CHAPTER 3

WORKING OF SYSTEM

3.1 SYSTEM ARCHITECTURE

Temperature sensor (DHT11) Pressure sensor (BMP180) ,Rain sensor (rain drop module) these sensor were the inputs connected to the Wi-Fi module ESP8266 which act as the controller and the Wi-Fi connecting module which is based on the node MCU the ESP8266 is connected to the thing speak cloud IOT platform through mobile hotspot we can able to view outputs of the sensors.

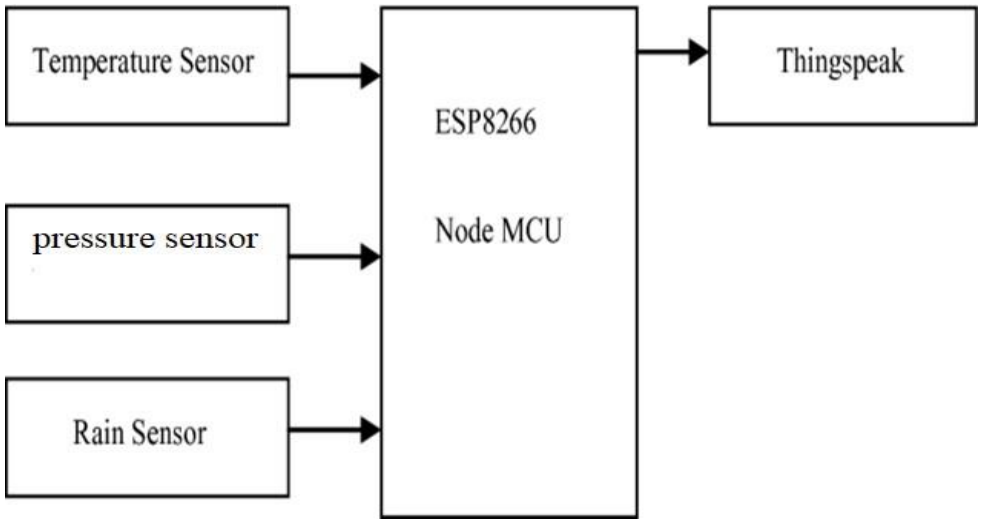

Fig 3.1 SYSTEM ARCHITECTURE

3.2 TEMPERATURE SENSOR

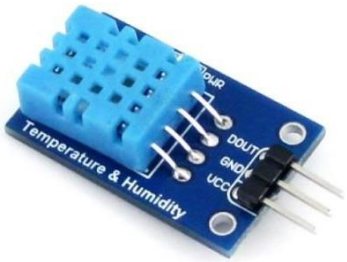

Fig 3.2 TEMPERATURE SENSOR

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 meters 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.

3.3 TECHNICAL SPECIFICATION

Item	Measurement Range	Humidity Accuracy	Temperature Accuracy	Resolution	Package
DHT11	20-90%RH 0-50 ℃	±5%RH	±2℃	1	4 Pin Single Row

TABLE 1 Technical Specification

Parameters	Conditions	Minimum	Typical	Maximum
Humidity				
Resolution		1%RH	1%RH	1%RH
			8 Bit	
Repeatability			±1%RH	
Accuracy	25℃		±4%RH	
	0-50℃			±5%RH
Interchangeability	Fully Interchangeable			
Measurement Range	0℃	30%RH		90%RH
	25℃	20%RH		90%RH
	50℃	20%RH		80%RH
Response Time (Seconds)	1/e(63%)25℃, 1m/s Air	6 S	10 S	15 S
Hysteresis			±1%RH	
Long-Term Stability	Typical		±1%RH/year	
Temperature				
Resolution		1℃	1℃	1℃
		8 Bit	8 Bit	8 Bit
Repeatability			±1℃	
Accuracy		±1℃		±2℃
Measurement Range		0℃		50℃
Response Time (Seconds)	1/e(63%)	6 S		30 S

TABLE 2 Parameters

3.4 TYPICAL APPLICATION

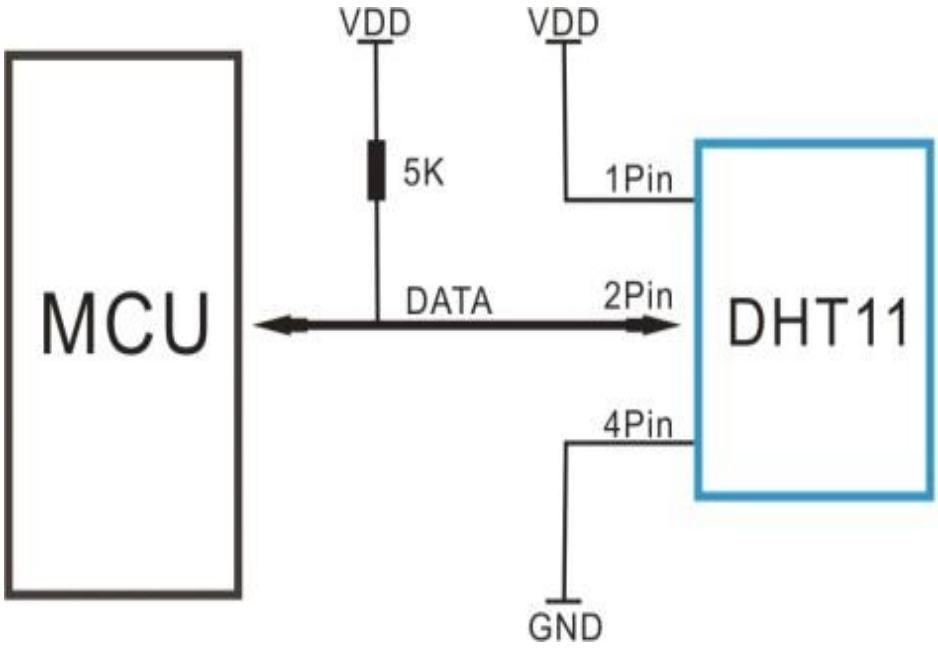

Fig 3.3 Typical Application

Note: 3Pin – Null; MCU = Micro-computer Unite or single chip Computer

When the connecting cable is shorter than 20 metres, a 5K pull-up resistor is recommended; when the connecting cable is longer than 20 metres, choose a appropriate pull-up resistor as needed.

POWER AND PIN: DHT11's power supply is 3-5.5V DC. When power is supplied to the sensor, do not send any instruction to the sensor in within one second in order to pass the unstable status. One capacitor valued 100nF can be added between VDD and GND for power filtering.

3.5 PRRESSURE SENSOR

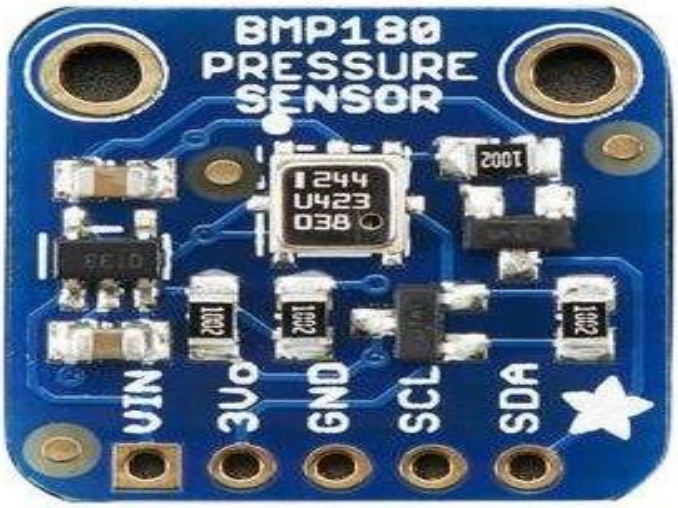

Fig 3.4 Pressure sensor

The BMP180 is the new digital barometric pressure sensor of Bosch Sensor Tec, with a very high performance, which enables applications in advanced mobile devices, such as smart phones, tablet PCs and sports devices.

3.6 BMP180 SENSOR FEATURES

- Can measure temperature and altitude.
- Pressure range: 300 to 1100hPa
- High relative accuracy of ±0.12hPa
- Can work on low voltages

- 3.4Mhz I2C interface
- Low power consumption (3uA)
- Pressure conversion time: 5msec
- Portable size

Pin Name	Description
VCC	Connected to +5V
GND	Connected to ground.
SDA	Serial Data pin (I2C interface)
SCL	Serial Clock pin (I2C interface)
3.3	VIf +5V is not present. Can power module by connecting +3.3V to this pin.

TABLE 3 Pin configuration

3.7 BMP180 SENSOR SPECIFICATIONS

- Operating voltage of BMP180: 1.3V – 3.6V
- Input voltage of BMP180MODULE: 3.3V to 5.5V
- Peak current: 1000uA
- Consumes 0.1uA standby
- Maximum voltage at SDA, SCL : VCC + 0.3V
- Operating temperature: -40ºC to +80ºC

3.8 TECHNICAL DATA

Technical Data	BMP180
Pressure range	300 ... 1100 hPa
RMS noise expressed in pressure	0.06 hPa, typ. (ultra low power mode) 0.02 hPa, typ (ultra high resolution mode)
RMS noise expressed in altitude	0.06 hPa, typ. (ultra low power mode)
	0.02 hPa, typ. (ultra high resolution mode)
Relative accuaracy pressure V_{DD} = 3.3 V	950 ... 1050 hPa @ 25 °C ±0.12 hPa ±1.0 m
	700 ... 900 hPa 25 ... 40 °C ±0.12 hPa ±1.0 m
Absolute accuracy p=300 ... 1100hPa (T=0 ... +65°C,	Pressure: -4.0 ... +2.0 hPa Temperature: -1 hPa (+/- 1 hPa), typ.
Average current consumption (1Hz data refresh rate)	3 µA, typ. (ultra-low power mode)
	32 µA, typ. (advanced mode)
Peak current	650 µA, typ.
Stand-by current	0.1 µA, typ.
Supply voltage V_{DDIO} Supply voltage V_{DD}	1.62 ... 3.6 V 1.8 ... 3.6 V
Operation temp. range full accuracy	-40 ... +85 °C 0 ... +65 °C
Pressure conv. time	-5 msec, typ. (std. mode)
I²C date transfer rate	3.4 MHz, max.
Package type / pin no.	LGA / 7
Package dimensions	3.6 x 3.8 x 0.93 mm³

TABLE 4 Technical data

3.9 RAIN SENSOR

Fig 3.5 Rain sensor

Rain Sensors also called raindrop sensors are very handy sensors that are used in a variety of use cases. Alone a rain sensor can only detect if it is raining and how strong it rains but in combination with other electrical devices you can build useful applications.

For me the most useful application is to detect an open window when it starts to rain because I am often not sure if I closed a window after I left the house.

The rain sensor consists of 2 components, which we consider in more detail below:

- Rain drop module to detect if it is raining or not
- Control board to process the data from the rain drop module

3.10 Functionality of the Rain Drop Module

The rain drop module is a printed circuit board in a rectangular shape. The size can differ between models, but the construction is the same for each model.

The ground plate of the circuit board consists of fibre reinforced plastic that is not conductive. On top of this ground plate there are two pins mounted. From each of these pins starts one conductor track, build like an “E” with an offset against the other conductor track. Therefore, the tracks are not connected but the conductor tracks are close together.

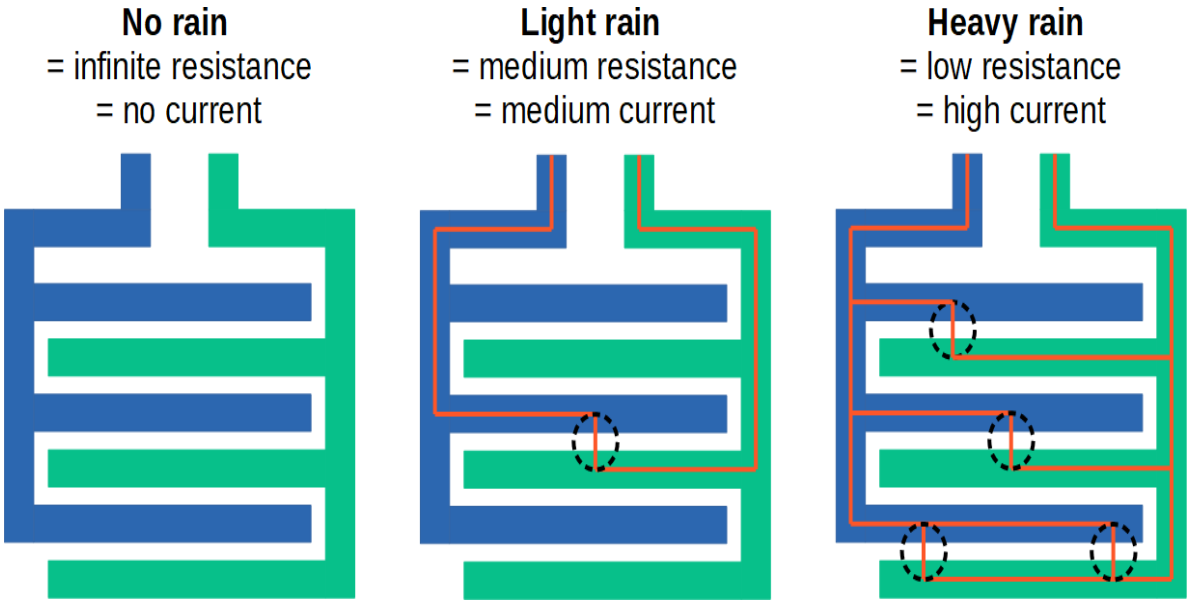

Fig 3.6 Functionality of the Rain Drop Module

3.11 Functionality of the Control Board of a Rain Sensor

The control board consists of two input pins and four output pins. The input pins are connected to the rain board and the output pins to your favourite microcontroller, for example an Arduino Uno or an ESP32 Node MCU.

On the control board you find multiple resistors that also functions are the voltage divider to provide an analogue signal for the rain intensity. Therefore as input we get a resistance from the rain board and the control board converts this resistance into a voltage drop between the analogue pin and ground. The microcontroller uses the internal analogue to digital converter (ADC) to convert the voltage from the analogue pin to a digital value between 0 and 1023 that can be printed to the serial output in your Arduino IDE.

The biggest part on the control board is the potentiometer to adjust the sensitivity of the rain detector. The potentiometer is only a variable resistor whose resistance is changed with the setting wheel at the top. We need this potentiometer to compare the resistance of the potentiometer with the resistance of the rain board. If the resistance of the rain board is lower than the threshold, defined by the potentiometer, the digital output of the control board changes from 1 HIGH to 0 LOW.

3.12 PIN CONFIGURATION OF RAIN SENSOR

S. No:	Name	Function
1	VCC	Connects supply voltage- 5V
2	GND	Connected to ground
3	D0	Digital pin to get digital output
4	A0	Analogue pin to get analogue output

TABLE 5 Pin Configuration

Most rain sensor implementations employ an infrared light that is beamed at a 45-degree angle onto the windshield from inside the car. If the glass is wet, less light makes it back to the sensor.

3.13 ESP8266 (NODE MCU)

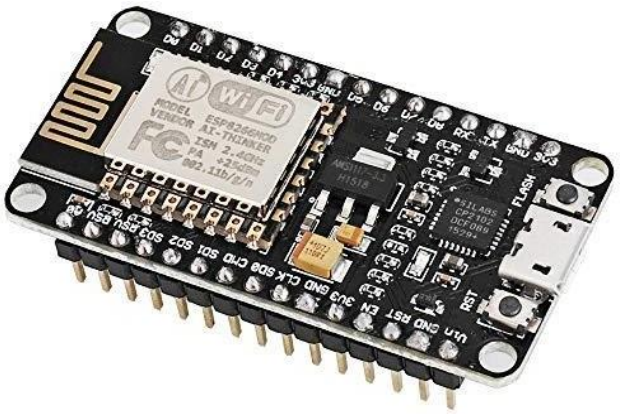

Fig 3.7 ESP8266

ESP8266 is a Wi-Fi SOC (system on a chip) produced by Express if Systems . It is a highly integrated chip designed to provide full internet connectivity in a small package.

ESP8266 can be used as an external Wi-Fi module, using the standard AT Command set Firmware by connecting it to any microcontroller using the serial UART, or directly serve as a Wi-fi enabled micro controller, by programming a new firmware using the provided SDK.

The GPIO pins allow Analog and Digital IO, plus PWM, SPI, I2C, etc.

This board has been around for almost a year now, and has been used mostly in IOT contexts, where we want to add connectivity for example to an Arduino project. A wide adoption has been facilitated by the very modest price, ranging from 2.50 to 10 USD depending on the features offered by the manufacturers.

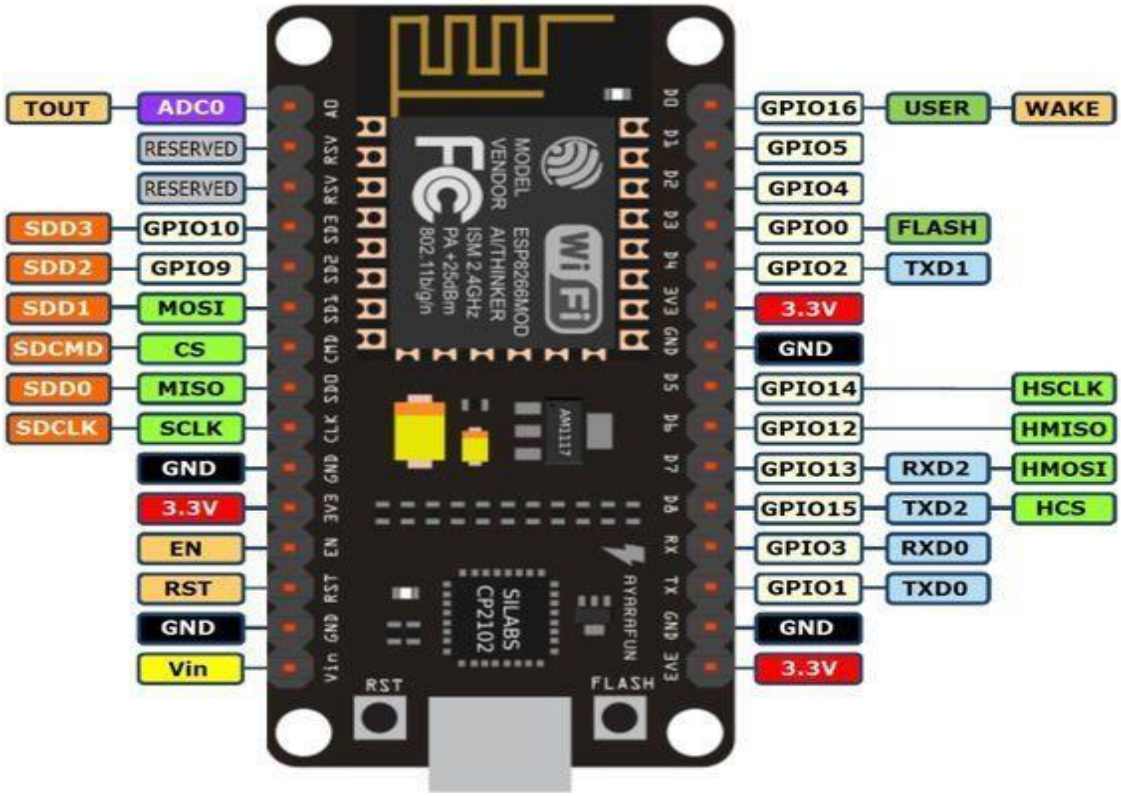

Fig 3.8 ESP8266 (NODE MCU)

3.14 TECHNICAL FEATURES

- 802.11 b / g / n
- Wi-Fi Direct (P2P), soft-AP
- Built-in TCP / IP protocol stack
- Built-in TR switch, Balun, LNA, power amplifier and matching network
- Built-in PLL, voltage regulator and power management components
- 802.11b mode + 19.5dBm output power
- Built-in temperature sensor
- Support antenna diversity
- off leakage current is less than 10uA
- Built-in low-power 32-bit CPU: can double as an application processor
- SDIO 2.0, SPI, UART
- STBC, 1×1 MIMO, 2×1 MIMO
- A-MPDU, A-MSDU aggregation and the 0.4 Within wake

- 2ms, connect and transfer data packets
- standby power consumption of less than 1.0mW (DTIM3)

3.15 ADVANTAGE OF DIRECT PROGRAMMING OFESP8266

- In order to program the ESP directly you need to install a tool chain andfirmware upload utility.
- The ESP8266 Wi-Fi explains the process in detail.
- You should use the ESP Open SDK to build your tool chain.
- Express if also provides an SDK containing the AT Firmware and theproprietary libraries.
- Finally, a ready to use Virtual Box virtual machine is available here
- As an alternative you might want to program the ESP using the Arduinolibraries. A port of the Arduino IDE 1.6.x is available here .