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Energy Efficient Cooler

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Abstract: *In this era of digitalization, automation has been the most vital revolution. Nowadays, the internet is an integral part of human life. Internet of things (IOT) provides a platform that allows devices to connect, sense and control remotely across a network infrastructure. In this paper, the focus is made on home automation through IOT and automation. The IOT devices control and monitor the electronic and electrical appliances in a typical household load. The proposed Arduino microcontroller-based home automation is achieved that allows smooth controlling of lighting and air-Cooling loads, and the complete setup is very economical and easy to implement. It gives a brief insight of the use of controllers and sensors that can help the researchers to design and deploy them in real-time commercial applications*

Keywords: Internet of things (IoT), Esp8266 controller, level sensors, SPDT Relay

I. INTRODUCTION

The project reveals the comfort condition achieved by the device for the human body. In the summer season, hot and humid conditions feel uncomfortable because of hot weather and heavy humidity, so it is necessary to maintain thermal comfort condition.

Thermal comfort is determined by the room's temperature, humidity, and air speed. Radiant heat (hot surfaces) or radiant heat losses (cold surfaces) are also important factors for thermal comfort. Relative Humidity (RH) measures moisture in the air compared to the potential saturation level. Warm air can hold more moisture. When you approach 100% humidity, the air moisture condenses. This is called Dew Point. The Temperature in the building is based on the outside temperature and sun loading plus whatever heating or cooling is added by the heating and cooling source. Room occupants also add heat to the room, since the normal body temperature is much higher than the room temperature. The Present air-cooling methods are evaporative coolers, air conditioning fans, and dehumidification and water-cooling methods for running all devices the source we need is electricity.

The electrical energy supplied to the motor and fan, states to produce airflow to the room. So, heat transfer occurs between air and water and cool air enters the room.

As the process of air cooling goes on continuously till we off the switch. At the same time, our energy meter runs fast and loss of electricity takes place. To avoid this loss of electricity and to save electrical energy we have used the *Arduino*, to control the ON & OFF switching of the water pump present inthe cooler.

1.1 Problem Statement

Water pumps are used for supplying heat exchangers with cooling water. It's **flow rate** varies depending on the heat flow to be dissipated. But the continuous operation the of water pump leads to more energy consumption. For making coolers more efficient and reducing energy consumption.

The wastage of energy can be reduced by up to 50% as compared to the normal operation of the cooler. It is energy saving technique due to the ON & OFF time of the water pump. By this, we can lower the temperature of air & water so that at the same time it becomes cool.

1.2 Cooler Specifications and Requirement

The specifications and requirements for Energy efficient coolers are set by looking at commercial needs and also it depends on the kind of energy westing through various appliances. The following requirements are set for the EEC.

- Rate of cooling required.

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- Atmospheric temperature.
- Maximum energy saving.
- To make it commercially useful.
- Self-Adjustment of temperature.

1.3 Tools and Accessories

IC LM7805: -

The LM7805 is a voltage regulator that outputs +5 volts. Like most other regulators in the market, it is a three-pin IC; an input pin for accepting incoming DC voltage, a ground pin for establishing the ground for the regulator, and an output pin that supplies the positive 5 volts.

ESP8266 CONTROLLER: -

Esp8266 controller is a low-cost, flexible, and easy-to-use programmable open-source microcontroller board that can be integrated into a variety of electronic projects. This boardcan be interfaced with other Arduino boards, Arduino shields and can control relays, LEDs, servos, and motors as anoutput.

SPDT RELAY: -

The SPDT Relay(30A) is a high-quality Single Pole Double Throw Relay (SPDT). The Relay consists of a coil, 1 common terminal, 1 normally closed terminal, and one normally open terminal. When the coil of the relay is at rest (not energized), the common terminal and the normally closed terminal have continuity.

DISPLAY:

Seven-segment displays are widely used in digital clocks, electronic meters, basic calculators, and other electronic devices that display numerical information.

PUSH BUTTON:

The main function of a push-button switch is to switch something either on or off and set it to time, however, there are different types of push-button switches and each different type has a different function.

LEVEL SENSOR:

A level sensor is a device that is designed to monitor, and maintain upper and lower tank water so that the water pump should not dry run.

BUZZER:

A buzzer is an efficient component to include the features of sound in our system or project. It is an extremely small & solid two-pin device thus it can be simply utilized on breadboard or PCB. So in most applications, this component is widely used.

II. WORKING OF ENERGY EFFICIENT COOLER

When the Power supply is ON, we are supplying a 230V AC to the main circuit where a stepdown transformer is connected which further gives us 230/6V AC. Then the Rectifier will excite, which will coverts that Alternating Current AC into Direct Current DC & gives Pulsating 6V DC. As we required a Direct Current in its pure form, so to get these Pulsating DC wehave to supply them to the further connected Filter Capacitor which will give us pulsating DC to Pure Direct Current 6V.

This pure form of Direct Current then supplies to the RegulatorIC which is IC 7805, where this voltage regulator IC will givethe output of 5V pure constant DC supply. This 5V DC supplythe passed to the Esp8266 controller of the circuit and SPDT relay connected in the same circuit, and at the same time, the motor pump of the cooler will also start when the main supply switches to ON.

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As Circuit will receive the input of +5V from the Regulator, itwill be initialized and then perform according to the Program set in it and will start to produce controlling signals by the timer IC to control the ON & OFF Conditions of the motor (Water Pump).

The Esp8266 controller program is set in such a way that, when the motor pump will be in an ON state for 5 min, it lifts up thewater from the lower tank of the cooler to the upper tank of it. This water in the upper tank will come down through Khach Pad which was surrounded by the motor present in the lower tank

After the 5 min of ON state, the controller will produce another single for the motor pump to remain OFF for another 5 minutes, where now the pump will not work for this minute. Similarly, again after a minute Controller will produce a signal for the motor pump to remain ON for 5 minutes for the water lifting process and vice versa. This process will be continuing in a loop for the water pump 5 minute ON & 5 min OFF until the main switch of the cooler goes OFF.

Water level sensors are used for monitoring, the main purpose behind using those is to get more time to flow water from the khach pads of the cooler. And also water pump should not run dry when the water level goes down.

III. CALCULATION OF ENERGY SAVING

Total Energy Consumption

Consider a cooler and water pump of 40w running for minimum 10hrs per day in summer.

If consumption is 400wh energy per day i.e., for one month it consumes 12 kw energy.

By using this circuit, we can reduce on time of the water pump by up to 50% of the total operating time.

So, we can save 200wh energy per day and 6kwh per month.

Consider the rate of one unit of energy = 7rs.

Saving = 6kwh × 7 Rs = 42 Rs.

Let us assume that there are 11,23,743 coolers in Maharashtra as only one cooler per middle class families.

So that we can save = no. Of coolers × saving.

= 11,23,743 × 42 Rs.

= 4,71,97,206 Rs. / Month.

11.2 Energy required for the circuit:

The energyS required for energy conservation circuit for onecooler in 10 hours.

i.e., circuit energy = 3W × 10

= 30W/day

Energy in one month = 30WH × 30days

= 900WH

= 0.9 KWH

We consider 11,23,743 coolers so total = 11,23,743 × 0.9 circuit energy = 10,11,368

KWH

Circuit Energy in Rs. = 10,11.368 × 7

= 70,79,576 Rs/month

B Total money saved**: -**

Total money/energy saved = 4,71,97,206 – 70,79,576

= 4, 01,17,630 Rs/month

IV. METHODOLOGY

The time period is selected by pressing the Select button which will circulate through the pre-sets. If held down it will move on every half second.

When activated by pressing the Go button, the relay is triggered through a transistor as the level of current drawn by the coil is too high for the maximum current deliverable by the Nano.

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After the selected time period, the output pin is changed to LOW turning off the relay and hence turning off the attached device. It is also possible to turn the device off early by pressing the Stop button.

Programme of Esp8266 controller

The variable will be used to store the selected duration. The bool timer Active records if the timer is currently active.
When turned on, the duration defaults to 10 minutes, and Wait For Start() is called. This uses a while loop to wait for the Start button to be pressed. In the loop, the program also checks if the Select Time button has been pressed and, if so, will advance the timer length turning the time indicator LEDs on and off as appropriate.
Once Start is pressed, the timer Active flag is set to true, the start Time variable set to the current millisecond counter (the number of milliseconds since the Nano was turned on), and the duration variable calculated based on the number of milliseconds in the selected duration or foran infinite loop.
The Active LED is turned on and output to the relay transistor set to HIGH to turn the relay on. Program flow then returns to the loop.
Operation Circuit**:**
When the Power supply is ON, we are supplying a 230V AC to the main circuit where a stepdown transformer is connected which further gives us 230/6V AC. Then the Rectifier will excite, which will coverts that Alternating Current AC into Direct Current DC & gives Pulsating 6V DC. As we required aDirect Current in its pure form, so to get these Pulsating DC we have to supply them to the further connected Filter Capacitor which will give us pulsating DC to Pure Direct Current 6V.
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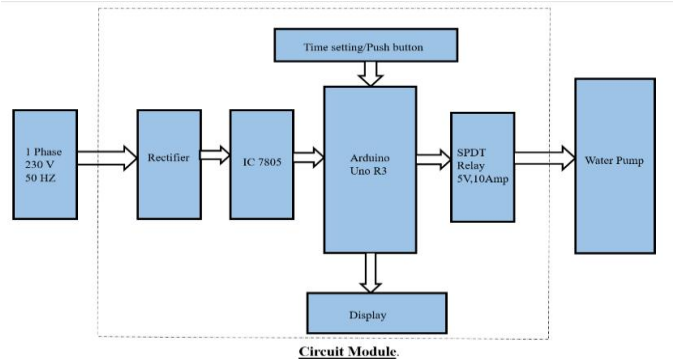
V. BLOCK DIAGRAM



Circuit Module.

There are various sensors that provide feedback to the maincontrol circuit which is Arduino.
Level sensor to give the state of water level.
Buzzer is used to give a siren when it tank needs to be filled.
Moisture sensor is an assumption for the measurement of khach pad moisture.

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VI. CONCLUSION

In This circuit, many mesmeric features are included such as cooling of the air, cooling of water, etc. The method we have used in this project is eco-friendly. We can save electricity andwaste water and money of consumers.

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