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# Microcontroller Based Room Temperature and Humidity Measurement System

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**ABSTRACT**

The objective of this paper is to achieve a functional system in terms of hardware and software, to measure temperature and humidity. In this paper, we use a microcontroller-based DHT11 sensor was designed developed to measure the value of temperature and humidity at room temperature. A microcontroller PIC16F877A was used to control the developed system's function. The system was measuring the temperature from 0ºC to 50ºCand the humidity %RH from 20 to 90.the reading was displayed in a liquid Crystal Display. MikroC language program was developed to control the microcontroller.

***KEYWORDS:*** *PIC16F887 microcontroller, DHT11 sensor, LCD Display*

## I. Introduction

Laboratories, industries, hospitals, stores etc require to measure the temperature and humidity for research, production, treatment and diagnosis of the patients, storing food, beverage etc. Sometimes, in weather monitoring, for instance, parameters such as the temperature and humidity needed to be measured, thus sensors have always been given the task for doing so. Temperature and humidity measurement is essential to taking control of our environment. The DHT11 temperature-humidity sensor is used to sense and measure the temperature and humidity of the room, and parameters are sent as input singles to the microcontroller. This paper aims to build a DHT11 to measure the temperature and relative humidity. The temperature is perceived using the sensor DHT11 and is read, stored and displayed by the PIC kit.

**Methodology:**

Microcontroller PIC16F877A is used as the heart of the whole system. Temperature humidity sensor DHT11 and 16 X 2 LCD liquid crystal display

## II. The Block Diagram of the Whole System

The block diagram of the constructed system is displayed in Figure 2.1. It consists of four main blocks; the temperature sensor, humidity sensor, microcontroller circuit, LCD module and power supply circuit.

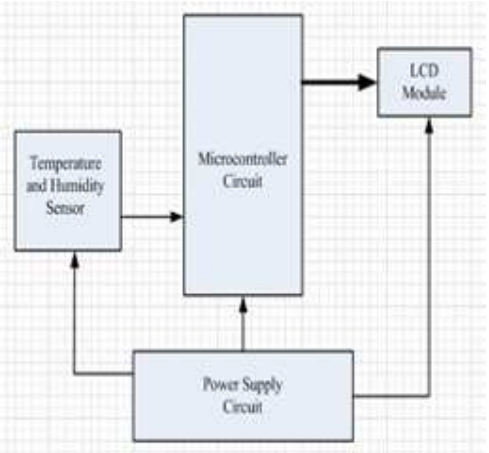


**Figure 2.1: The block diagram of the constructed system**

**Humidity Sensor**

Humidity Sensor has four pins as shown below. Vcc is connected with 5-volt power supply Data pin is connected with input pin of microcontroller through a 5k OHM push-pull resistor.NC pin has not used a pin. So there is no need to connect it with anything. The ground pin is connected with the ground terminal of the power supply.DHT11 PINOUT

It can measure temperature within an accuracy of 2% and humidity with the inaccuracy of 5%. It can be connected with a microcontroller with a maximum wire of 20-meter range. 100nF capacitor between ground and Vcc pin to voltage fluctuations. DHT11 sensor consists of a resistive type humidity measurement component and NTC type temperature measurement component. It provides humidity and temperature value on a highly calibrated digital output signal. So we need to measure this digital output signal with the help of microcontroller to measure temperature and humidity. So it has a single wire serial interface, we will use this interface to connect DHT11 sensor with pic microcontroller.

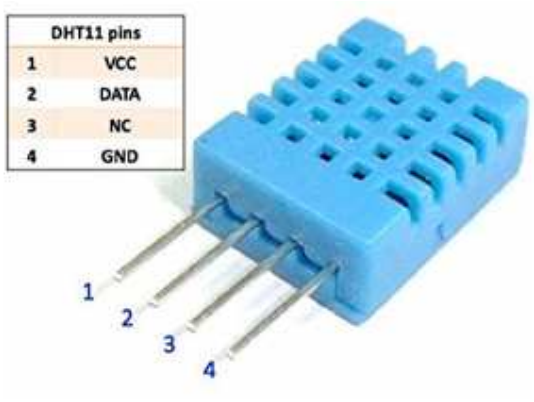


**Figure2.2: Humidity Sensor**

**PIC16F887** microcontroller

**PIC16F887** microcontroller is basically a computer on a chip. It is one of the most important developments in electronics and needed for the process of devices such as mobile phones, DVD players, video cameras, and most self-contained electronic systems. Microcontrollers contain all the components required for a processor system in one chip: a CPU, memory and input, output. A complete system can be built using one Micro Controller Unit (MCU) chip and a few inputs, output devises such as a keypad, display and other interfacing circuits (Bates, 2013). PICF16887 chip can be found in different packages, 40-pin Dual In-Line Package (DIP), square surface mount or socket format. It is the 14-bit instruction word mid-range microcontroller from Microchip Technology. The PIC microcontroller architecture is based on Reduced Instruction Set Computer (RISC) instruction set (Ibrahim, 2006). The PIC16F887 is a 40-pin device and is one of the popular microcontrollers used in complex applications. The pin structure of the PIC16F887 microcontroller(Ibrahim, 2008) is displayed in Figure 2.1.

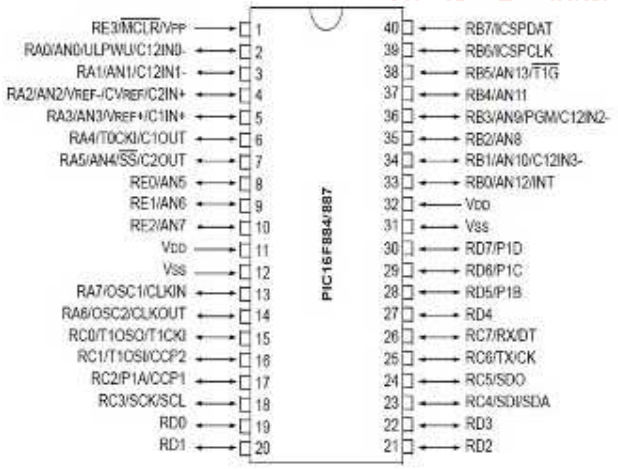


**Figure 2.3: The pin structure of the PIC16F887 Microcontroller**

**7805 Voltage Regulator**

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection in a single IC. Although the internal construction of the IC is somewhat different from the discrete voltage regulator circuits, the external operation is the same. IC units provide regulation of a fixed positive, a fixed negative, or an adjustable set voltage. The LM323 regulator is chosen for peripheral devices. The 5V voltage regulated supply will supply the power of ESP866 microcontroller. The pins that are used in the system are D1, D2 and D4.

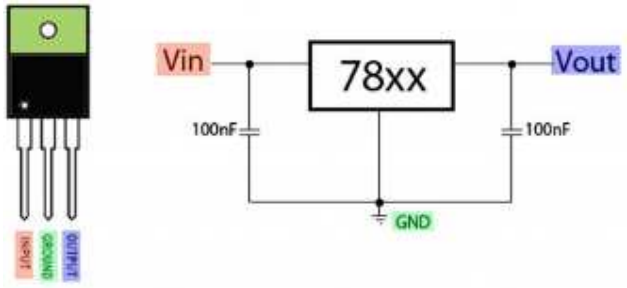


Figure 2.4: 7805 Voltage Regulators

**Liquid Crystal Display (LCD)**

Liquid Crystal Displays are alphanumeric displays which are normally used in microcontroller-based applications. LCDs are model in low-power, battery-operated portable applications. There are two types of LCDs: parallel LCDs and serial LCDs. Parallel LCDs are connected to the microcontroller I/O ports using 4 or 8 data wires and data is transferred from the microcontroller to the LCD in parallel form. These modules have a built-in controller, driver, character generator RAM/ROM. It is capable of displaying two lines of 16 characters. The LCD module provides 4-bit or 8-bit parallel interfaces and writes data directly. The LCD module follows standard eight-data lines, three control lines, and five power lines. The connections are laid out a single row of 16 pins. Pin 1 and Pin 2 are the power supply lines, $V_{SS}$ and $V_{DD}$. The $V_{DD}$ pin is connected to the positive supply and $V_{SS}$ to the 0V supply or ground. $V_{EE}$ or $V_0$ used to adjust the contrast of the display. Ideally, this pin connected to a various resistor. The pin description of the 16 x 2 line LCD module is shown in Figure 2.5.

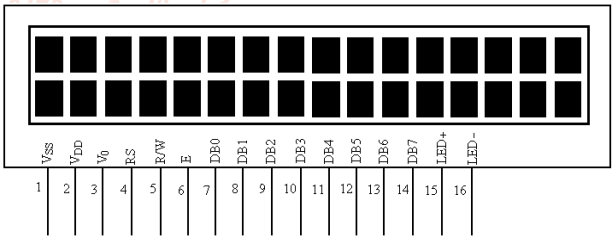


**Figure 2.5: The pin description of the 16 x 2 line LCD module**

## III. Construction and Operation of the System

Microcontroller based humidity and temperature monitoring circuit is designed and constructed temperature sensor, amplifier circuit, PIC 16F887 microcontroller circuit, 16 x 2 line LCD module and power supply circuit. The temperature sensor is used to measure room temperature. Measured data is sent to the microcontroller circuit. DHT11 sensor sends data to the microcontroller in the form of pulses. It takes around 45ms to complete this process. The microcontroller circuit processes on measured data and then sent to the Liquid Cristal Display-LCD module. The power supply circuit is used to supply necessary voltages to other sections.

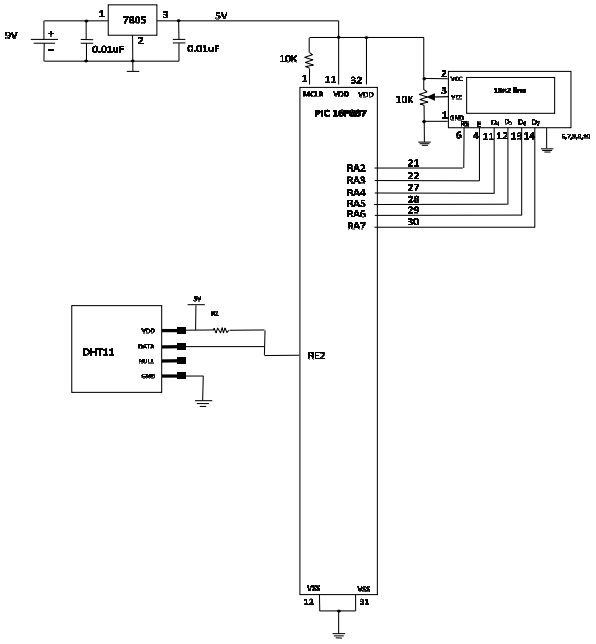


**Figure3.1: The complete circuit diagram**

The temperature and humidity measurement is found on the use of a DHT11 sensor. The result is as shown in fig3.2.

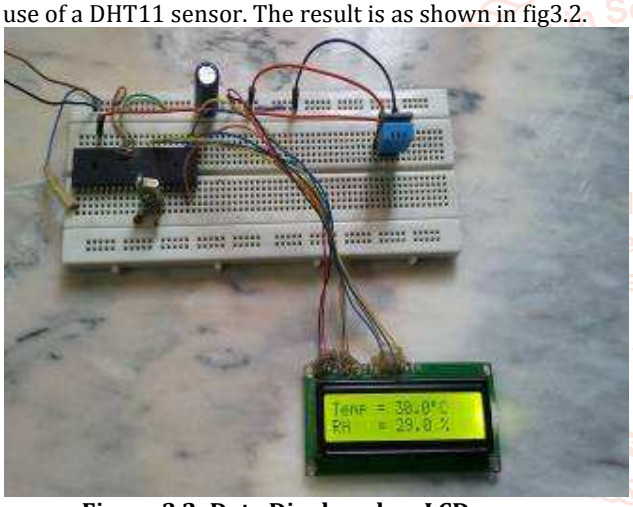


**Figure 3.2: Data Displayed on LCD screen**

The temperature value and humidity value are as shown in figure 3.2.

## IV. Conclusion and Future Scope

The accuracy of DHT11 is not as good as Sensirion's SHT1X/7X series sensors, but it provides an easy and cheap solution to hobbyists for measuring relative humidity and temperature in parallel using a single device, which is sometimes required in certain applications such as calculating the dew point.

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 the 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 the cooler fan.

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