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Automatic Temperature Based Fan Speed Controller Using Arduino

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Abstract: *This project is a independent automatic fan speed controller that controls the speed of an electric fan according to the requirement by using electronic circuit consists of an Arduino board. Use of embedded technology makes this closed-loop feedback-control system efficient and reliable. Arduino board is very progressive among all controller circuits, thus we employed Arduino board for fan speed control. The proposed framework is intended to determine the temperature of the room and send that data to the Arduino board. At that point the Arduino board executes the difference of current temperature and set temperature dependent on the inbuilt program of the Arduino.*

Keywords: Arduino, Fan Speed controller, temperature sensor, Liquid Crystal Display (LCD),etc.

I. INTRODUCTION

With the advancement in technology, intelligent systems are introduced every day. Everything is getting more sophisticated and intelligible. There is an increase in the demand of cutting edge technology and smart electronic systems. Micro-controllers play a very important role in the development of the smart systems as brain is given to the system. Today, micro-controllers are used in many disciplines of life for carrying out automated tasks in a more accurate manner. Electric fan is one of the most well-known electrical device because of its cost effectiveness and low power consumption advantages. Fan can be turned on and off physically by using switch button. Where right now, change in the temperature won't give any adjustment in the fan speed. So, an automatic temperature control system technology is necessary for the controlling speed of fan according to the temperature changes.

II. OBJECTIVE

In the electronics world we want to make the human life comfortable. Therefore the home automation system is very essential. Fan speed controller is one of the parts of the home automation system. The main objective of this project is to develop an low cost, user friendly automated temperature-controlled fan regulator which reduces power consumption and also assist physically challenged or older peoples so, they can able to control the speed of fan from their locations.

III. SYSTEM DESIGN

Temperature Based Fan Speed Control & Monitoring With Arduino and LM35 Temperature Sensor. The micro-controller controls the speed of an electric fan according to the requirement & allows dynamic and faster control and the LCD makes the system user-friendly. Sensed temperature in Celsius Scale and fan speed in percentage are simultaneously displayed on the LCD panel.The project is very compact and uses a few components only. The project will help to save energy/electricity. It can be implemented for several applications including air-conditioners, water-heaters, snow-melters, ovens, heat-exchangers, mixers, furnaces, incubators, thermal baths and veterinary operating tables.

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A. Methodology

Circuit diagram of the temperature based fan speed control and monitoring is shown in Fig. 1. It is built around Arduino Uno board (Board1), 16×2 LCD (LCD1), temperature sensor LM35 (IC1) and few other components. Arduino is at the heart of this circuit as it controls all the functions.

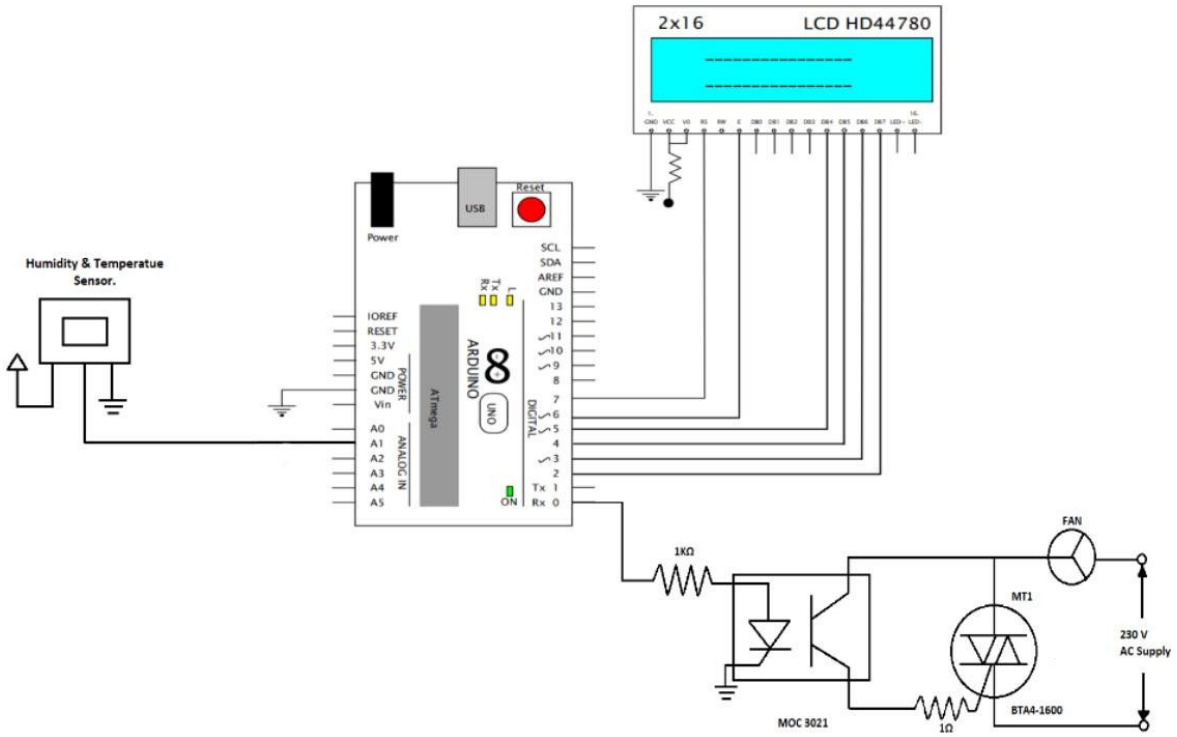

Figure 1: Circuit Diagram

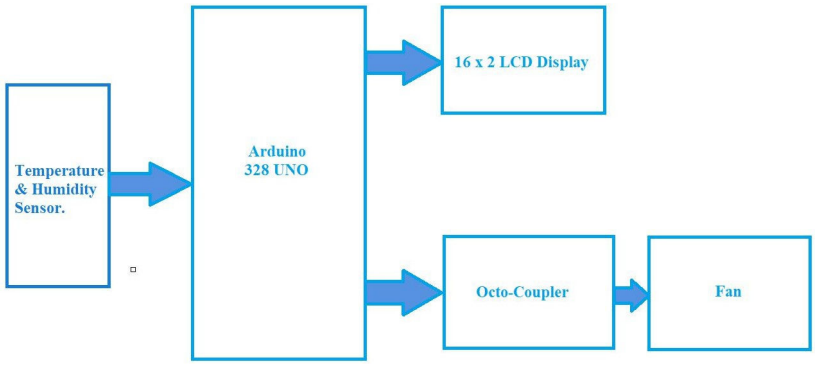

Figure 2: Block Diagram.

Block diagram of the proposed concept the above Fig 2 represents the block diagram representation of the proposed concept. The temperature sensor is interfaced with Arduino to fetch the data of temperature in the room. The data is processed if the temperature is high fan speed is more relatively if the temperature is low fan speed is low. Moreover, if the temperature is below the threshold set then fan will be in off condition. The data related to temperature; fan speed is displayed on the LCD for user interaction. The fan speed is controlled relatively with the temperature using PWM pins available on the Arduino.

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B. Software

Software for the automatic temperature controller and monitor circuit is written in Arduino programming language. Arduino Uno is programmed using Arduino IDE software. ATmega328P on Arduino Uno comes with a pre-programmed boot loader that allows users to upload a new code to it without using an external hardware programmer. Connect Arduino board to the PC and select the correct COM port in Arduino IDE. Compile the program (sketch). Then select the correct board from Tools Board menu in Arduino IDE and upload the sketch to Arduino through standard USB port.

IV. List Of Components

A. Arduino

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board -- you can simply use a USB cable. Additionally, the Arduino IDE uses a simplified version of C++, making it easier to learn to program.

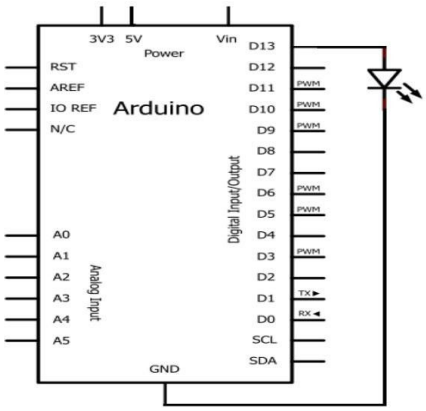

Figure 3: Pin Diagram of Arduino

Specifications:

- Micro-controller : ATmega328
- Operating Voltage : 5V
- Input Voltage (recommended) : 7-12V
- Input Voltage (limits) : 6-
- Digital I/O Pins : 14 (of which 6 provide PWM output)
- Analog Input Pins : 6 DC
- Current per I/O Pin : 40 mA
- Current for 3.3V Pin : 50 mA

B. DHT11 Temperature and Humidity sensor

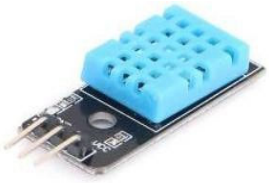

Figure 4: DHT 11 Temperature and Humidity sensor

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This DHT11 Temperature and Humidity Sensor features a calibrated digital signal output with the temperature and humidity sensor capability. It is integrated with a high-performance 8-bit microcontroller. Its technology ensures the high reliability and excellent long-term stability. This sensor includes a resistive element and a sensor for wet NTC temperature measuring devices. It has excellent quality, fast response, anti-interference ability and high performance .

Specifications:

- Operating Voltage: 3.5V to 5.5V.
- Operating current: 0.3mA (measuring) 60uA (standby)
- Output: Serial data.
- Temperature Range: 0°C to 50°C.
- Humidity Range: 20% to 90%
- Resolution: Temperature and Humidity both are 16-bit.
- Accuracy: ±1°C and ±1%

C. Triac

The triac has three terminals namely Main Terminal 1(MT1), Main Terminal 2 (MT2) and Gate (G) as shown in figure. If MT1 is forward biased with respect to MT2, then the current flows from MT1 to MT2. Similarly, if the MT2 is forward biased with respect to MT1, then the current flows from MT2 to MT1.

D. Opto-Coupler

Specifications:

- Input Diode Forward Voltage: 1.25V
- Collector-Emitter Voltage: 80V (max)
- Collector Current: 50mA (max)
- Cut-off frequency: 80 kHz
- Rise Time: 18us
- Fall Time: 18us
- Available as 4-pin DIP through hole and also as SMT package

E. LCD Display (Liquid Crystal Display)

This component is specifically manufactured to be used with microcontrollers, which means that it cannot be activated by standard IC circuits. It is used for displaying different messages on a miniature liquid crystal display. it can display messages in two lines with 16 characters each. Also it can display all the letters of alphabet, Greek letters, punctuation marks, mathematical symbols etc. Fig. 3 illustrates LCD (2 x 16 characters) and its connection .

Specifications:

- Operating Voltage is 4.7V to 5.3V
- Current consumption is 1mA without backlight
- Alphanumeric LCD display module, meaning can display alphabets and numbers
- Consists of two rows and each row can print 16 characters.
- Each character is build by a 5×8 pixel box
- Can work on both 8-bit and 4-bit mode
- It can also display any custom generated characters
- Available in Green and Blue Backlight

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F. Stepdown Transformer (230V -12V)

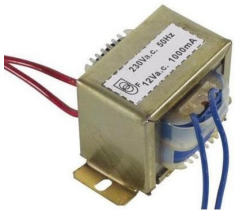

Figure 5: Stepdown Transformer (230V -12V)

Here, NP is primary winding turns = 30000
NS is secondary winding turns = 150
VP is voltage at the primary winding of the transformer = 240V
VS is the voltage at the secondary of the transformer =
VS = (VP * NS)/NP = 240*150/3000 = 12V

G. Voltage Regulator

Figure 6: Voltage Regulator

Specifications:

- Input voltage range 7V- 35V
- Current rating I_c = 1A
- Output voltage range V_{Max} = 5.2V ,V_{Min} = 4.8V

H. DIODE (1N 7007)

Specifications:

- Maximum Recurrent Peak Reverse Voltage 1000V.
- Maximum RMS Voltage 700V.
- Maximum DC Blocking Voltage 1000V.
- Average Forward Current: 1.0A.
- Peak Forward Surge Current: 30A.
- Maximum Instantaneous Forward Voltage: 1.0V.

V. OPERATION

Temperature sensor DHT11 Temperature and Humidity sensor senses the temperature and converts it into an electrical (analog) signal, which is applied to the ATMega328 microcontroller of the Arduino UNO Board. The analog value is converted into a digital value. Thus the sensed values of the temperature and speed of the fan are displayed on the LCD. When the temperature exceeds 30°C 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 can be used here. It is efficient because the pass transistor is used as a switch.

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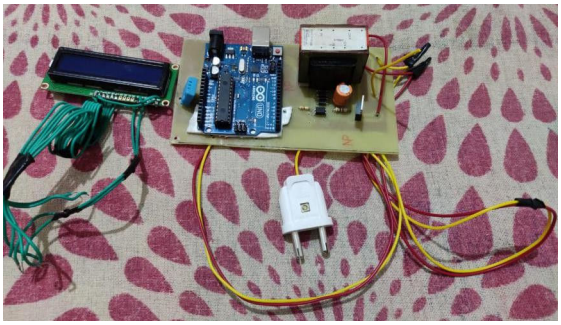

Figure 7: Hardware implementation of the proposed concept.

VI. CONCLUSION

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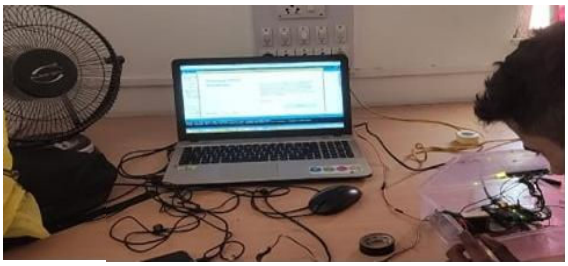

Figure 8: Result

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