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AVR Microcontroller based remote controlled embedded system to regulate AC fan or dim AClight with power level, temperature and humidity display.

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***Abstract*—The paper presents the commercial design for AVR Microcontroller based remote controlled embedded system to regulate AC light or fan with power, temperature and humidity display. Speed control of fan or dimming ac lights is generally done manually hand operated potentiometer. But controlling fan speed at a comfortable distance by a hand-held infrared remote introduces automation at home.Zero cross optocoupler circuit, infrared receiver TSOP 1738 is used to control the speed of fan automatically. 16X2 carbon display is used to display power consumption of fan at any interval. DHT22 has been used to show the temperature and humidity of the room when we are not regulating/ controlling the fan or light.**

Keywords—Fan speed control, microcontroller, Zero Cross Detector, ATmega 328P, Optocoupler, 16X2 Carbon Display, infrared remote.

I. INTRODUCTION

Speed control of fan using any infrared remote is possible using the designed circuit. Programming the microcontroller using the codes against the buttons of different types of remotes have been tried in this project. Controlling fan speed by remote and getting to know about load percentage of fan with a display is crucial since we are mostly not sure how much energy the device is consuming. This project can be used for industrial applications by **c**hecking how much power a motor is consuming. In addition, room temperature and humidity is showed in this display. This paper will show you how ATmega328P microcontroller can be used and applied in a real world scenario.

II. REMOTE CONTROL FAN REGULATOR COMPONENTS

The Remote control fan regulator in this paper incorporates ATmega328P microcontroller.This circuit employs zero cross detection for triac firing to control the speed of fan or dimming of light. And this zero crossing is fed into the PWM pin of the microcontroller. Also, a DHT22 humidity and temperature sensor is used in PWM pin to display room temperature and humidity in LCD. Whereas the level of power received by the load is shown by the LCD in operation. All this can be summarized in the fig.1

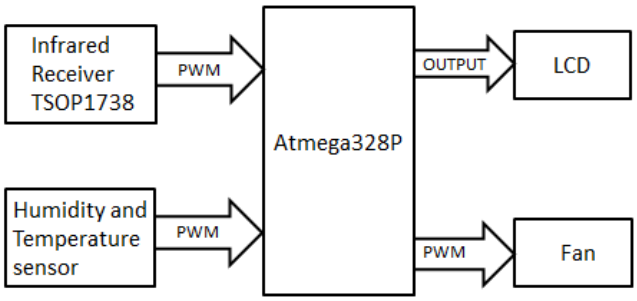

Fig. 1 Block diagram of fan speed control system

A. *ATmega328P microcontroller*

ATmega328P is an 8-bit AVR RISC-based 28 pin microcontroller featuringADC input and PWM output pins. The pin diagram is shown in the fig 2.

Fig 2: Pin diagram of Atmega328P

B. *Regulated Power Supply*

LM7805 Regulator IC is connected for 5 Volt DC regulated output across unregulated 9Volt power supply. The pinout of LM7805 is shown in the fig. 3

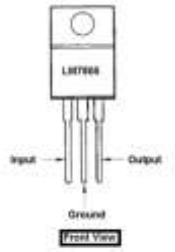

Fig. 3 Pin diagram of LM7805

C. *Infrared Receiver TSOP1738*

The TSOP1738 is an infrared receiver to react to IR frequency of 38kHz only. The pinout is shown in fig. 4.

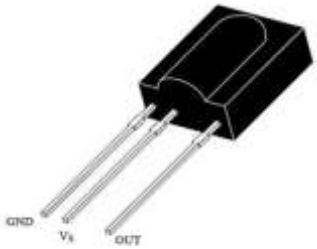

Fig. 4 Pin diagram of TSOP1738

D. *LCD*

A 16x2 characterLCD display with a built-in controller.

E. *Humidity and Temperature sensor*

The DHT22 is a digital thermistor based temperature and capacitive type humidity sensor. The pin diagram is shown in fig 5.

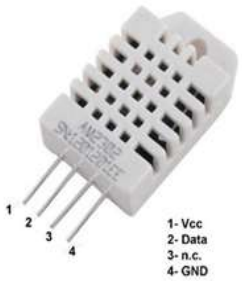

Fig. 5 Humidity and temperature sensor

F. *OPTOCOUPLER*

MOC3021

The MOC3021 is a 6 terminal dual in-line IC package optocoupler. The pin diagram is shown in fig. 6

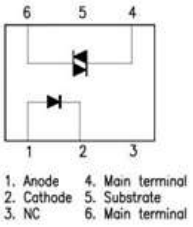

Fig. 6 pin diagram of MOC3021

MCT2

The MCT2 is a 6 Terminal dual in-line IC package optocoupler. It has gallium arsenide infrared emitting diode that drives a silicon phototransistor. The pi diagram is shown in fig. 7

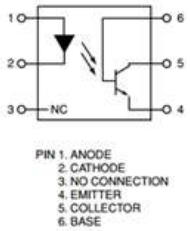

Fig. 7 pin diagram of MCT2

III. FLOW CHART

The Operation of this circuit in flow chart is shown in fig. 8

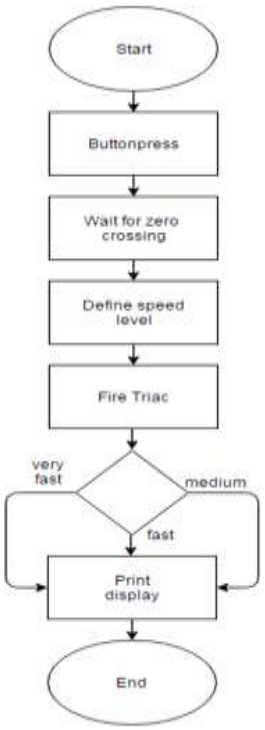

Fig. 8 Flow Chart

IV. CIRCUIT DESIGN OF SPEED REGULATOR/DIMMER

This Section describes how the speed of fan is controlled by PWM output of ATmega328Pmicrocontroller, with room temperature and humidity display.

A. DC 5 Volts power supply

It's a capacitive 5 Volts dc power supply where a fuse is used as overcurrent protection. 0.47uF capacitor in parallel with 1M resistor is used as a filter that will attenuate EMI from travelling back into the line. And a MOV is used as transient protection.

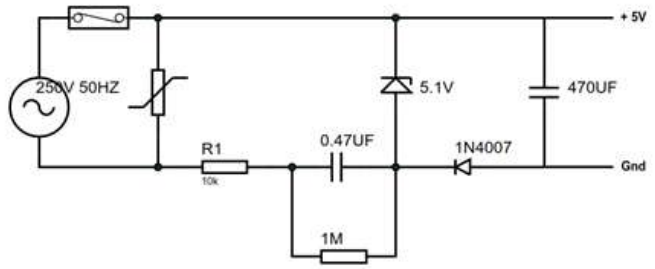

Fig. 9 Circuit diagram of dc 5volts regulated power supply

B. Opto isolated zero crossing detector circuit

The circuit has two opto-coupler, one is used forzero-crossing detector and the other is used to trigger the triac. The opto-couplerkeeps low voltage circuitseparated from the power circuit. The zcd circuit provides a 5V pulse each time the ac signal crosses zero volts. It is detected by the ATmega328p microcontroller.After zero crossing, the BT136 logic triac remains off. When turned on, the triac stays on even if there is no gate voltage. And turns onfor the next zero crossing. In this way triac gets turned off for every half cycle. Thereby chopping the output wave, this circuit accomplishes PWM control of the ac wave.

The schematic diagram of zero cross detection circuit is shown in fig. 10.

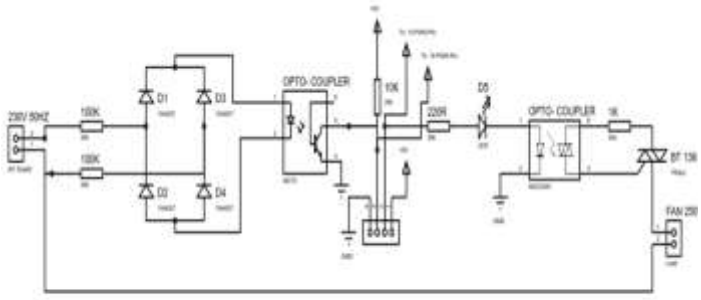

Fig. 10 Zero Crossing Circuit

C. IR receiver, DHT22 and LCD circuit

Here the TSOP1738 receives the control signal from the infrared remote and fed into the PWM pin of the microcontroller. Thereby speed controlled is done remotely. Where 16X2 LCD shows load percentage of different speed of fan as it is fed into PWM pin of the microcontroller. In addition, it has a feature of showing room temperature and humidity.

The Schematic of IR receiver, DHT22 (humidity and temperature sensor) an LCD circuit diagram is shown in fig 11.

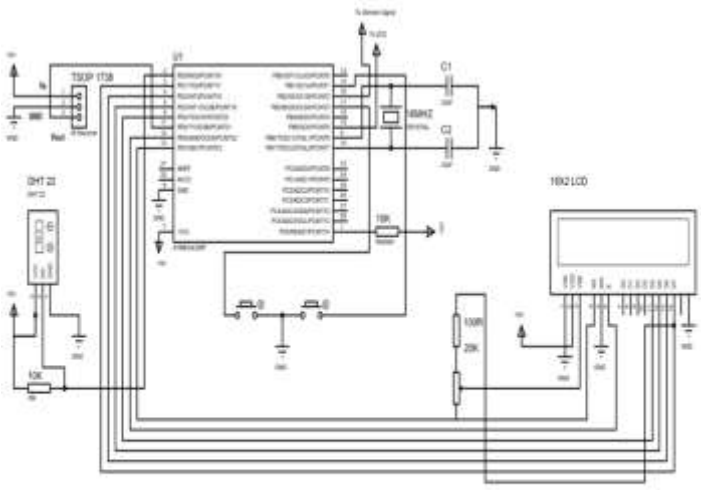

Fig. 11 IR receiver, DHT 22 and LCD circuit diagram

The Hardware Connection is shown in fig 12.

Fig. 12 Hardware Connection

Waveform across the two terminals of triac at different speed levels:

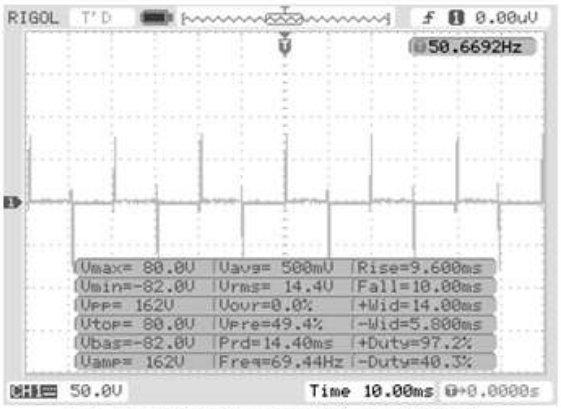

Fig. 13 waveform across triac output at speed level one (14.4 Volts)

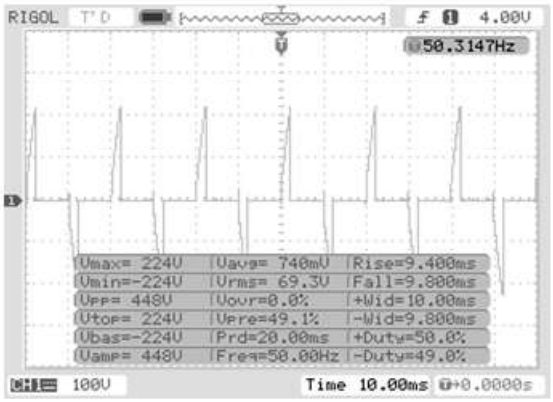

Fig. 14 waveform across triac output at speed level two (69.3 Volts)

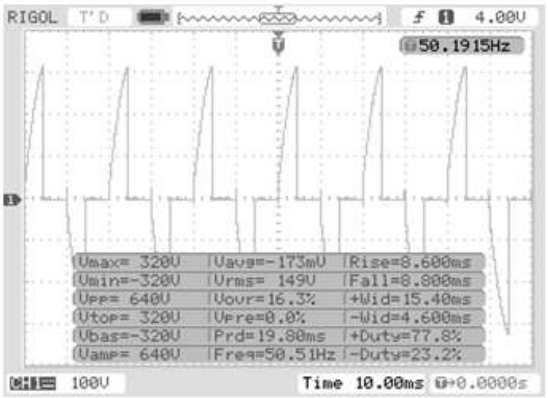

Fig. 15 waveform across triac output at speed level three (149 Volts)

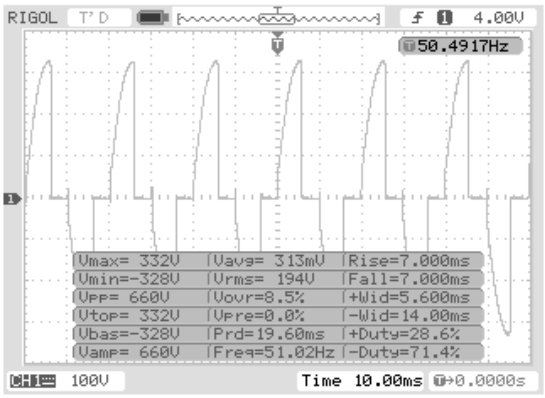

Fig. 17 waveform across triac output at speed level five (194 Volts)

Waveform across the DC 5 volts regulated power supply :

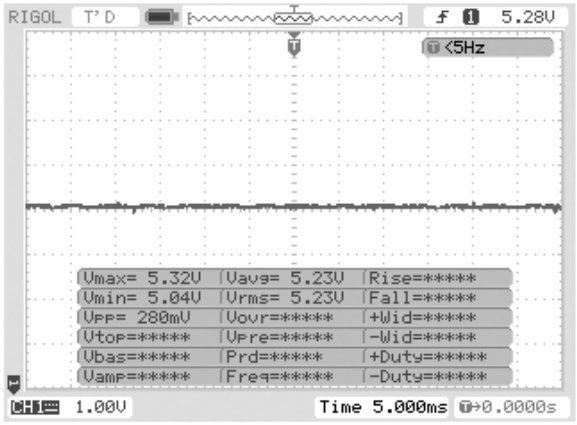

Fig. 18 waveform across dc 5volts power supply

V. RESULT

The circuit can be used for motor with higher power but to calibrate the triac firing cross checking has been done for smooth and noise free regulation. The circuit has been provided with transformerless power supply so that it can be light weight and cost effective.

VI. CONCLUSION

This paper elaborates the design and construction of fan Speed control system. The ATmega328P microcontroller had been used to control the fan speed using the PWM, the fan speed in rpmand the room temperature and humidity was successfully programmed usingC Language and their values displayed on LCD. Ascalibration process, one method was usedto measure the supply voltage of fan at different speed.

VII. REFERENCES

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