

CLIMATE MONITORING SYSTEM AND TRANSMISSION OF DATA WITHOUT INTERNET

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Abstract - A weather station is a facility, either on land or sea, with instruments and equipment for measuring atmospheric conditions to provide information for weather forecasts and to study the weather and climate. The measurements taken include temperature, absolute pressure, relative pressure, humidity, altitude, dew point, heat index and amounts. You can set alarms when an excessive weather-related measurement occurs keeping you always up to date. Present day climate information is mostly known through internet connected devices like mobiles, PC's and some other electronic devices. Manual observations are taken at least once daily, while automated measurements are taken at least once an hour. In highly secured areas it is not possible to use the mobiles and other internet connected devices especially in military and research laboratories. To overcome such difficulties in climate monitoring with portable size and less weight device is designed. This project consists of different types of sensors which are used to sense the surrounding environment and give precise information regarding surrounding atmosphere. The sensors that are used in this project are DHT22 temperature and humidity sensor, BMP180 or BMP280 pressure sensors and arduino mega are used for the project. For programming part, the arduino IDE software is used to program the device. Using ESP 8266 WIFI module the climatic parameters are transferred to a mobile or PC. The size of the device is small so it is more convenient to move the device from one place to another place. As the device senses the atmospheric values continuously so reduces the human interference in the climate estimation.

Key Words: temperature, absolute pressure, humidity, altitude, dew point, arduino, DHT 22, BMP 180, ESP 8266

1. INTRODUCTION

The system proposes a wireless connectivity by using the WIFI communication standard providing of a reliable, portable and a low-cost tool for industry where it is necessary to have an environmental control to carry out critical processes.

The weather system consist of an embedded system to the development of multimedia applications based on the AT mega 2560 microcontroller, and development is performed using the arduino methodology for the construct embedded systems.

In this project the design of a portable system that allows monitoring of four climatic variables (temperature, humidity, relative pressure, absolute pressure, dew point, heat index and altitude) [1]. The purpose of the system is to serve as an auxiliary tool to make decisions subsystems for environmental control in different areas especially in remote areas where the internet access is not possible.

Climate observing has critical influence on mankind. Gathering of the various data of fleeting elements of the climate variations is extremely noteworthy. Generally, to observe the various climatic factors in the environment and his surroundings one depends on internet based data [2].

The essential point of this project is to build up an installed framework to outline a climate observing framework which empowers the checking of climate parameters. This type of frame work includes various sensors involving temperature, Humidity, pressure, heat index, dew point information can be signed into cloud so that any one (validated individual) from wherever can watch the information.

Based on the previous researches, this project is designed in such a way that the data collected by the equipment should be transferred to the near by mobiles or computers using 802.11 wireless protocol.

In this project DHT 22 temperature sensor is used which is used to measure temperature in the surroundings. BMP 180 is a barometric pressure sensor used to detect the pressure and altitude of the surroundings. ESP 8266 is a Wi-Fi module which is used to transfer the data wirelessly.

2. Material and methodology

In this research, the proposed system uses the arduino mega board. The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

It contains everything needed to support the microcontroller simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.



Fig-1: Arduino mega board

The DHT 22 is the more expensive version which obviously has better specifications. Its temperature measuring range is from -40 to +125 degrees Celsius with +/-0.5 degrees accuracy. The DHT22 sensor has better humidity measuring range, from 0 to 100% with 2-5% accuracy, while the DHT11 humidity range is from 20 to 80% with 5% accuracy.



Fig-2: DHT 22 temperature and humidity sensor

BMP-180 is a pressure sensor based digital barometric pressure sensor module and is functional compatible with older BMP-085 digital pressure sensor with less power consumption smaller in size and more accurate. BMP180 combines barometric pressure, temperature and altitude. The I2C allows easy interface with any microcontroller. On board 3.3V LDO regulator makes this board fully 5V supply compatible. BMP-180 can measure pressure range from 300 to 1100hPa (+9000m to -500m relating to sea level) with an accuracy down to 0.02hPa (0.17m) in advance resolution mode. BMP-180 is an improved replacement for BMP-085 sensor. BMP-180 uses piezo-resistive technology for high accuracy, linearity, EMC robustness and stability for a longer period of time.



Fig-3: BMP 180 pressure sensor

The ESP8266 wi-fi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WIFI network. The ESP8266 is capable of either hosting an application or offloading all wi-fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community[3][4].

This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

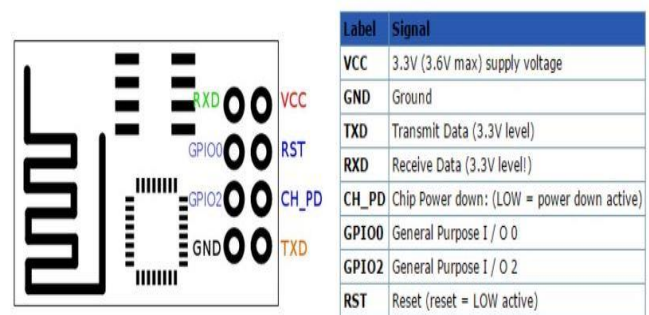


Fig-4: Pin Description of ESP 8266 WIFI module

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits.

These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD.



Fig-5: LCD display

The I2 C LCD component drives an I2 C interfaced 2 line by 16 character LCD. The I2 C LCD component is a wrapper around an I2 C Master component and makes use of an existing I2 C Master component. If a project does not already have an I2 C Master component, one is required in order to operate. When one of the API functions is called, that function calls one or more of the I2 C Master functions in order to communicate with the LCD. The I2 C LCD component is used in applications that require a visual or textual display. This component is also used where a character display is needed but seven consecutive GPIOs on a single GPIO port are not possible. In cases where the project already includes an I2 C master, no additional GPIO pins are required.



Fig-6: I2C Driver

This project mainly consists of the temperature and humidity sensor, pressure sensor which are used to get the values of temperature, humidity, dew point, heat index. Whereas the pressure sensor is used to get the values pressure, altitude etc., the block diagram of the project is as follows.

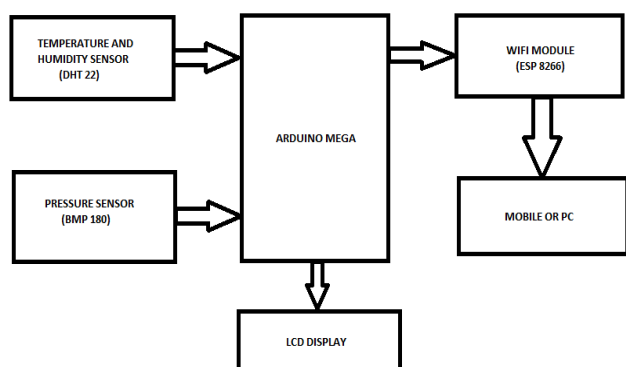


Fig-5: Block Diagram

The main components that are required for this project are Arduino mega, DHT 22(temperature and humidity sensor), BMP 180 (pressure sensor), ESP 8266-01(WIFI module), 16*2 LCD display, I2C driver. These are the main components that are used for the project. The project is mainly divided into three main sections.

- Interfacing Temperature and Humidity sensor (DHT 22) and a pressure sensor(BMP 180) with Arduino mega.
- Connecting ESP 8266-01 WIFI module with Arduino mega.
- Coding part of the Arduino mega and ESP 8266 wifi module.

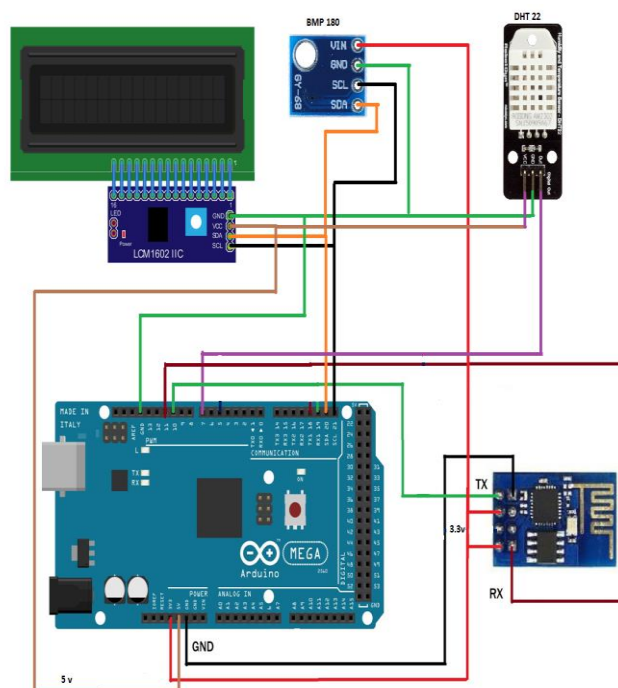


Fig-7:Designed Circuit Diagram of the project

4. RESULT OBTAINED

The proposed system is to view the vital information of the various climatic parameter in the surroundings. The only thing needed is the smart phone to access the climatic information through the WIFI module.

The climatic values like temperature, humidity, relative pressure, Absolute pressure, humidity, altitude, heat index, dew point are displayed in the LCD screen and the same data is transmitted to the connected smart mobile phone.

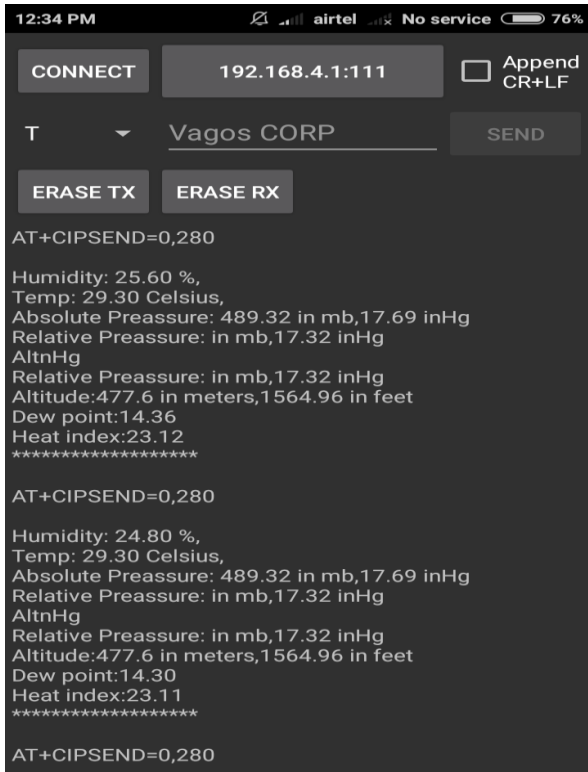


Fig-8: Data transmitted to the smart phone

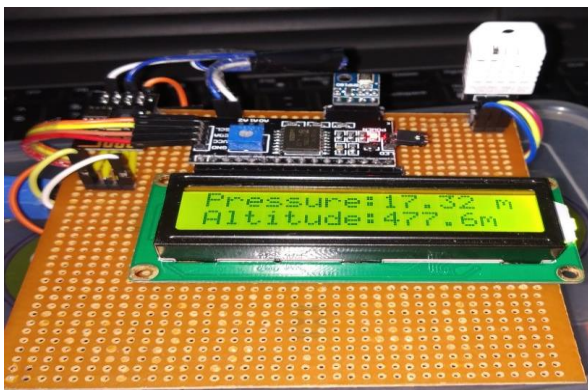


Fig-9: Prototype of the project

5. CONCLUSION AND FUTURE WORK

In this paper climate monitoring system and data transmission without internet is done and the climatic parameters are transferred to the smart mobile without any internet connection. The mobile phone is connected to the WIFI network to the ESP 8266 WIFI module. It helps in better monitoring of the climatic parameters, secure data transfer, elimination of constant maintenance and low cost easy to install climate monitoring system is designed.

The future work is to include the data entry from multiple locations and storing data in cloud to access the data globally.

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