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DESIGN AND EVOLUTION OF INDUSTRIAL IOT SYSTEM USING RASPBERRYPI AND ENTERPRISE PYTHON AND C APPLICATIONS

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ABSTRACT

The Climate Tracking Process found on Node and microcontroller control unit ESP8266 is adapted to provide real-time environmental data acquisition and remote monitoring capabilities. The system leverages the NodeMCU ESP8266 microcontroller, integrated with various sensors, to collect and transmit weather- related data into centralized server. The primary sensors include calescence, damp, and atmospheric pressure sensors. The NodeMCU ESP8266 linked with the cyberspace using Wi-Fi, enabling seamless communication with cloud-based platforms. The data mining is transmitted in real-time to a designated server, where it is processed and stored for data analysis. Users can access the weather data through a user-friendly web interface or a dedicated mobile application. The Climate tracking process joins with NodeMCU ESP8266 presents an efficient and cost-effective solution for individuals, researchers, and organizations seeking a customizable and easily deployable weather monitoring platform. Mixture of IoT technologies and cloud-based services enhances the system's capabilities, providing a comprehensive and accessible solution for weather data acquisition and analysis.

KEYWORDS: Weather monitoring system, microcontroller, sensors, IOT, integration.

1. INTRODUCTION

Weather monitoring systems play a important role in gathering and analyzing meteorological data to offer useful data for motley applications including farm work, environmental monitoring, and disaster preparedness. The NodeMCU ESP8266, a versatile and cost-effective microcontroller, holds a data to create a sturdy also its efficient climate checking process. By this introduction, we will outline the key components and functionalities of such a system. A Climate tracking process is predicated on NodeMCU ESP8266 provides an affordable and scalable solution for collecting and analyzing meteorological data. Whether for personal use, agriculture, or research purposes, this system offers the flexibility to adapt and expand based on specific requirements NodeMCU, an open-source programs and devices platform, is processed for the IOT applications. Leveraging the controls the ESP8266 Wireless fidelity module, NodeMCU provides a versatile and accessible platform for developers to create IoT projects seamlessly. Key Features: ESP8266 Wi-Fi Module: At the core of NodeMCU is the ESP8266, a low-cost, yet powerful Wireless Fidelity part. This module facilitates wireless communication, enabling devices to link with cycberspace and exchange data. Lua Scripting Language NodeMCU supports Lua, a lightweight scripting language, making it user-friendly for those with low firmware knowledge. This simplicity accelerates the evolution of IoT applications. Rapid Prototyping With built-in USB-to-Serial programming, NodeMCU allows for swift protocols and easy code uploading. This feature simplifies the development cycle and accelerates project implementation. Extended GPIOs and Hardware Interfaces: NodeMCU provides a range of GPIO pins and hardware interfaces, allowing developers to connect sensors, actuators, and other components for diverse IoT applications. Community Support: Being an open-source platform, NodeMCU benefits from a robust community of developers. This community support ensures a wealth of resources, tutorials, and libraries, making it easier for newcomers to commence and experienced developers to find solutions. Applications NodeMCU finds applications in various IoT scenarios, including home automation, smart agriculture, industrial monitoring, and more. Its adaptability and ease of use make it a preferred choice for projects where wireless connectivity and IoT functionality are crucial.

2.1 Photo resistor sensor

The Light Dependent Resistor (LDR), also named as a photoresistor, is a semiconductor device broadly used for light-sensing applications. Its operational principle relies on the photoconductivity of certain materials, such as cadmium sulfide (CdS), which form the foundation of the detector. Structurally, an LDR typically consists of two terminals and exhibits a resistance that inversely correlates with the intensity of incident light. In well-lit conditions, the LDR's resistance diminishes, while it increases in darkness. This unique property makes LDRs invaluable for various applications, including automatic street lighting, camera light meters, and environmental detecting process. When integrated into a system such as a climate detecting setup done with NodeMCU ESP8266, these detector serves as a valuable component for light intensity detection. Through a connection to a certain one of NodeMCU's analog pins, the LDR, in conjunction with a fixed resistor and a voltage divider circuit, allows the microcontroller to obtain analog values that reflect the ambient light conditions. The acquired data can then be interpreted to discern day and night cycles, estimate cloud cover, or measure sunlight intensity. While programming, developers read analog values from the connected pin and utilized the obtained information to make informed decisions built on prevailing light conditions. In the realm of weather monitoring, these detector contributes to a more comprehensive deal of the environment, offering insights into diurnal patterns and potential correlations between light levels and atmospheric conditions. However, it's crucial to consider factors such as response time and calibration to ensure accurate and reliable readings, particularly in dynamic outdoor environments where lighting conditions can vary widely. Overall, the phot resistor detector emerges as a versatile and accessible tool for enhancing the capabilities of NodeMCU ESP8266-based projects, providing a cost-effective solution for light-dependent applications in diverse fields. conditions. The acquired data can then be interpreted to discern day and night cycles, estimate cloud cover, or measure sunlight intensity. While programming, developers read analog values from the connected pin and use the obtained information to make informed decisions according to on the prevailing light conditions. In the realm of weather monitoring, the photo resistor sensing detector contributes to a more comprehensive understanding of the environment, offering insights into diurnal patterns and potential correlations between light levels and atmospheric conditions. However, it's crucial to consider factors such as response time and calibration to ensure accurate and reliable readings, particularly in dynamic outdoor environments where lighting conditions can vary widely. Overall, the Photo resistor sensor emerges as a versatile and accessible tool for enhancing the capabilities of NodeMCU ESP8266-based projects, providing a cost-effective solution for light-dependent applications in diverse fields.

Fig. 2.1: Photo resistor sensor.

2.2 BMP 180 SENSOR

These sensor designed to measure Barometric pressure. High accuracy sensor developed for client uses. The BM180 also has good room temperature measuring sense.

2.1.1 BMP180 MODULE 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
- Potable size

2.1.2 BMP180 MODULE 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: -40°C to +80°C

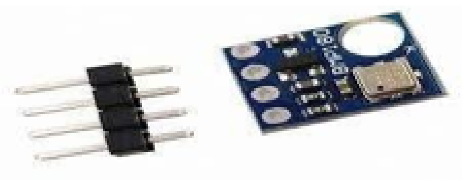

FIG. 2.2: Barometric 180 Sensor.

2.3 DHT11 SENSOR

The DHT11 is a cost-effective and widely used digital temperature and humidity sensor that Works as major part in various IoT applications, including weather monitoring systems. This sensor equipped with a calibrated digital signal output, providing accurate calescence and damp studies with a relatively simple interface. Interfacing with microcontrollers, similar as the NodeMCU ESP8266, is straightforward, typically involving a single-wire communication protocol. These sensor's are affordable and ease of use make it popular for hobbyists and professionals alike in projects where monitoring ambient conditions is essential. In a climate detecting process, the DHT11 can bring value for data to understanding calescence and damp variations, aiding in weather forecasting, climate analysis, and agricultural applications. Despite its simplicity, these sensor remains a dependable and accessible choice for projects requiring basic environmental sensing capabilities. This will be utilized in various demand such as calculating damp and calescence reading in warm, forum processes. Climate workspace are also using these sensing detectors helps to find climate conditions. The damp sensor is need for people who is suffering from damp issues. This detectors used for calculating damp readings and as a safety measure.

FIG 2.3: Dht11 Sensor.

2.4 RAINFALL SENSING DETECTOR

This detector is a fundamental component in climate detecting systems designed to detect and measure rainfall. It plays a main role in various applications, including smart irrigation systems, weather stations, and flood monitoring. Rain sensors help in providing real-time data about precipitation, allowing for informed decision-making. Most used method is tilted used rainfall measuring techniques. When a predefined amount of rainwater collects in one part of the bucket, it tips over, triggering a switch. Each tip of the bucket corresponds to a specific volume of rainfall. By counting its reading in the tips over a given period, the rainfall detector can calculate the total rainfall. Integration of a rain sensor, such as the tilted measuring rainfall, with microcontrollers like the NodeMCU ESP8266 allows for current trend detecting process and data transmission. The NodeMCU can be programmed to receive signals from the rainfall detector, tally the tips, and send the data to a cloud service or store it locally for further analysis. Rain sensors are valuable in a range of applications, including smart agriculture where precise irrigation is crucial, urban planning to prevent flooding, and in meteorological research for accurate rainfall data. The information gathered by rain sensors contributes to a better understanding of local weather patterns, aids in water resource management, and supports the evolution of resilient systems that respond effectively to changing environmental conditions. The ease of integration and stability of rain sensors make them indispensable tools in creating effective and responsive weather monitoring systems.

Fig. 2.4: Rain Sensor.

2.5 LCD DISPLAY AND I2C MODULE

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels. LCDs were a big leap in terms of the technology they replaced, which include light-emitting diode (LED) and gas-plasma displays. LCDs allowed displays to be much thinner than cathode ray tube.

LCDs consume much less power than LED and gas- display displays because they work on the principle of blocking light rather than emitting it. Where an LED emits light, the liquid crystals in an LCD produce an image using a backlight. As LCDs have replaced older display technologies, LCDs have begun being replaced by new display technologies such as OLEDs.

FIG. 2.5: LCD.

3. Source code

```
#include <LiquidCrystal_I2C.h> #define
BLYNK_PRINT Serial #include <ESP8266WiFi.h> #include <BlynkSimpleEsp8266.h>
#include <DHT.h>
#include <SFE_BMP180.h>
LiquidCrystal_I2C lcd(0x27, 16, 2);
SFE_BMP180 bmp;
```

```
char auth[] = "";
char ssid[] = "";
char pass[] = "";
DHT dht(D3, DHT11);
BlynkTimer timer;
#define rain A0 #define light D0
double T, P;
char status;
void setup()
{Serial.begin(9600);
bmp.begin();
lcd.init();
lcd.backlight();
pinMode(light, INPUT);
Blynk.begin(auth, ssid,pass, "blynk.cloud", 80);
dht.begin();
lcd.setCursor(0, 0);
lcd.print("Weather Monitor");
lcd.setCursor(4, 1);
lcd.print("System");
delay(4000);
lcd.clear();

Timer.setInterval(100L, DHT11sensor);
timer.setInterval(100L, rainSensor);
timer.setInterval(100L, pressure);
timer.setInterval(100L, LDRsensor);}
void DHT11sensor()
{float h = dht.readHumidity();
float t = dht.readTemperature();
if (isnan(h) || isnan(t))
{Serial.println("Failed to read from DHT sensor!");return;}
Blynk.virtualWrite(V0, t);
Blynk.virtualWrite(V1, h);
```

```
lcd.setCursor(0, 0);
lcd.print("T:");
lcd.print(t);
lcd.setCursor(8, 0);
lcd.print("H:");
lcd.print(h);}
void rainSensor() {int value = analogRead(rain);
value = map(value, 0, 1024, 0, 100);
Blynk.virtualWrite(V2, value);
lcd.setCursor(0, 1);
lcd.print("R:");
lcd.print(value);
lcd.print(" ");}
void pressure()
{status = bmp.startTemperature();
if (status != 0) {delay(status);
status = bmp.getTemperature(T);
status = bmp.startPressure(3);
if (status != 0)
{delay(status);
status = bmp.getPressure(P, T);
if (status != 0)
{
}
}
}
Blynk.virtualWrite(V3, P);
lcd.setCursor(8, 1);
lcd.print("P:");
lcd.print(P);}
void LDRsensor()
{bool value = digitalRead(light);
if (value == 0)
{WidgetLED LED(V4);
```

```
LED.on();}
else
{WidgetLED LED(V4);
LED.off();}}
void loop()
{Blynk.run(); timer.run();}}
```

4. RESULT

SN	Time	Weather	Temperature reading	Humidity reading	Pressure reading	Rain reading
1	9:00 am	Mist	14 °C	87%	1016 mbar	38 %
2	12:00 pm	Clouded	13 °C	78%	1018 mbar	32%
3	2:00 pm	Partially sunny	14 °C	72%	1019 mbar	34%
4	5:00 pm	Fog	15 °C	73%	1018 mbar	39%

5. CONCLUSION

In conclusion, a climate detecting system implemented with the NodeMCU ESP8266 offers a less cost and stable solution for gathering, transmitting, and analyzing weather data. The NodeMCU's compact design, low power consumption, and built-in Wi-Fi capabilities make it well-suited for remote sensing applications. By integrating various weather detectors like a contemperature, damp, and barometric pressure detectors, the procedure can provide comprehensive and real-time information. The NodeMCU ESP8266's ability to join with cyberspace to the facilitates data transmission to online platforms, enabling users to access and analyze weather data remotely. This link also sends for the execution of IoT (Internet of Things) attribute, alerts and notifications based on predefined weather thresholds. Moreover, the process will expanded or customized by adding additional sensors or incorporating advanced data processing algorithms; Practical terms, this Climate tracking process can proves valuable for agriculture, environmental monitoring, and other fields where accurate and timely weather information is crucial. It empowers users with the capability to function according to informed decisions, to utilized complete resource, and respond effectively to changing weather conditions. Overall, the NodeMCU ESP8266-based climate detecting process demonstrates a versatile and accessible solution for individuals and organizations seeking a reliable method for monitoring and understanding local weather patterns.

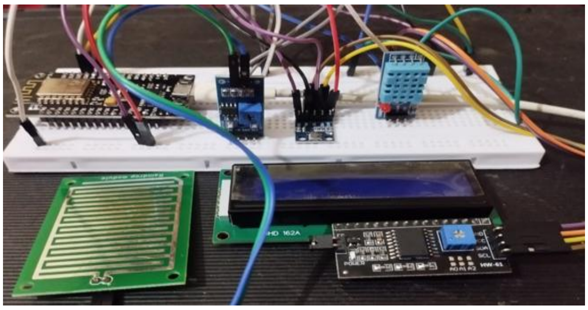

FIG. 5: Project Image.

6 . Future scope

The future scope of climate tracking process utilizing the NodeMCU ESP8266 presents a promising trajectory towards more sophisticated and interconnected environmental sensing As technology continues to evolve, we anticipate enhanced capabilities in real-time data acquisition, transmission, and study. The NodeMCU ESP8266's low-cost and energy-efficient design make it an ideal candidate for widespread deployment in climate detecting networks. Future developments may include the all combined sensors for measuring additional meteorological parameters, such as air quality, UV radiation, and soil moisture. Machine learning algorithms could be used to process the vast amounts ofdata generated enabling more accurate weather predictions and trend analyses. Furthermore, the incorporation of web of Things principles may Foster a network of interconnected weather stations, forming a comprehensive grid that provides a detailed and geographically widespread view of environmental conditions. This collaborative approach can contribute to better understanding climate patterns, disaster Preparedness, and sustainable resource management. As we move forward, the fusion of the NodeMCU ESP8266 with emerging technologies is poised to Revolutionize weather monitoring, offering valuable insights into the dynamic nature of our planet's atmosphere.

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