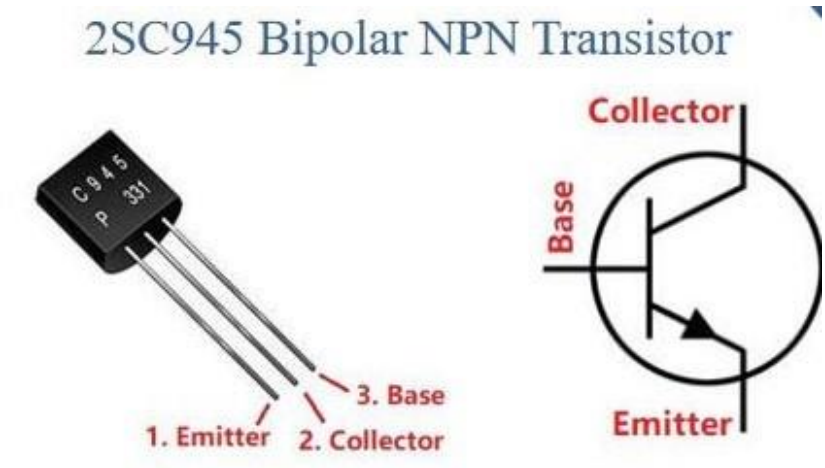
4060B PIN CONFIGURATION

The IC 4060 is highly versatile and has unlimited applications in electronic circuits. It is basically a 14 stage binary ripple counter and consists of an internal oscillator. The IC requires just a couple of resistors and a capacitor connected externally to start the oscillator.

Its 16 pins are designated as follows:

- Pin 1 to 7 and 13 to 15 are the outputs of the IC.
- Positive supply is given to pin 16. Like all CMOS ICs it should be in between 5-15 volts.
- Pin 8 is to be connected to the ground.
- Pin 9, 10, and 11 are reserved for the external frequency determining components.
- Pin 12 is the reset pin.

3. NPN Transistor (2SC945)



The C945 is an old Japanese bipolar audio frequency NPN transistor. It has a decent gain value (h f e) of a maximum of 700 and is highly linear. It has been widely used in amplifier applications for pre-amplification purposes, in high-frequency circuits. It is also used as oscillators with its **complementary A733 PNP transistor**.

When used as a switch, it can be easily controlled by an MCU/MPU since it has a base voltage of only 5V. It can switch loads up to 50V but has a very low collector current rating of only 150mA, so this transistor is not a good choice to use as a switch. 2N2222 will be a better alternative for switching applications.

FEATURES

- Type - NPN
- Collector-Emitter Voltage: 50 V
- Collector-Base Voltage: 60 V
- Emitter-Base Voltage: 5 V
- Collector Current: 0.1 A
- Collector Dissipation - 0.25 W
- DC Current Gain (h f e) - 90 to 600
- Transition Frequency - 150 MHz
- Noise Figure - 0.8 dB
- Operating and Storage Junction Temperature Range -55 to +150 °C
- Package - TO-92

4. Cooler body

Cooler body is made up of either plastic or steel sheet it accommodates various parts such as fan , pump , water storing tank, pipes for transferring water. The main function of the body gives specified shape and protects various parts from damage. These are designed variety of shapes. It has grass, switches help to regulate the flow of velocity of air.

COOLER BODY

5. Fan

FAN

Fan is a main component of a cooler which is used to converts pressure energy of air into kinetic energy this s done by giving a specific shape to a fan blade. The blades are connected to shaft which is coupled to a motor.

The fan (impeller) rotates inside the shell. The shell is so designed that the air is rushed out forcibly. The blower consists of two main parts. They are:

1. D.C motor

2. Blades (fan)

The D.C motor is directly coupled with Impeller blades. The water pump is used to circulate the water to the blower. The cool air is rushed out forcibly. The battery is connected to the D.C motor, so that the D.C motor runs directly. The switch is connected to disconnect the water pumping system when the time of water heater is ON. The water heater has drawn the power from the single phase power supply. The blower runs both the time of operation (i.e., air cooler and heater).

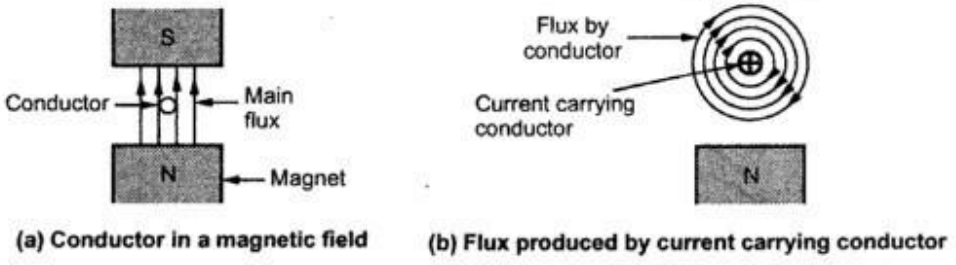
6. D. C. Motor

MOTOR

The D.C motor is used to control the direction of hot air flow. It is a device which converts electrical energy into mechanical energy. In our project, the hot air is distributed in all directions with the same rate by using D.C motor tilting mechanism.

PRINCIPLE OF OPERATION:

The basic principle of motor action lies in a simple sketch. The working principle explains that, when a current carrying conductor is placed in a magnetic field, a force is produced to move the conductor away from the magnetic field.



The force given by the equation,

F = B I L Newton's

Where,

B = Flux density in WB/sq. m
I = Current passing through the conductor
L = Length of the conductor

Let us consider a single turn coil. The coil side A will be forced to move downward, whereas the coil side "B" will be forced to move upward. Due to this movement, the coil is made to rotate.

IMPELLER:

Impeller consists of more number of blades. The number of blades increases the amount of cold air rushed out forcibly. The impeller blades are slightly bended. So that the cold air is forcibly transmitted to the outside.

7. WATER PUMP

WATER PUMP

Water Pump is a device which is used to convert mechanical energy into hydraulic energy by which water present below in container transferred to above the cooler. It circulates the water. The battery is connected to the D.C water pump, so that D.C water pump runs directly.

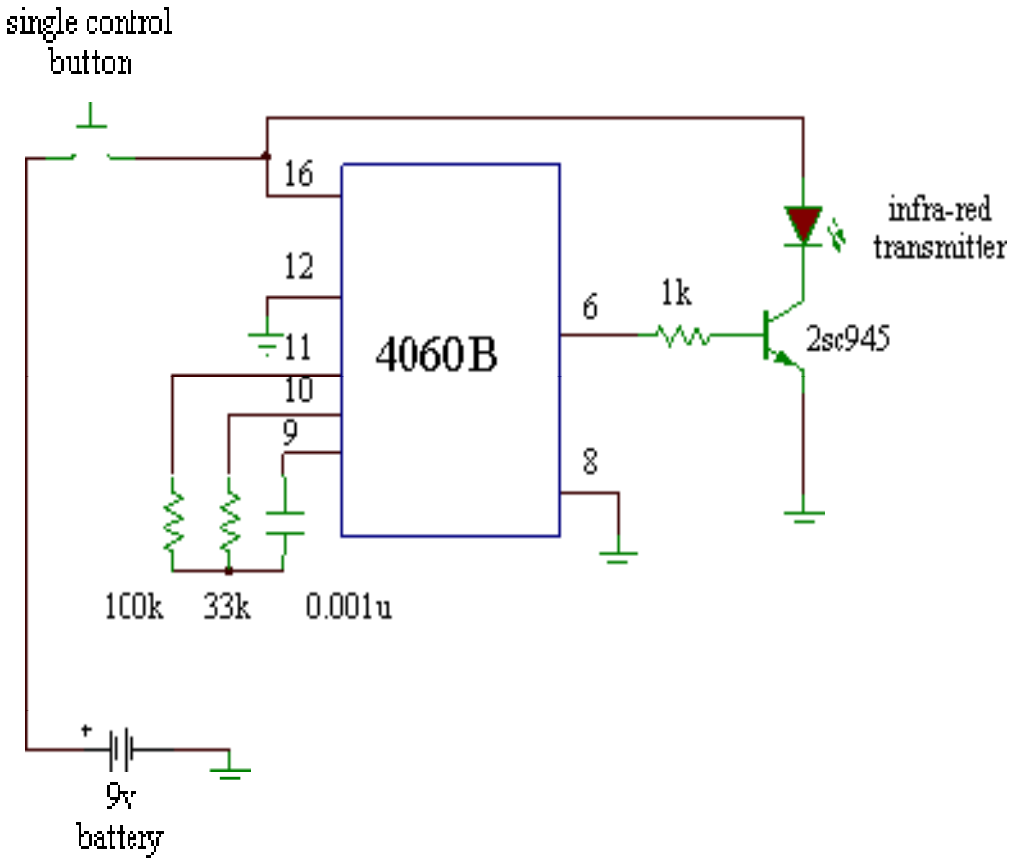
8. COOLING PADS

Grass is used to store the water particles so that humidity content will be increased in surrounding so that we feel comfort. Khus is a type of grass, which is used as a coolant in the coolers. As the dry air passes through these wet paddings, it has a cooling effect, with a sweet aroma diffusing in the air.

GRASS

TRANSMISSION

The remote control device has the task of sending the infrared signal, which is received by the infra-red sensor. It's mode of operation can be better understood through the circuit diagram shown in Figure



CIRCUIT OF REMOTE DEVICE

At the application of voltage from the 9v battery or when the single switch is closed, the 4060B oscillator IC, produce high and low signals on pin 6, which is fed across the base of the 2sc945 NPN transistor. When the output from the oscillator is high, there is a high voltage across the base of the NPN transistor, which turns it on.

This permits the infra-red emitting diode to be grounded, resulting in the emission of an infra-red ray. When the output from the oscillator is low, there is a low voltage across the base of the NPN transistor, which turns off the switching transistor. Resulting in no emission of any infra-red ray from the infra-red emitting diode.

The 4060B oscillator IC produces a stream of pulses at a frequency determined by the RC configuration on pins 11, 12 13. The frequency of oscillation is given by:

$f_1 = 1/(2.3 \cdot R \cdot C)$,

where $R = 33 \cdot 10^3\ \Omega$ and $C = 0.001 \cdot 10^{-6}$ F

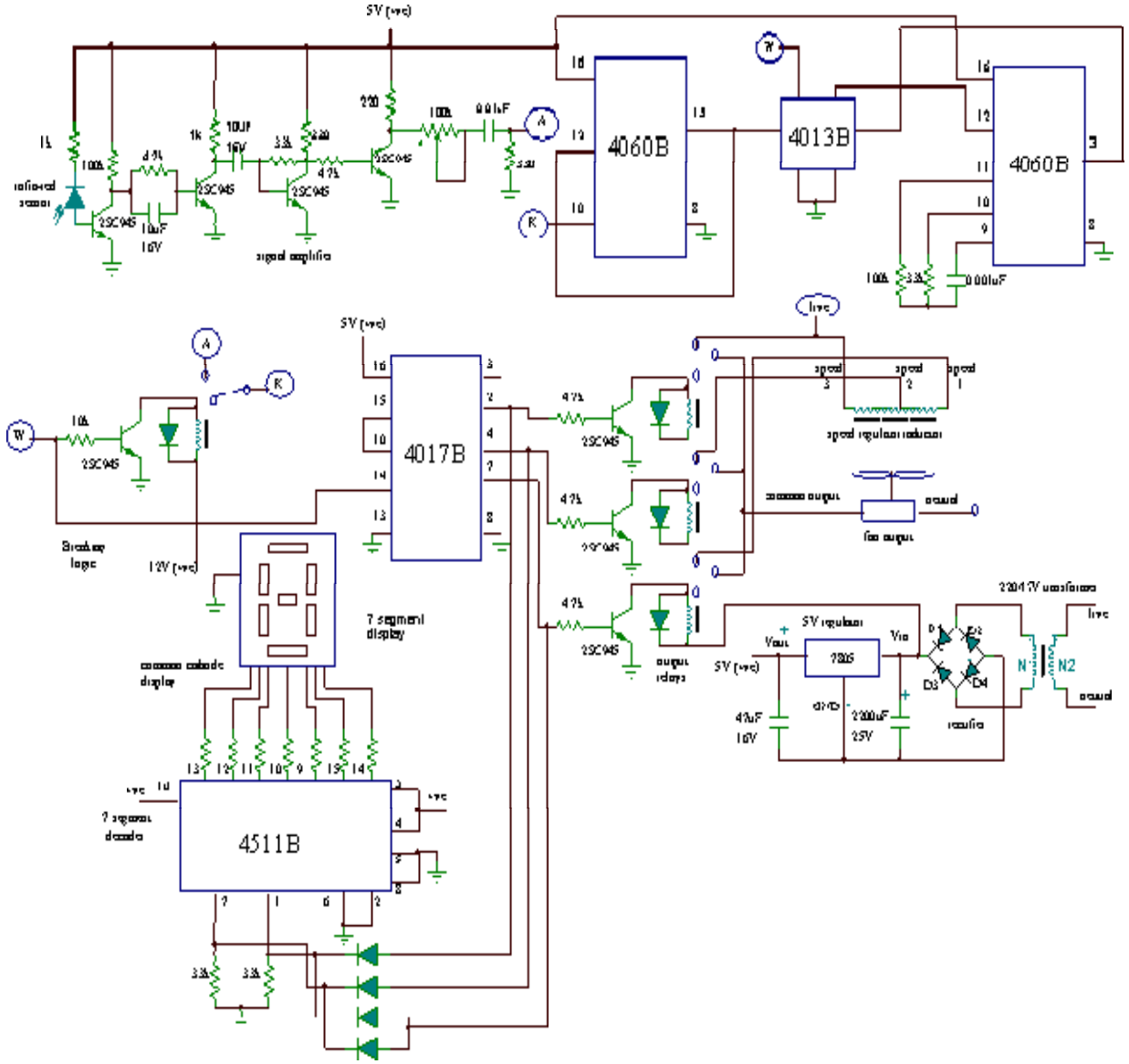
$f_1 = 1/(2.3 \cdot 33 \cdot 10^3 \cdot 0.001 \cdot 10^{-6}) = 13.18$ KHz

The pulse is connected to the base of the switching transistor (NPN 2SC945) through a 1kΩ resistor. The pulse determines frequency on the infra-red beam, such that it's detection by the sampler would be possible.

REMOTE DEVICE

DETECTION

Infra-red sensor and signal amplifier. The signal from the infra-red transmitter is divided to an infra-red sensor. The sensor converts the infra-red energy into corresponding electric current. The current from the sensor diode is weak and needs extra amplification. The four stage NPN transistor amplifiers boost the intensity of the signal to a reasonable level.



CIRCUIT OF DETECTION

The output is fed out to a connected RC filter. Such that any reasonable distortion is simple is simply removed from the signal. The signal is connected to the input of a breaking relay. The relay is designed to switch off for sometime after the signal has being sampled by the sampler. The cutoff technique eliminates any distortion or errors coming along with the transmitted signal.

Sampler

The sampler recognizes the input signal through a high logic level at its pin 13. The incoming signal sets the input latch of the sampler and Q changes to a high logic from a low logic. And $\overline{Q}$, low. The input logic 4060B is designed to reset the input latch automatically. This is to allow another input response. The point Q is connected to the point W and also connected to clock input of the control stepper.

Control Stepper and Display Unit

The control stepper is designed to control the switching of the control relays. The control stepper has three active outputs. The output directs some codes to the 4511B (7 segment decoder) through corresponding or related diode which behave like read only memory (ROM). The output of the display decoder visually defines the code on the seven segment display. The link is done through 270 Ω current limiting resistors.

Control Unit

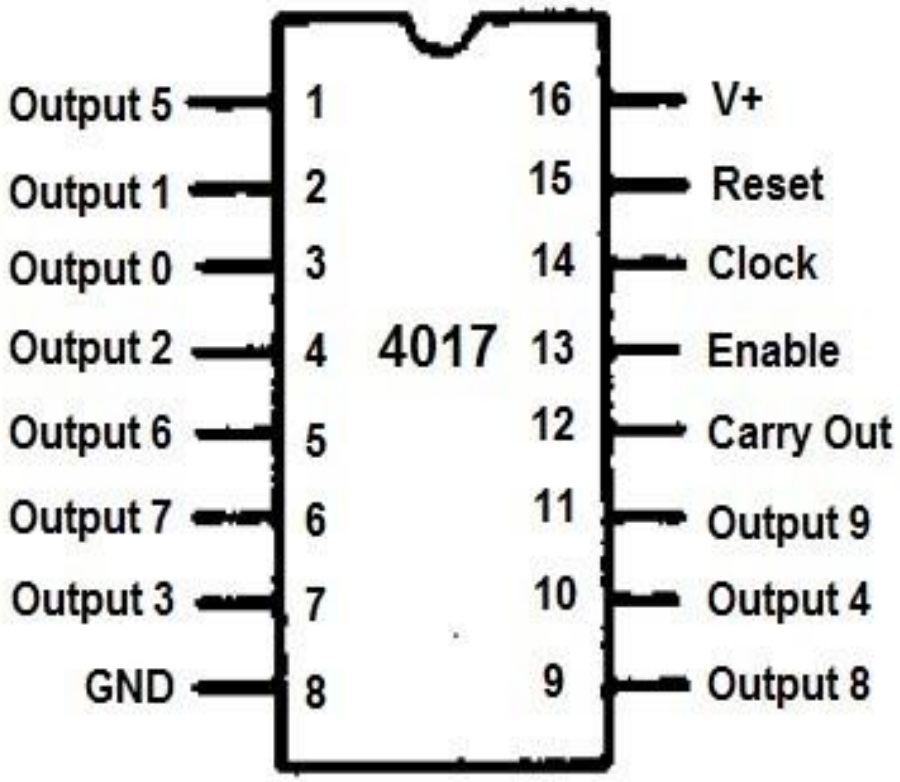
The control unit mainly embodies three relays. Each of such receives command from the control stepper. The relay selects a specific terminal from the speed regulator inductor. The effective inductive reactance of the selected portion of the transformer adds in series to the fan. So that there is a voltage drop across the fan and therefore, the

speed is altered. At the highest speed the fan is directly connected to the full A.C. mains supply. And at the lowest speed, there is a high value inductor in series with the load.

The Power Section

It holds a 220/12V transformer, a filter capacitor (2200µF 25V) and a 5V regulator. The relays are supplied by a 12V supply from the rectifier. And the regulated 5v supply from the 7805 is used for the main circuit.

4017B



PIN DIAGRAM

The 4017B is a 5-stage divided-by-10 counter with ten decoded outputs and a carryout [2]. The counter is cleared its zero count

by a logical “1” on their reset line. This counter is advanced on the positive edge of the clock signal when the clock enable signal is in the logical “0” state. Its configuration permits medium speed operation and assures a hazard free counting sequence. The ten decoded outputs are normally in the logical “0” state only at their respective time slut. Each decoded output remains high for 1 full clock cycle. The carryout signal completes a full clock cycle for every ten clock input cycles and is used as a ripple carry signal to any succeeding stages.

It consists of two identical independent data-type flip-flops. Each flip-flop has an independent data, set, reset, and clock inputs and Q and Q outputs. These devices can be used for shift registers and SR flip-flop applications. The SR configuration is used in the circuit merely by grounding the clock and data inputs. The device has a medium speed operation.

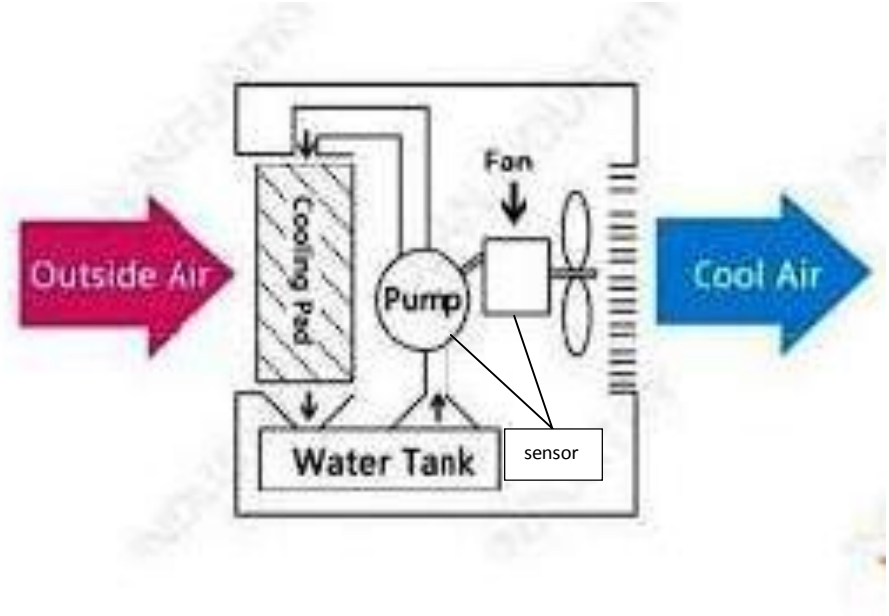
This integrated circuit is designed to convert binary coded decimal inputs into equivalent display pattern, for instance a 4-bit code of 0010 is converted to a 7-segment display, a visual information or the digit of 1 is seen through the formation of the related light emitting diode (LED) that make up the display.

The input pins are 7, 1, 2 and 6. And pins 3 and 4 are the control terminals, which are always connected to the positive side of the power supply. The latch terminal, pin 5 is normally grounded. The output pins 13, 17, 11, 10, 9, 15, and 14 are connected to the terminals a, b, c, d, e, f and g of the 7-segment display.

WORKING PRINCIPLE

Air cooler works on the principle of evaporating cooling. It is generally used in dry climates as such it is sometimes called as desert cooler. In this case, water is used as a cooling medium. The temperature of air is decreased (i e. sensible heat is removed) by the water when air is brought in contact with the water. Water absorbs heat from the air and evaporates. To compensate loss of water due to evaporation, make up of water is added.

When the power supply is given to air cooler the power is switched on by the remote control, it 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 air cooler detects the infrared light and it gets on.



Circuit connection of air cooler

The speed of the motor can be set of our requirement through the remote. The D. C. Motor is coupled with impeller blades starts rotating. The water pump is used to circulate the water to the blower unit. The forced air flows through the water which is sprayed by water pump, around the three sides of the cooler. Air sucked through pads from the three sides and it gets cooled. The cool air is discharged by the motor driven fan into the room or space to be cooled. The direction of the air flow can be adjusted with the help of grills fitted on the discharge side of the cooler.

For the better performance pads to be changed every year and water tank should be cleaned from time to time.

TECHNICAL PARAMETERS

- Remote Operation Distance : 5m- 10m
- Power Requirement : 230v- 50Hz
- Cooling Area : 3500cu feet
- Power Consumption for cooling : 150W
- Air Throw : 46 feet
- Water Tank Capacity : 45L
- Height : 102.5cm
- Weight : 11.5kg
- Dimensions : 61.8cm* 102.5cm*50.5cm

ADVANTAGES

- Cost effective with energy saving
- Occupies less space
- No installation hassle
- Portability
- Less power consumption
- The cool air reduce sweating and dehydration
- Filtered and disinfected air reduce asthma
- Improve the air quality and Improve the quality of surroundings
- Simple and easy to operate
- It is very reliable

APPLICATIONS

- Air coolers for Cooling all Types of Rooms
- To Cool Additional Spaces in the Home
- Air coolers to Cool Offices
- Air coolers to supplement HAVC system
- Air coolers for emergency cooling
- Air coolers to cool RVs
- Cooling while sailing
- Portable coolers during vacations
- Air cooling during special occasions

CONCLUSION

By completing this project, we have achieved clear knowledge of comfort cooling system for humans by using a remote. It enables the user to operate an air cooler from 5 to 10 meters away. As the instruction is given by using the remote control device, it sends an infra-red beam, which is received by the infra-red sensor in the air cooler, and it operates according to the given instruction.

This 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 an air cooler. The system seeks to develop a system that is cost effective while not under mining the need for efficiency.

FURTHER IMPLEMENTATION

The remote control was developed using infra-red. This posed its difficulties and gave certain limitation i.e. the infra-red sensor could not filter out surrounding bright light. Engineers are trying to improve on this. It should work towards perfectly filtering out bright light so that only the infra-red rays are incident on the infra-red sensor. The power supply could be improved, where a step-down would not be used, thereby reducing the entire size of the project. Similarly, micro soldering could also be used in order to further reduce the size of the equipment.

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