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Interfacing of Humidity Sensor using 8051 Microcontroller

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ABSTRACT

We never know the level of humidity in the atmosphere and its variations. It would be difficult to adjust the air cooler in such circumstances and instead of cooling the room in summer it would make very uncomfortable while the humidity goes up because of water particles are constantly released to the room by the cooler water pump. This project will fade away all the previous bad experiences that switch off releasing water particles and brings smile on the face just by adding a moisture sensor. The motor used represents the water pumping motor of the cooler. Initially a value is fixed and if the humidity goes up the specified value, then microcontroller is used to interface the sensor and it will switch on the cooler fan if the value goes higher than the pre-specified value i.e. humidity present in the room is higher and cooler fan should get ON and it will turn ON the cooler fan and if the value printed on LCD is below the pre-specified voltage then it means humidity present in room is quite low and we don't require any fan to be turned ON in our room so our system will turn OFF the cooler fan.

Keywords-- Humidity Sensor, 8051 microcontroller, air cooler, LCD

I. INTRODUCTION

Nowadays, the air conditioning is widely used especially in warm countries including Malaysia. Usually the conventional air conditioning is always cooling the room depending on the fixed temperature and humidity setting and is not automatically adjusted for the comfort of the users. In the central air conditioning control field, excellent real-time, high reliability, and good intelligence are proposed by many researchers.

The traditional PID algorithm is, in fact, still playing a main role in the control process. The air conditioning system has becoming a field to be researched to improve the user convenience by applying intelligent system such as Adaptive Fuzzycontroller. While the enhanced air conditioning system is being designed, the consideration of the type of control system must be included in a modelling design. In particular the controller must be able to avoid the inefficiency of having the air conditioning operate all the time.

Several control options were considered at presence sensing circuit, which would turn the air conditioning off when people are not in the room with the air conditioning and a temperature sensor input, which would change the air conditioning operation depending on room temperature . Based on the observation of the using the present conventional air conditioning application, it always working all the time without a systematic control. Therefore, the control of the air conditioning is adjusted through a feedback control system to monitor and maintain a constant temperature based on the data input from the sensor.

This project presents an air conditioning temperature control by using the current temperature in the room as well as outside temperature. The difference between the two temperature sensors will affect to compressor speed to achieve the desired point. Only when the difference between indoor and outdoor temperatures is small or zero and the indoor temperature exceed a predefined threshold does the controller run the air conditioner. This research focuses only on main component, which is the compressor system, in air conditioning that significantly affects the temperature change.The problem happens when the air conditioning is still functioning although in the event of cold weather. The function is uncontrolled and must be manually turned on and off. Sometimes it can lead to high usageof electricity which in turn raises the electricity bill when the user forgot to switch it off.

The system also does not have the capacity to adjust the room temperature regardless of the ambient temperature. To address the problem, the automatic room humidity control that can control the humidity automatically is proposed. The advantages of such a system are less energy usage, and provides more convenient to the consumers. The objectives of this project are to find the mathematical model of an air conditioning system, to design a controller using Proteus with proper coding, to analyses the performance of the controller.

The controller used is 8051. Proteus software is used to simulate the performance of the controller. Inside room humidity is used in the controller design. The analysis controller performance in terms of automatic humidity control is based on the humidity present in the room.

II. LITERATURE REVIEW

It is known that humidity plays an important and significant role in every part of the Earth in biology and automated industrial processes. To have a desirable surrounding atmosphere, it is essential to monitor, detect and control the ambient humidity under different conditions ranging from low temperature to high temperature. As time is passing, modern technologies are coming in role. People now require more comfort efficiently. In other terms, we can say that automatic control of equipment of their house and office. So this is also a system which is designed to sense the humidity of room and then have control over the cooler fan. This system includes the following main parts which are:

1. Humidity Sensor (DHT11)
2. LCD Showing sensed humidity
3. 8051 microcontroller

A. Humidity Sensor- A humidity sensor senses,measures and regularly reports the relative humidity in the air. It measures both moisture and air temperature.Relative humidity, expressed as a percent, is the ratio of actual moisture in the air to the highest amount of moisture air at that temperature can hold.The warmer the air is, the more moisture it can hold, so relative humidity changes with fluctuations in temperature.[2]

Humidity sensors detect the relative humidity of the immediate environments in which they are placed. They measure both the moisture and temperature in the air and express relative humidity as a percentage of the ratio of moisture in the air to the maximum amount that can be held in the air at the current temperature. As air becomes hotter, it holds more moisture, so the relative humidity changes with the temperature.Most humidity sensors use capacitive measurement to determine the amount of moisture in the air. This type of measurement relies on two electrical conductors with a non-conductive polymer film laying between them to create an electrical field between them. Moisture from the air collects on the film and causes changes in the voltage levels between the two plates. This change is then converted into a digital measurement of the air's relative humidity after taking the air temperature into account.

B. LCD- We require a 16 X 2 character LCD to show the sensed value by the humidity sensor .It will show a digital output. A LCD consists of following features which are-

1. Built-in controller(KS 0066 or equivalent)
2. 1/16 duty cycle
3. N.V. optional for +3V power supply
4. +5V power supply
5. 5 X 8 dots with cursor

C. Microcontroller- Microcontroller are the device which are used to process the signal or for the purpose of interfacing. There had been many microcontrollers as the time passes on with some advancement in them but these are still used as per their efficiency and convenient purpose. Some microcontrollers are 8051, PIC and ATMEGA16, ATMEGA32 microcontrollers etc. and many more.

The AT89C51 is normally shipped with the on-chip Flashmemory array in the erased state (that is, contents = FFH)and ready to be programmed. The programming interfaceaccepts either a high-voltage (12-volt) or a low-voltage(VCC) program enable signal. [3]

The low-voltage programming mode provides a convenient way to program theAT89C51 inside the user's system, while the high-voltageprogramming mode is compatible with conventional thirdparty Flash or EPROM programmers. The AT89C51 is shipped with either the high-voltage orlow-voltage programming mode enabled.

III. DESIGN AND IMPLEMENTATION

There is sensor which is used to detect the level of humidity present in the room namely named as DHT11. Microcontroller is used to interface the components and to provide a specific working to the device.

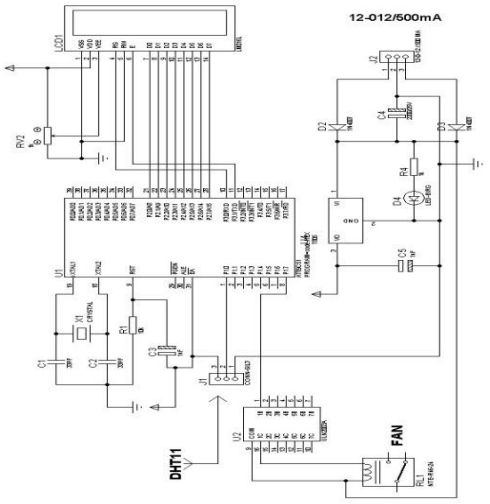

Figure 1: Block Diagram

A. Hardware Description-

(1) Humidity Sensor- This DFRobot DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistivetype humidity measurement component and an NTC temperature measurement component, and connects to a high- performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness.

Figure2: Humidity Sensor

Each DHT11 element is strictly calibrated in the laboratory that is extremely accurate on humidity calibration. The calibration coefficients are stored as programmes in the OTP memory, which are used by the sensor's internal signal detecting process. The single-wire serial interface makes system integration quick and easy. Its small size, low power consumption and up-to-20 meter signal transmission making it the best choice for various applications, including those most demanding ones. The component is 4-pin single row pin package. It is convenient to connect and special packages can be provided according to users' request.

(2) 8051 Microcontroller- The AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density non-volatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C51 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

The AT89C51 provides the following standard features: 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, two 16-bit timer/counters, five vector two-level interrupt architecture, a full duplex serial port, and on-chip oscillator and clock circuitry. In addition, the AT89C51 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port and interrupt system to continue functioning. The Power-down Mode saves the RAM contents but freezes the oscillator disabling all other chip functions until the next hardware reset.[3]

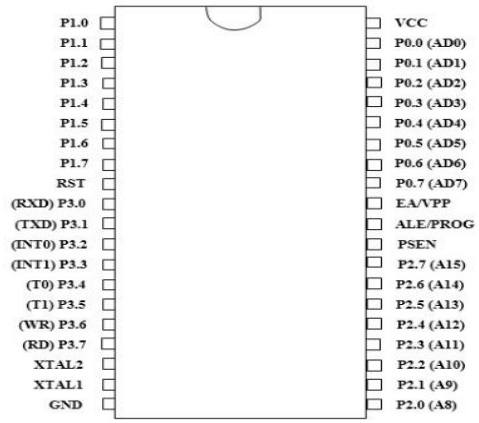

Figure3: Pin Diagram of 8051 microcontroller

(3) Crystal Oscillators and Circuits- It is often required to produce a signal whose frequency or pulse rate is very stable and exactly known. This is important in any application where anything to do with time or exact measurement is crucial. It is relatively simple to make an oscillator that produces some sort of a signal, but another matter to produce one of relatively precise frequency and stability. AM radio stations must have a carrier frequency accurate within 10Hz of its assigned frequency, which may be from 530 to 1710 kHz. SSB radio systems used in the HF range (2-30 MHz) must be within 50 Hz of channel frequency for acceptable voice quality, and within 10 Hz for best results. Some digital modes used in weak signal communication may require frequency stability of less than 1 Hz within a period of several minutes.

The carrier frequency must be known to fractions of a hertz in some cases. An ordinary quartz watch must have an oscillator accurate to better than a few parts per million. One part per million will result in an error of slightly less than one half second a day, which would be about 3 minutes a year. This might not sound like much, but an error of 10 parts per million would result in an error of about a half an hour per year. [5]A clock such as this would need resetting about once a month, and more often if you are the punctual type. A programmed VCR with a clock this far off could miss the recording of part of a TV show. Narrow band SSB communications at VHF and UHF frequencies still need 50 Hz frequency accuracy. At 440 MHz, this is slightly more than 0.1 part per million.

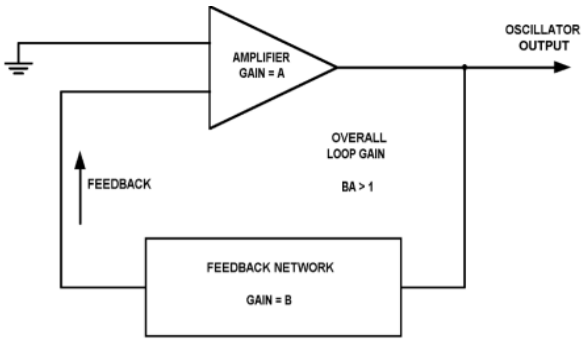

Figure4: Symbol of crystal oscillator

(4) Voltage Regulator (7805)-

Features-

- 3-Terminal Regulators
- Output Current up to 1.5 A
- Internal Thermal-Overload Protection
- High Power-Dissipation Capability
- Internal Short-Circuit Current Limiting
- Output Transistor Safe-Area Compensation

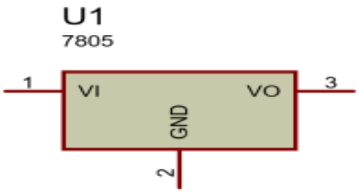

Figure5: Symbol of 7805

(5) Relay- A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits, repeating the signal coming in from one circuit and re-transmitting it to another.[6]Relays were used extensively in telephone exchanges and early computers to perform logical operations.

A type of relay that can handle the high power required to directly drive an electric motor is called a contractor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protective relays".

(6) Features of LCD-

- It is 5 x 8 dots with cursor
- Built-in controller (KS 0066 or Equivalent)
- + 5V power supply (Also available for + 3V)
- 1/16 duty cycle
- B/L to be driven by pin 1, pin 2 or pin 15, pin 16 or A.K (LED)
- N.V. optional for + 3V power supply

IV. SIMULATION AND RESULTS

The presented system is designed and configured for practical use. The system is able to sense the humidity present in the surrounding. The system will respond teach state according to a specific program which is coded and installed in the 8051 microcontroller.

The portability is an important parameter of the system. The system which can be worn and used by the subject for prolonged time is considered as a portable system; otherwise it is regarded as non-portable. The easiness of the system usage is considered as another parameter. An easy to use device is actually easy to get to and an easy to function. Finally the non-invasive utilization of the system is considered as a property of the system.

System will detect the temperature automatically present in the room as a function of percentage of humidity. Now whenever humidity present exceeds the present value of humidity sensor then it will pass a trip signal to relay and coil present in relay gets energised and gets trip, cooler starts.

Advantages-

- Low design time.
- Low production cost.
- This system is applicable for both the indoor and outdoor environment.
- Setting the destination is very easy.
- It is dynamic system.
- Less space.
- Low power consumption.

V. CONCLUSION AND FUTURE SCOPE

We would like to conclude that the proposed system completed successfully. As we stated earlier in a problem statement, the previous problem like a poor sensing problem and poor efficiency of humidity sensor are overcome and successfully implemented with efficiency of sensed humidity and proper control over the cooler fan with the help of microcontroller. Hence, it can be concluded that this project is able to play a great contribution to the state of the art and will play a great role to minimise the waste of electricity or in other words we can say that electricity consumption can be reduced a lot.[7]

Future work will be focused on enhancing the performance of the system and a much efficient project can be made if we add the features of temperature sensor into it. As our humidity sensor (DHT11) is able to sense both humidity and temperature of a room, it can make our system more efficient and reliable and most important thing that our comfort level will raise as our system is going healthier. With the Combine operation of sensing the temperature and humidity of a room, it is much more advance version of our project .Now if it is done as described then we can connect more appliances of our house , shop, and in small industries, it will not strict to only on cooler fan. We can connect it to fan, lights, motors, AC,heaters and many more equipment's which requires an auto control for better efficiency .If the equipment's of house or industry will work efficiently then it can directly reduce the consumption of electricity, which I think a great achievement which we provide to our country.

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