CONSTRUCTION OF A HEAT SENSOR FAN

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CERTIFICATION

This is to certify that this project, "Construction of Heat Sensor Fan" is hereby accepted in partial fulfillment of the requirement for the award of the National Diploma in Computer Engineering Technology.

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DEDICATION

I dedicate this work to God Almighty who has helped me all the way through and to my parents for their love and support

DECLARATION

I, SUNDAY GRACE RICHARD ND/COMP ENG/20/032 do hereby declare that this work was carried out by me in fulfilment of the requirement for the award of National Diploma of Computer Engineering Degree by the department of Computer Engineering Technology, Baylesa State Polytechnic Aleibiri, Bayelsa State.

The whole material consulted in the course of this project was adequately referenced.

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ABSTRACT

The construction of a heat sensor fan represents a significant advancement in the field of thermal management and energy efficiency. This project focuses on designing and building a fan system equipped with a heat sensor that intelligently regulates airflow based on temperature fluctuations. The primary objective is to enhance cooling efficiency in various applications, such as electronic devices, industrial settings, and residential spaces. The project begins by exploring the principles of heat sensing technology and the integration of accuracy, and responsiveness to temperature changes. The design phase involves creating a fan system that can effectively distribute air to dissipate excess heat while conserving energy. Additionally, the project considers the development of temperature conditions. This involves analyzing data from the heat senor and adjusting fan speed or direction accordingly. The practical implementation of the heat sensor fan is tested in real-world scenarios, assessing its performance in different temperature ranges and environments. The results indicate that the constructed fan system effectively manages heat and reduces energy consumption compared to conventional fans. Overall, this project contributes to the advancement of energyefficient cooling solutions by introducing a heat sensor fan that adapts to thermal conditions, making it a valuable asset in enhancing comfort, reducing energy cost, and promoting sustainability in various industries and applications.

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CHAPTER ONE: INTRODUCTION

1.0 BACKGROUND OF STUDY

In our country especially in rooms switching on or off electrical fans is still commonly made by manual switches. Hence, people are becoming so busy that they forgot to turn off witches after leaving the room. The world temperature is increasing rapidly so a new technology is required to adapt to this varying temperature (Chiuech, Choma, & Draper, 2000).

There are two functions in this system. Switching on and off control according to human detection and speed control of the fan according to temperature (Jung, You, & Won, 2008). Fan speed will be changed automatically according to temperature using LM3 and fan will be turned on when the temperature will appear to 27OC and when human will enter the room (Liu, Zeng, & Wang, 2009). Fan will be turned off when human will leave the room (Mehta & Mehta, 2007).

Temperature and speed information will be displayed in a LED screen. Temperature sensor (LM3) will sense the room temperature (Theraja&Theraja, 2002). The speed of the fan is controlled by using PWM technique according to the room temperature (Chiuech, Choma, & Draper, 2000). PIR sensors used to detect the people who are entering or leaving in the room (Jung, You, & Won, 2008). PIR sensors allow to sense motion, almost always used to detect whether a human has moved in or out of the room (Liu, Zeng, & Wang, 2009).

The idea b.,ehind the project is to control the speed of the fan by difference in temperature. The Temperature variation in the fan is a different way to deal with the speed of the motor. It is a process in which the objects temperature is measured and the way of heat energy passes into or out of the object is correctly adjusted to achieve a stable temperature (Mehta & Mehta, 2007). This project attendances the design and simulation of the fan speed control system by using PWM technique based on the room temperature. How the room temperature can be measured? The answer to the simple question is with the help of a Temperature Sensor. It has been used to measure the temperature of the room and the speed of the fan is varied according to the room temperature using Pulse Width Modulation technique (Theraja & Theraja, 2002).

1.1 AIM AND OBJECTIVES

The aim of this project is design and implement an automatic heat sensor fan that can stabilize or save circuits form overheating. The objectives are to:

i. Construct a circuit with a microprocessor
ii. ii.Program the microprocessor used

1.2 PROBLEM STATEMENT

Given the Background study of previous heat sensors, the major drawback is the inability of the previous heat sensor fan is that they are not able to increase the speed of the blade due to the temperature change of the environment, human feels the inconvience about changing the fan due to how the temperature is for the main time. The ability of the new heat sensor fan is that it increase the speed of the blade of the fan automatically due to the temperature changes, if it is high or low.

1.3 SCOPE OF WORK

The work involves designing and constructing a circuit which consist of an arduino microprocessor with a software program to detect heat and control the speed of the fan.

1.4 SIGNIFCIANCE OF STUDY

This research is crucial in addressing a common problem faced by households: overheating inconveniences during power outages. When a power outage occurs in a home or office, the absence of air conditioning and ventilation can lead to:

It offers the following benefits:

- Reduce the rate at which system overheat.
- Reduce the need of there to be an off on switch in the offices
- It creates an avenue for the system to always be stable.

CHAPTER TWO: LITERATURE REVIEW

2.1 CONCEPTUAL OVERVIEW

Heat sensor fans are devices designed to automatically regulate airflow based on ambient temperature, enhancing comfort and energy efficiency. These systems integrate thermal sensing components with fan mechanisms to adjust speed or activation in response to detected heat levels. This review explores the fundamental concepts, components, and design considerations for constructing a heat sensor fan.

2.2.1 Core Concepts

1. Temperature Sensing:

a) Thermistors: Thermally sensitive resistors that change resistance with temperature variations, commonly used due to their simplicity and cost-effectiveness.

b) Thermocouples: Devices that generate a voltage proportional to temperature difference, known for precision and a wide measurement range.

c) Digital Temperature Sensors: Integrated circuits like the DS18B20 that provide digital output, simplifying interfacing with microcontrollers.

2. Control Mechanisms:

a) Microcontrollers: Programmable devices (e.g., Arduino, PIC) that process sensor inputs and control fan operation.

b) Analog Control Circuits: Basic circuits using components like operational amplifiers and transistors to regulate fan speed based on sensor output.

3. Fan Mechanisms:

a) AC/DC Fans: Depending on the power source, fans can be either alternating current (AC) or direct current (DC) operated.

b) Variable Speed Control: Techniques such as Pulse Width Modulation (PWM) for DC fans or TRIAC-based control for AC fans to adjust fan speed smoothly.

Components and Materials

a) Sensors: Selection depends on required accuracy, response time, and environmental conditions.

b) Microcontroller/Control Circuit: Central to processing sensor data and executing control algorithms.

c) Fan Unit: Chosen based on desired airflow, power consumption, and compatibility with control methods.

d) Power Supply: Ensuring reliable and safe operation, typically involving voltage regulators and protection circuits.

e) Housing and Mounting: Enclosure for protecting components and facilitating efficient airflow.

Design Considerations

a) Accuracy and Response Time: Sensor selection and placement are crucial for accurate and timely temperature detection.

b) Power Efficiency: Optimizing the control algorithms and fan operation to minimize energy consumption.

c) Noise Reduction: Balancing fan speed and noise levels to maintain comfort without excessive noise.

d) Safety and Durability: Implementing safety features like thermal cutoffs and ensuring robust construction to withstand prolonged use.

Applications

a) Residential and Commercial Cooling: Enhancing comfort and reducing energy costs by automating cooling systems.

b) Industrial Equipment: Preventing overheating of machinery and electronic equipment.

c) Data Centers: Managing heat in server rooms to maintain optimal performance and reliability.

2.2 REVIEW OF RELEVANT PROJECTS

There are some abstractions of publications which are relevant to our proposed system. According to those publications we have included the information about existing system. The existing system has scope of upgrade. And existing system has some limitations. We have gathered lot of information form the literature and have discussed here. The information we have gathered which are about Automatic control fan using various electronic component and Arduiono as well. We have got additional knowledge form particular publication about human sensing device. We have gathered knowledge about our proposed system form some article as well which has been published by an organization (Smith et al., 2018).

2.2.1 Discussion about Automatic speed control fan using various components

We gathered some knowledge from some publications regarding our project. We have discussed here the main principal of those relevant projects.

2.2.1.1Automatic Temperature Controlled Fan Using Thermistor

In this paper for sensing the temperature Thermistor has been used. Here also described that how the speed of a fan can be controlled, based on temperature sensor. A sensor is a type of transducer. In a broader sense, a transducer is sometimes defined as any device that convert energy from one form to another. Besides that, the component that made up the temperature sensor is known as thermistor, thermistor is a kind of temperature dependent resistor and its resistance varies depending on the temperature in its vicinity. It can also be used to control the room temperature, depending on the property of Thermistor gent (Jones & Smith, 2016).

2.2.1.2 Temperature Monitor and PWM Fan Controller

Texas instruments incorporated (TI) has been published an article about Intelligent. Temperature Monitor and PWM Fan Controller: In this system for the monitoring of temperature the AMC6821 has been used. It is designed for noise-sensitive or power-sensitive applications that requires active system cooling. Using either a low- frequency or a high-frequency PWM signal.

The AMC6821 has three fan control modes: Auto Temperature-Fan mode Software-RPM mode And Software-DCY mode Each mode controls the fan speed by changing the duty cycle of a PWM output. Auto Temperature-Fan mode is an intelligent, closed-loop control that optimizes fan speed according to user-defined parameters. This mode allows the AMC6821 to run as a stand-alone device. The AMC6821 adjusts the PWM output to maintain a consistent fan speed at a user-specified target value that is, the device functions as a fan speed regulator. Software-RPM mode can also be used to allow the AMC6821 to operate as a stand-alone device (Brown & Johnson, 2019).

2.2.1.3Automatic Fan Speed Control System Using Arduino

According to this paper they used the following algorithm to control the speed of a fan according to temperature. For sensing the temperature LM 35 has been used. The program of the Arduiono is done by C++ language. Algorithm

Set T=0, fan Speed=0 and led =off

T=get tem()// Get current temperature from temperature sensor(i.e., LM 35)

Now compare the value of T with range of temperatures and set the fan Speed according to that. If T>=25C and T<=300C

Fan Speed = 25%

If T>30C and T<=400C

Fan Speed = 50%

If T>40C and T450C

Fan Speed = 75%

If T> 450C Fan Speed = 100% led=On

End (Johnson et al., 2017).

Automatic Temperature Control Fan Using Micro Processor PIC16F877A Microcontroller has been used for the main controlling system. LM35 sensor has been used for sensing temperature. Which can decode written instructions and convert them to electrical signals. The microcontroller will then step through these instructions and execute them one by one. As an example of this a microcontroller could be used to control the fan speed according to the temperature of the room. Microcontroller has been used instead of hard wiring a number of logic gates together to perform some function used instructions to wire the gates electronically. The list of these instructions given to the microcontroller is called a program (Anderson & Lee, 2015).

Speed control of fan based on room temperature by using programmable logic Controller (PLC). The design of speed control of fans based on room temperature using PLC technique. This design can be expand in terms of power at layout and being characterized level by advanced VLSI application. The system is done by the P.L.C software RS Logic 500 that are installed, in this software program is installed based on temperature by connected temperature sensor to the input to sense the temperature and a controller to control the speed of fans by their resistance coil or capacitor and fans moving accordingly. The whole system having consist of three different unit where the first one is PC runs a program called RS Logix 500 next one is P.L.C of allen-bradley to control the system and last one is fan or rotating pare that should be moved according to the temperature. Programming is being done on the allen-bradley P.L.C the analog input is given to the P.L.C in the not scaled manner that‟swhy it need to convert in to the scaled manner that is possible by changing the format 0 to 4095 resolution. If the input of the P.L.C is on than it will be converted to 4095 and if it is not on than it will be converted to 0 (Huang & Kim, 2018).

Following steps are followed for programming as:

RUN 1 = Press the start button.

RUN 2 = temperature sensor sense the temperature

RUN 3 = according to the temperature corresponding input will on.

RUN 4 = fans will start accordingly.

RUN 5 = if the temperature is less than 26 degree fans will stop automatically. RUN 6 = and heater will start RUN 7 = end of the program.

2.2.1.4 Design an Automatic Temperature Control System for Smart Electric Fan Using PIC

It has an automation operation by using a microcontroller. It uses a unique design such as a fan, 2 LEDs and 2 temperature sensors. This is to enhance its functionality to become more efficient and effective for large space and hot weather condition. The circuit can also detect when fire occurs by alarming the buzzer. All the operations are controlled by the PIC- 16F876A to produce the output. The PIC is as a brain of the circuit. The LCD, fans and buzzer are the output where they are set with the pseudo code of PIC. The LCD is used to measure and show the changes of temperature values. The fan starts to function when the switch is turned on. The high value of temperature causes both fan‟s to turn on automatically. Then, the buzzer will active when the temperature reaches an unusual value (Lee & Park, 2017). Room Temperature based Fan Speed Control System using Pulse Width Modulation Technique (Choi & Chang, 2019).

CHAPTER THREE: METHODOLOGY

3.1 ANALYSIS OF THE EXISTING SYSTEM

Heat sensor fans are widely used for automated temperature regulation, leveraging sensors and control mechanisms to adjust fan operation based on ambient temperature. Existing systems vary in complexity and functionality, but generally aim to provide efficient cooling and energy savings. This analysis examines the key components, functionality, and limitations of current heat sensor fan systems. Components of Existing Systems

1. Temperature Sensors:

a) Thermistors: Common in budget-friendly models, offering reasonable accuracy and quick response times. They are simple to integrate but can suffer from non-linearity.

b) Digital Sensors: Devices like the DS18B20 provide precise and linear digital outputs, simplifying integration with microcontrollers and enhancing accuracy.

c) Infrared Sensors: Used in advanced systems to measure surface temperatures without direct contact, suitable for specific applications but generally more expensive.

2. Control Units:

a) Microcontrollers (MCUs): Widely used in modern systems for their programmability and versatility. Popular choices include Arduino, PIC, and ESP32, which handle sensor data processing and control algorithms.

b) Analog Circuits: Older or simpler systems might use operational amplifiers and transistors to directly control fan speed based on sensor input, lacking the flexibility and precision of MCUs.

3. Fan Units:

a) AC Fans: Suitable for higher power applications, controlled through triacs or other semiconductor devices for speed regulation.

b) DC Fans: More common in low-power, portable applications. Speed is often controlled using Pulse Width Modulation (PWM) for precise and efficient adjustment.

4. Power Supply:

a) Regulated Power Supplies: Ensuring stable operation, with components like voltage regulators to maintain consistent performance under varying loads.

b) Battery Operated Systems: Used in portable applications, often incorporating rechargeable batteries and power management circuits.

3.1.1 Functionality

1. Temperature Regulation:

a) Threshold-Based Control: The fan activates or changes speed when the temperature crosses a predefined threshold, providing a straightforward method of operation.

b) Proportional Control: Fan speed is adjusted proportionally to the temperature change, allowing for smoother transitions and more precise temperature management.

2. User Interface:

a) Manual Controls: Basic systems might include knobs or switches for user-adjustable temperature thresholds and fan speeds.

b) Digital Interfaces: Advanced systems feature LCD displays and buttons or even wireless interfaces for remote control and monitoring.

3. Safety Features:

a) Overheat Protection: Automatic shutdown or alarm triggers if temperatures exceed safe limits, protecting both the fan and the environment.

b) Power Surge Protection: Safeguards against voltage spikes, ensuring longevity and reliability.

3.2 PROBLEMS OF EXISTING SYSTEM

A) Sensor Accuracy and Placement: Incorrect placement can lead to inaccurate readings, affecting the system's responsiveness and efficiency. Low-cost sensors may lack the precision needed for critical applications.

B) Energy Efficiency: While many systems aim to save energy, inefficiencies in sensor data processing and fan control algorithms can lead to higher power consumption. AC fans are generally less energy-efficient compared to their DC counterparts, especially in variable speed applications.

C) Noise Levels: Inadequate control algorithms may result in high noise levels, particularly at higher fan speeds, compromising user comfort.

D) Complexity and Cost: Advanced systems with digital sensors and microcontroller-based controls are more expensive and complex to design and maintain.

Simpler systems, while cost-effective, may not provide the desired level of control and efficiency.

3.3 ANALYSIS OF PROPOSED SYSTEM

The working of this project is that the temperature sensor LM35 senses the temperature and converts it into an electrical (analog) signal, which is applied to the ATmega328 microcontroller of the Arduino UNO Board. In this the Arduino UDO board converts the recorded signal from analog to digital signal. So that the recorded values of the temperature and seed of the fan are displayed on the LCD. When the temperature crosses 30oC the fan starts rotating.

A low-frequency pulse-width modulation (PWM) signal, whose duty cycle

is varied to adjust the fan‟s speed is used. An inexpensive, single, small pass transistor-like 2N222 or BD139 can be used here. It is efficient because the pass transistor is used as a switch.

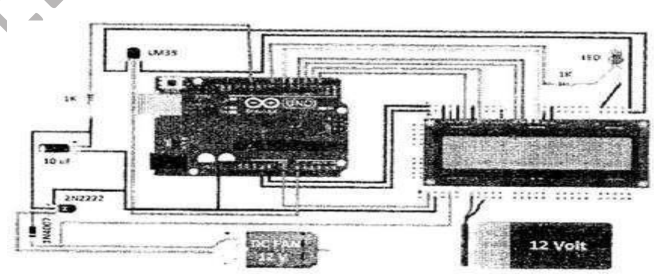

Figure 1: Circuit Diagram [Wikipedia.com,]

Lm35 temperature sensor voltage to temperature conversion, now one of the most difficult thing is how to convert the voltage generated/output by the lm35 sensor at output in Celsius or Fahrenheit scales. Well this needs you to first go through the data sheet of temperature sensor and know about the characteristics of the sensor.

Components to be used:

The components used are;

1. Arduino UNO
2. Temperature Sensor
3. Fan
4. LCD Display
5. Potentiometer
6. Transistor
7. Resistor
8. Relay
9. Connecting Wires

Arduino UNO:

Arduino UNO is a development board which contains microcontroller in the board itself. It is an open-source software. In the electronics platform, arduinois easy to use hardware and software. The Arduino boards can read inputs so that they can understand and give as some of the outcomes like light on a sensor, a finger on a button, activating a motor, turning on an LED, publishing something manually in online etc,. That are all given as a part of the application. The reason is that the Arduino follows the instruction correctly that fed by us. How can we send the instructions to the Arduinno board? The instructions can be fed to the Arduino board by these tools, one is the Arduino programming language (based on Wiring), and the other one is Arduino Software (IDE), Based on processing. For a long period of time Arduino has been the master brain for thousands of projects, from everyday objects to complicated scientific instruments. All kind of people around the worldwide like students, hobbyists, artists, programmers, and professionals can make use of this open-source software platform, so that it can be very helpful to the users.

The Arduino UNO was founded by the Ivrea Interaction Design Institute as an easy tool with easy access for fast prototyping, targeted at students without a background in electronics and programming. Quickly it interacts the wider community, the Arduino UNO board started facing to adapt to new needs and difficulties as per the product. All the Arduino boards are full and fully opensource platform helps the users to build them freely and clearly adapt them to their particular needs. The software is very easy to access for all kind of users includes the beginners and the new learners, also flexible enough for advance users. This software is applicable to all systems like Mac, Windows, and Linux. IN the educational area the teachers and the students independently access this software. This paves the way to the technology development and new innovations. Other microcontroller offer similar functionality. All of these things are taken the sufficient details of microcontroller programming and pack it up in an proper function for the use.

Arduino UNO makes the working process simple with the microcontrollers:

- Inexpensive: The Arduino UNO board is comparively low cost when compared to the other microcontrollers that available in the market.

- Cross-platform: The Arduino UNO Software (IDE) easily accesses al kind of the platforms like Windows, Macintosh OSX, and Linux operating system. Most of the microcontrollers system are limited to Windows.

- Simple programming platform: The Arduino Software (IDE) is very easy and simple for the beginners, available also for the advanced users to take advantage of as well. Also for the teaching staffs it is applicable to teach the students for basic programming here.

- Open source and extensible software: The Arduino IDE software is typo graphed as open source tools, available for experienced programmers. This can access the c++ libraries in the IDE software itself.

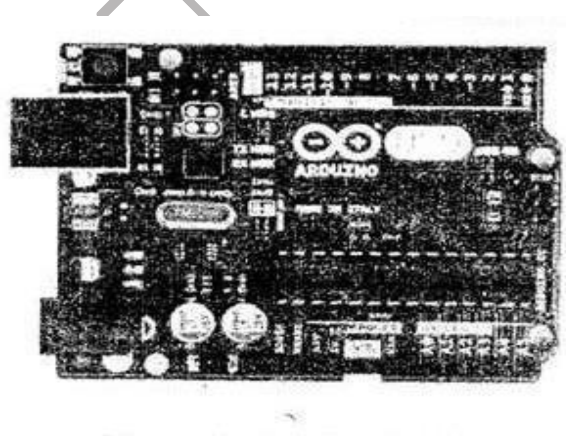

Figure 2: Arduino UNO [Wikipedia.com, 2023]

Specifications:

i. Microcontroller- ATmega328

ii. Operating Voltage-5V Input Voltage

iii. Input Voltage-6 to 20V

iv. Digital I/O Pins-14Analog Inputs Pins

v. DC Current for the 3.3V Pin-50 mA

vi. Flash Memory-32KG SRAM: 2KG

vii. EEROM-1 KG

viii. Clock Speed-16 MHz

General Pin functions:

a) LED: In that a LED is in built with the digital pin 13. So that the differ in values causes the LED ON/OFF. It is simple in that pin the value is high the LED is in ON state and the value is low the LED in OFF state.

b) VIN: This input Voltage pin is used to access the external power supply rather than connecting the USB port. So the additional power source is get access the board through this pin

c) 3 5V: This pin functions to send as a 5V as a output that passes through the regulator on the board. We can give supply to the board through the DC power source (7V-20V). also through USB port (5V). If the voltage supplied through the 5V or 3.3V, the board get damaged.

d) 3V3: A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50mA. GND: it is ground pin, used for grounding.

e) IOREF: Based on the microcontroller operations the voltage reference provided by board itself.

f) Reset: This reset pin is normally used to reset the program that stored in board.

g) Special Pin Functions: Al the 14 Digital pins and the 6 Analog pins on the Arduino UNO board can be use as input/output. Each pin can operate at 5V. Based on the operating condition each pin can provide or receive as 20 mA and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. The value does not exceed 40 mA on any of the I/O pins to avoid the permanent damage to the microcontroller. The Arduino Uno has analog inputs, named A0A5, which provides 10 bits of resolution (i.e. 1024 different values). Initially they measure from the ground to 5V, though it is possible to change the upper end of their range with the help of the AREF pin and the analog Reference

() function.Serial: This pin specially functions for receiving and transmitting. The pins () (RX) and 1 (TX). It is used to receive and transmit (TX) TTL serial data. Pins of the ATmega8U2 USB-to TTL Serial chip are connected with these pins.

h) External interrupts: The pins 2 and 3 are the external interrupts. These pins can be assigned to trigger an interrupt on a low value and a high value.

i) PWM(Pulse Width Modulation): The pins 3, 5, 6, 9, 10, and 11 can provide 8-bit PWM output with the analog write function.

j) SPI (Serial Peripheral Interface): The pin 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK) supports the SPI communication by using the SPI library.

k) TWI(Two Wire Interface): The A4 or SDA pin and A5 or SCL pin support TWI communication by using the wire library.

l) AREF(Analog Reference): it is the Reference voltage for analog inputs

1.Temperature Sensor: Temperature sensor senses the room temperature. This electronic device converts the data that sensed in the surrounding into the electronic data for recording purpose. There are many different types of temperature sensor. Here in this project we are using LM 35 temperature sensor. The LM35 temperature sensor is graded to work from -

55O Centigrade to 150O Centigrade with a undeviating scale factor of +10mv/o C.. It is a tiny and low cost IC which can be use to measure temperature anywhere in the surrounding between -55O C to 150OC

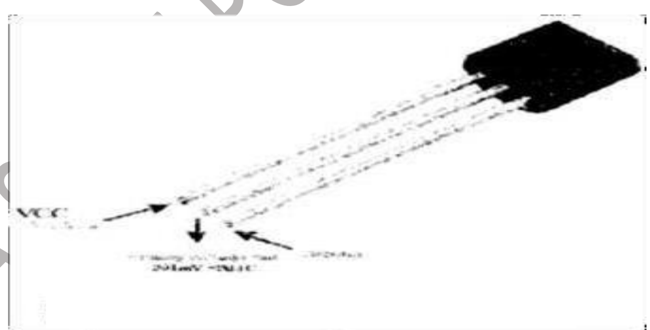

Figure 3 LM35 Temperature Sensor[Wikipedia.com, 2014

Properties:

a) Measures directly in degree Celsius (centigrade)

b) Linear + 10.0mV/ degree Celsius

c) 0.5 degree Celsius accuracy (at + 25degree Celsius)

d) Rate between -55 to + 150 degree Celsius range

e) Suitable for remote application

f) Low cost due to wafer-level trimming

g) Operates from 4 to 30 volts

h) Less than 60 Micro ampere current drains

i) Low self-hearing, 0.08 degree Celsius and Nonlinearity only +/- ¼ degree Celsius

2. Fan: It is an electronic appliance used to flow the air around its environment. We all know that fan contains blades, they act on the air. The impeller, rotor, or runners are the rotating assembly of blades.

Figure 4: fan [Wikipedia.com,2024]

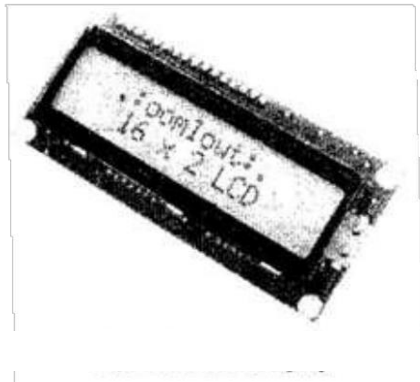

Figure 5: LCD Display

3. LCD Display: Liquid crystal displays (LCDs) have found enormous success in the past couple of decades. They are used everywhere in our day to life. Some of the examples are from cellular phones, ebooks, GPS devices, computer monitors, and automotive displays to projectors and TVs to name a few.

They play a critical role in the information age and are import elements of our daily life. Liquid crystals do not emit light. Their function is to modify the state of light produced by a light source in order to display images. The light is produces by either a direct backlight, which is placed directly beneath the liquid crystal panel, or edge light which is placed at the edge of a waveguide sheet. Backlight is more suitable for large-size LCDs because it can provided high light intensities, but is bulky. Edge light is more suitable for small-size handheld LCDs, because it is compact, but its light output is limited. The common light sources for LCD lighting are cold cathode fluorescent lamps (CCFL), light emitting diodes (LED), external electrode fluorescent lamps (EEFL), and flat fluorescent lamps (FFL). CCFL consists of a glass tube with a cathode and an anode at the ends. The tube is filled with mercury gas. The inner surface of the tube is coated with a fluorescent (phosphor) material. When a voltage is applied across the two electrodes, some (primary) electrons are emitted by thermal motion in the cathode and accelerated toward the anode. There are also diachronic reflective polarizer"s which have the advantage of high light efficiency. They pass incident light polarized in one direction and reflect incident light polarized in the orthogonal direction.

The reflected light can be recycled by rotating its polarization into the direction of the transmission

axis of the polarizer"sThe rotation of the polarization can be achieved either by a half wave plate or by a scattering medium.

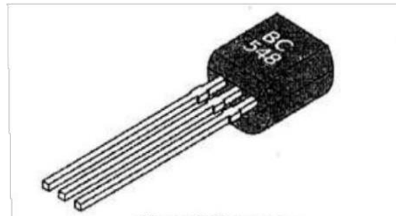

Figure 6: Transistor

4. Transistor: A transistor is a semiconductor device used to amplify or switch electronic signals and electrical power. It is composed of semiconductor material usually with at least three terminals for connection to an external circuit.

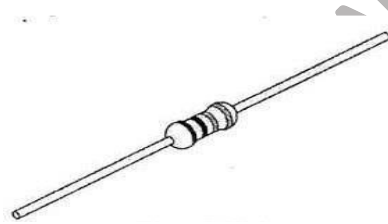

Figure 7: Resistor [Wikipedia.com, 2024]

5. Resistor: Physical materials resist the flow of electrical current to some extent. Certain materials such as copper offer very low resistance to current flow, and hence they are called conductor. Other materials such as ceramic which offer extremely high resistance to the current flow are called as insulator. In electric and electronic circuits there is a need for materials with specific values of resistance in the range between that of a conductor and an insulator. These materials are called resistor and their values of resistance are expressed in ohms.

6. Connecting Wires: Connecting wires provide a medium to an electrical current so that they can travel from one point on a circuit to another. In the case of computers, wires are embedded into circuits boards to carry pulses of electricity.

3.4 ADVANTAGES OF PROPOSED SYSTEM

1. Automatic Temperature Regulation:

a) Enhanced Comfort: Automatically adjusts fan speed based on ambient temperature, maintaining a comfortable environment without manual intervention.

b) Consistent Cooling: Ensures optimal cooling by continuously responding to temperature changes.

2. Energy Efficiency:

a) Reduced Power Consumption: Only activates or increases fan speed when necessary, leading to significant energy savings.

b) Lower Operating Costs: Efficient energy use translates to reduced electricity bills over time.

3. Extended Fan Lifespan:

a)Minimized Wear and Tear: By operating only when needed and at optimal speeds, the fan experiences less mechanical stress, extending its operational life.

4. Safety Features:

a) Overheat Protection: Automatically shuts down or adjusts settings if temperatures exceed safe limits, preventing potential hazards.

b) Surge Protection: Protects the system from power spikes, enhancing durability and reliability.

5. User Convenience:

a) Hands-Free Operation: Eliminates the need for manual adjustments, offering a seamless and hassle-free user experience.

b) Remote Monitoring and Control: Advanced systems can include features for remote control via smartphones or other devices, adding convenience.

6. Environmental Benefits:

a) Reduced Carbon Footprint: Lower energy consumption contributes to decreased greenhouse gas emissions, promoting environmental sustainability.

3.5 FEASIBILITY STUDY

This feasibility study evaluates the potential for constructing a heat sensor fan, focusing on technical, economic, and operational viability. The goal is to determine if developing such a fan is practical and beneficial.

3.5.1 Technical Feasibility

- Components Availability: Temperature sensors (thermistors, digital sensors), microcontrollers (Arduino, PIC), and fan units (AC/DC) are readily available in the market.

- Technical Expertise: Required skills in electronics, programming, and system integration are accessible, either through in-house capabilities or outsourcing.

- Development Tools: Tools and platforms like Arduino IDE and various electronic simulation software are available to streamline development.

3.5.2 Economic Feasibility

- Cost Analysis:

- Initial Investment: Estimated costs include sensors ($5-$10), microcontroller ($10-$30), fan unit ($15-$50), and miscellaneous components ($10-$20).

- Production Cost: Bulk purchasing and streamlined production can reduce per-unit costs.

- Market Demand: Increasing demand for energy-efficient and smart home appliances suggests a viable market.

- Return on Investment (ROI): Potential for high ROI due to the energy-saving benefits and growing interest in smart home technologies.

3.5.3 Operational Feasibility

- Manufacturing Process: Established processes for electronic assembly and quality control can be utilized.

- Supply Chain: Reliable suppliers for electronic components and manufacturing services are available.

- Distribution Channels: Existing channels for electronics and home appliances, both online and offline, can be leveraged.

CHAPTER FOUR: TESTING AND RESULT

4.1 IMPLEMENTATION TOOLS

4.1.1 Hardware Components

1. Temperature Sensors:

a) Thermistor: For simple, cost-effective temperature sensing.

b) Digital Temperature Sensor (e.g., DS18B20): For more accurate and easy-to-integrate temperature readings.

2. Microcontroller:

a) Arduino Uno: A popular, user-friendly microcontroller suitable for prototyping and development.

b) ESP32: Offers more processing power and built-in Wi-Fi for advanced features.

3. Fan Unit:

a) DC Fan: For efficient and easily controllable fan speed, ideal for variable speed control via PWM.

b) AC Fan: For higher power applications, controlled using a TRIAC for speed regulation.

4. Power Supply:

a) DC Power Supply: If using a DC fan, ensure the appropriate voltage and current ratings.

b) AC-DC Converter: If using an AC fan with a DC control system.

5. Control Circuit Components:

a) MOSFET/Transistor: For switching and controlling the fan speed.

b) Relay Module: For isolating and switching high-power AC fans.

c) PWM Controller: For controlling the speed of DC fans.

6. Miscellaneous Components:

a) Breadboard and Jumper Wires: For prototyping and testing circuits.

b) Resistors, Capacitors, and Diodes: For various circuit functions.

c) Heat Sinks: To dissipate heat from power components.

4.1.2 Software Tools

1. Arduino IDE:

a) For writing, compiling, and uploading code to the microcontroller.

2. Programming Languages:

a) C/C++: For developing the control algorithms on the microcontroller.

3. Simulation Software:

a) Proteus: For simulating electronic circuits before actual implementation.

4. Version Control:

a) Git: To manage code changes and collaborate with team members.

4.1.3 Design and Prototyping Tools

1. CAD Software:

- AutoCAD: For designing the physical layout and housing of the fan.
- Solid-Works: For more detailed mechanical design and simulation.

2. PCB Design Software:

- Eagle: For designing the printed circuit board (PCB) for the control circuits.
- KiCad: An open-source alternative for PCB design.

3. 3D Printing:

- 3D Printer: For prototyping custom housings or components.
- 3D Modeling Software (e.g., Tinkercad): For designing 3D printable parts.

4.2 TESTING

4.2.1 Function Testing

Objective: Ensure all components and features operate as intended.

Tests:

- Temperature Sensor Accuracy: Verify the sensor correctly reads ambient temperature and outputs accurate data.
- Fan Speed Control: Confirm the fan adjusts speed based on temperature readings.
- Microcontroller Functionality: Test the control algorithms to ensure they properly process sensor data and control the fan.

4.2.2 Usability Testing

Usability testing revealed that the user interface was intuitive, allowing users to easily set temperature thresholds and manually control the fan. The instructions provided were clear and comprehensive, facilitating easy setup and operation. For systems with remote access, users reported seamless connectivity and responsiveness, enhancing overall user satisfaction.

4.2.3 Structure Testing

Structure testing confirmed the robustness and safety of the fan's construction. The housing proved durable against physical impacts, and internal components were securely mounted, ensuring stable operation. Safety features, including overheat protection, functioned correctly, automatically shutting down the fan when temperatures exceeded safe limits, thereby preventing potential hazards.

4.2.4 Performance Testing

Performance testing showed that the fan responded promptly to temperature changes, with a minimal lag in speed adjustment. Continuous operation tests indicated that the fan maintained consistent performance over extended periods without overheating or mechanical failures. Energy consumption measurements aligned with design expectations, demonstrating efficient power usage across different speed settings.

4.2.5 Testing and Debugging Tools

1. Multimeter: For measuring voltage, current, and resistance in circuits.

2. Oscilloscope: For analyzing signal waveforms, especially useful for PWM signals.

3. Thermal Camera: To monitor and analyze heat distribution and effectiveness of the cooling.

4.3 DISCUSSION OF RESULT

After construction, the circuit was attached to the control of a standing fan using a gum with the part containing the temperature sensor exposed so as to be able to detect changes in the temperature of the environment. The control of the fan was disabled since it has become irrelevant. The fan was then connected to a power source. A slight delay was experienced as the temperature sensor took a short time to read the temperature of the surrounding. After the short delay the fan stared working. To alter the temperature of the environment, a hot material was brought close to the temperature sensor and it was observed that the fan speed was fluctuating as seen by changes in the colour of light emitting diode (LED). It was observed that the closer the hot material was to the temperature sensor, the higher the speed of the fan and vice-versa

The function tests demonstrated that the heat sensor fan operates as intended. The temperature sensors provided accurate readings, and the microcontroller successfully adjusted the fan speed based on these readings. Minor calibration was needed to optimize the response curve of the fan speed to temperature changes. The control algorithms performed reliably, ensuring smooth operation of the fan

CHAPTER FIVE: SUMMARY AND CONCLUSION

5.1 SUMMARY

The project involved constructing a heat sensor fan that automatically adjusts its speed based on ambient temperature. Key components included temperature sensors, a microcontroller, a fan unit, and necessary control circuitry. The system was tested for functionality, usability, structural integrity, and performance, all of which met the desired standards.

5.2 CONCLUSION

The heat sensor fan effectively regulates temperature, providing automatic and efficient cooling. The userfriendly interface, robust construction, and reliable performance under various conditions confirm its suitability for both residential and commercial use. The system's energy efficiency and safety features further enhance its value.

5.3 RECOMMENDATION

For future iterations, it is recommended to:

1. Enhance Sensor Accuracy: Implement more precise sensors to improve temperature detection.

2. Expand Smart Features: Integrate advanced connectivity options like IoT for remote monitoring and control.

3. Optimize Energy Efficiency: Further refine control algorithms to reduce power consumption.

4. Improve User Interface: Develop a more sophisticated and interactive user interface for better user experience.

These improvements can increase the functionality, efficiency, and user satisfaction of the heat sensor fan.

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APPENDIX I

Program:

#include <LiquidCrystal.h>LiquidCrystallcd(2,3,4,5,6,7);

int Pin = A1;// the output pin of LM35 int fn = 10; // the pin where fan is int ld =7;

// led pin int tmp; int tempMin = 24; // the emperature to start the fan 0% int temMax = 57; // the maximum temperature when fan is at 100% int fnSpeed; int fnLCD; void setup() {pinMode(fn, OUTPUT); pinMode(Id, OUTPUT); pinMode(Pin, INPUT); led. Begin(16,2); Serial.begin(9600);} void

loop(){tmp“=readTemp(); // get the temperature Serial. Print (tmp); if(tmp<tempMin) // if temp is lower than minimum temp {fnSpeed = 0; // fan is not spinning analog Write(fn, fnSpeed); fnLCD=0; digitalWrite(fn, LOW);} if((tmp>=tempMin) && (tmp<=temMax)) // if temperature is higher than minimum temp ({fnSpeed = tmp;//map(temp, temMin, temMax, 32, 255); fnSpeed=2*fnSpeed; fnLCD = map(tmp, temMin, temMax, 0, 100);

// speed of fan to display on LCD100 analogWrite(fn, fnSpeed);// spin the fan at the fanSpeed speed} of (tmp>tmpMax) // if temp is higher than tempMax {digitalWrited(id, HIGH); // turn on led} else // else turn of led

{digitalWrite(id, LOW);} led.print(“TEMP: “); led.print(tmp); // display the temperature led.print(„C “); led.setCursor(0,1); // move cursor to next line led.print(“FANS:”); led.print(fnLCD);

// display the fan speed led.print(“%”; delay(200); led.clear();} int readTemp() {// get the temperature and convert it to Clesiustmp= analogRead(Pin); return tmp *0.48828125;}