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IoT-based Weather Information Using WeMos

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Abstract: The most modern internet innovation, known as the "Internet of Things" (IoT), continuously broadcasts real-time data on the state of the entire planet, including details on humidity, temperature, thunderstorms, earthquakes, floods, and other conditions that potentially jeopardise human life. Our study suggests a low cost weather informative and monitoring system that displays the output on an OLED display and retrieves the weather information for any place via a cloud database management system. This proposed method (system) is constructed on Arduino platform and employs a WeMos D1 board with an ESP8266-EX microcontroller to retrieves data from cloud. This paper's major goal is to provide access to current data from any station while allowing users to view weather conditions at any place.

***Keywords*:** *IoT, weather, WeMos, OLED, cloud service*

1. Introduction

The goal of weather forecasting is to make predictions about the upcoming weather. Weather forecasting is crucial in the internet world for a variety of reasons, including the fact that it can save lives and be helpful during natural disasters like floods, tornadoes, and hurricanes. These natural calamities can be foreseen using weather forecasting. People can better prepare for impending disasters the more warning they receive. Our daily life can be impacted by the weather; if we didn't know the weather at the appropriate time, we would be seriously troubled. Sports, outdoor activities, farming, navigation, and transportation, among other things, may be affected. Farmers depend on the weather in order to cultivate seeds in the proper climate by Wale Anjali et.al.

It is crucial for farmers to keep an eye on the weather from planting the seeds to bringing the harvest home. Actually, forecasting the weather is crucial for pilots, sailors, and those involved in the transportation industry. Prior to flying, sailing, or travelling in any other means, they should be aware of the weather conditions. Monitoring the weather has become crucial in many different fields. It is quite difficult to retrieve the site's precise climate data. ProposedWeather Station is built-in a way which can forecast meteorological information including temperature, humidity, thunderstorms, rainfall, air pressure, the current day, time and date in addition to measuring other atmospheric conditions.

The goal for a smarter world will be achieved on the foundation of the newly emerging idea of the IoT Wale Anjali et.al. IBM vision of a smarter planet is said to be based on the subsequent trio of Pillars, known as Three Pillars and seen in fig. 1. The first one "instrumented," means that information is gathered wherever it is by using remote sensors. The second is Interconnected, which means that information is sent from one place to another where it can be valuable. The third letter stands for intelligence, indicating that information is processed, examined, and used to generate knowledge by Versus.com.

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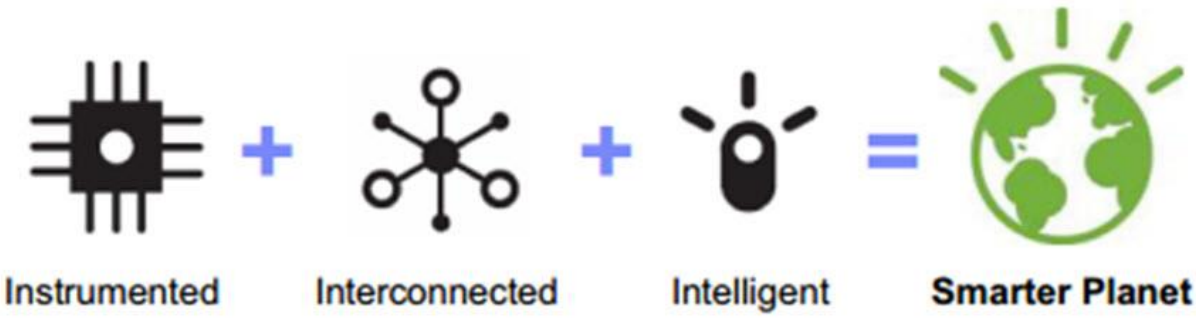

Fig. 1-The Smarter Planet system's cornerstones

The designed methodology turns an IOT device, the WeMos D1, into a realtime weather station by connecting it to the internet and using numerous Cloud Services, including Thingspeakand Wunderground, to collect data as well as display the weather on OLED. Wunderground is a cloud-based service that creates API key specifically for Location and offers real-time meteorological data that is available to anyone, anywhere. You may gather data, get it, display it, analyse it, store it, and draw real-time charts on its channels using Thingspeak, HTTP-based data platform for the IoT. The Thingspeak client has the option to establish a private or public channel. Every channel has it's own channel name, channel ID, API key, description, and each channel has eight fields total. Figure 2 shows the various weather information.

Fig. 2-Weather Cloud Services Scoring Charts

2. Literature Survey

Today, it is increasingly difficult to obtain accurate weather data at the appropriate time and location, making weather monitoring one of the most difficult tasks. Farmers and our agricultural lands are negatively impacted by the climate and are having a difficult time adjusting to these challenging weather circumstances. A survey was carried out in India to observe different Weather parameters using analogue equipment throughout Weather risks by Kalyani G. Gajbhiye et.al.

Climate estimating is a scientific and technology application that gathers quantitative information about the existing states of the atmosphere and predicts future states by examining present and past circumstances using Arduino. This study discusses one such proposed method after reviewing numerous articles by Karthik Krshnamurthi etal.

It is a very difficult undertaking, but in recent years, various sensors have been used to detect temperature, humidity, rainfall, and wind direction. Based on MEMS and WSN technologies, this study's by Rong-Hua Ma et.al proposal is for a wireless remote weather monitoring system that includes sensors for measuring meteorological conditions.

IoT is a collection of consistent, locally intelligent devices that can push and draw data from the networked world by M. Sowjanyaet.al. In this method, an LPC1768 microcontroller and GSM network are used to collect meteorological data from the outdoors and display it on the internet.

In order to prevent tragic collisions, this research by Vicente R. Tomas et.al introduces a Autonomous scheme that quickly provides realtime weather conditions and alerts drivers to impending weather conditions. The hardest task at hand right now is accurately retrieving weather information from the website. A region's specific weather information may not always be sufficient due to rapid weather fluctuations.

Using crowdsourcing and telecom infrastructure, a zone-specific weather monitoring system proposed by Varad Vishwarupe et al. proposes service providers who can make it simple to retrieve meteorological parameters.

Instead of receiving a single set of weather conditions for the entire city, this method offers an option for acquiring weather information unique to a given region.

Environments differ from area to area in large cities, necessitating the need for zone-specific information by Christopher et al. The weather monitoring scheme that links Online for data Logging and Display is described in the study. In this method, the data transmission is reliable and stable thanks to an Ethernet connected connection.

When the Earth circles around the sun, the weather varies with each season by Sankar. P. In this study, a hydrogen balloon with sensors attached inside of it is used as an embedded system to display temperature, pressure, humidity. Communication and transmission of measured data to ground station both require radio frequency signals.

For the purpose of building an automatic weather station during an emergency. In this study, we demonstrate the real-time installation of an automatic weather station (AWS).

3. Design and Implementation

Figure 3 depicts the overall structure of suggested system for a live weather monitoring system.

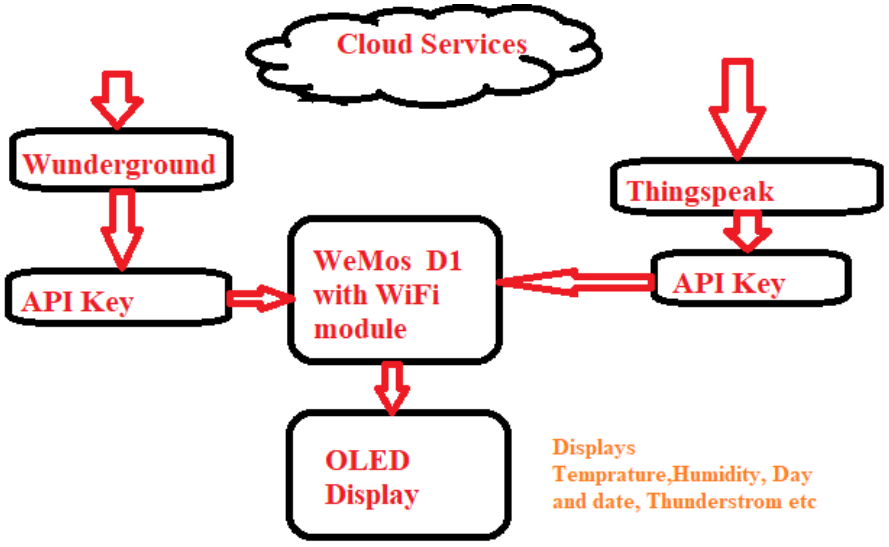

Fig. 3- Architecture of WeMos D1 based Weather Monitoring System using IoT

A. WeMos D1 Board:

A tiny WiFi-IoT module with 4MB flash, WeMos D1 is based on the ESP-8266EX microprocessor. This board is appropriate for a broad IOT target audience thanks to its nine GPIO pins. It is a fantastic MCU that can be programmed using the Nodemcu or Arduino IDE. It contains a micro USB port for automatic programming and supports OTA programming.

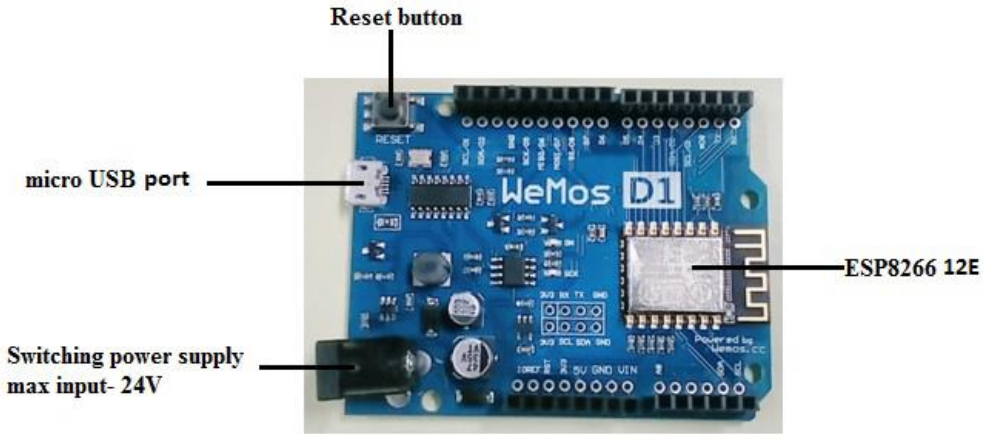

Fig. 4-Wemos D1 board

With a ssid and password, the station in this suggested system's WiFi module connects to the Thingspeakand Wunderground, retrieves the data, and displays it on OLED. This technology is economical because it doesn't use any sort of sensor to retrieve data.

B. OLED Display

It uses the I2C protocol and is small, low power, straightforward, and simple to use. An integrated circuit can communicate with one another through a two-wire interface using the serial protocol known as I2C. This display has a 128 x 64 resolution and a driver IC of SSD1306. In the suggested system, an OLED is utilised to show data that has been retrieved from a cloud database and contains information on temperature, humidity, the current date and time, a forecast for the next three days of weather, and the presence or absence of thunderstorms.

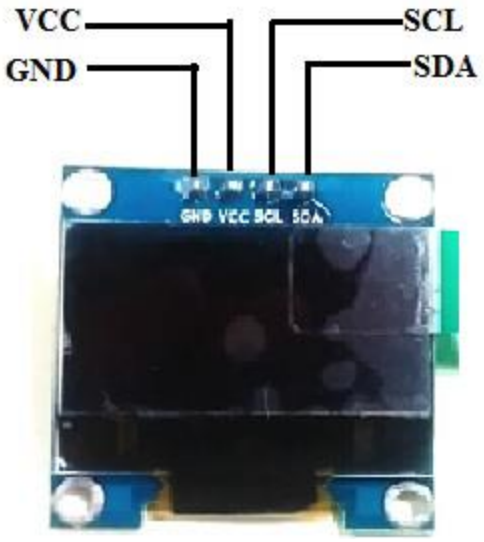

Fig. 5- OLED Display

C. Cloud Services

We must use a few cloud services in order to display the most recent weather data. A for-profit weather service called Wunderground gives us access to real-time meteorological data including temperature, humidity, pressure, wind gust, and more whenever and wherever wants. More than 180,000 personal weather stations (PWS) are included in the data it offers, among other services. The Wunderground service transmits requests to stations, user information, and sensor data using the straightforward HTTP GET protocol. It has an API, and getting ours API key requires creating an account, which is quick and cost-free.

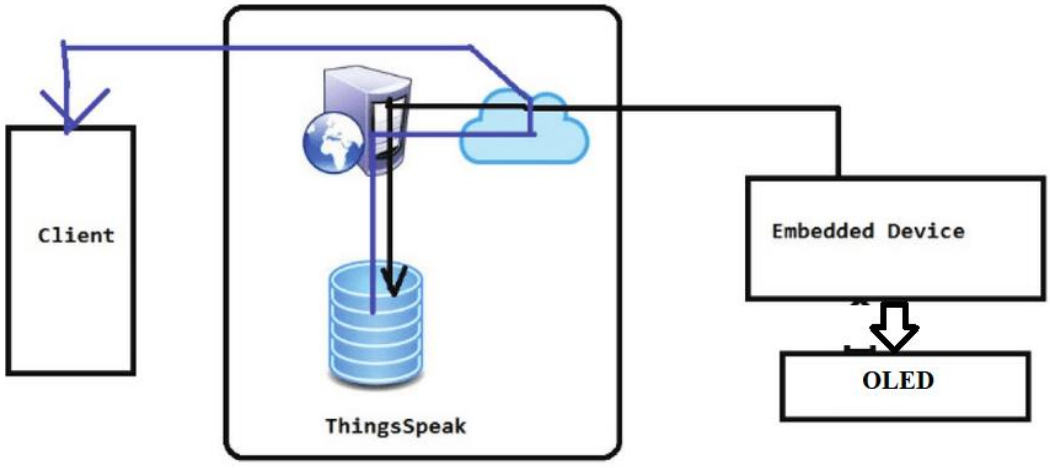

Fig. 6 -Thingspeak Service Architecture

4. Implementation of Hardware

The WeMosD1 board, which has onboard Wi-Fi module OLED display, which is used to produce a Weather Monitoring system. Including OLED display with four ports SCLand SDA are the data lines of the I2C protocol, and GND stands for ground. V_{CC} represents positive power supply voltage. Figure 7 illustrates the OLED's pin connections to the WeMos board. The OLED's GND and V_{CC} pins are linked, respectively, to the GNDand 3V3 pins

of the WeMos D1 board. The GPI_{O4} and GPI_{O5} pins of the WeMos board are connected to SDA and SCL pins of the OLED, respectively.WeMos uses a micro USB cord as its power supply.

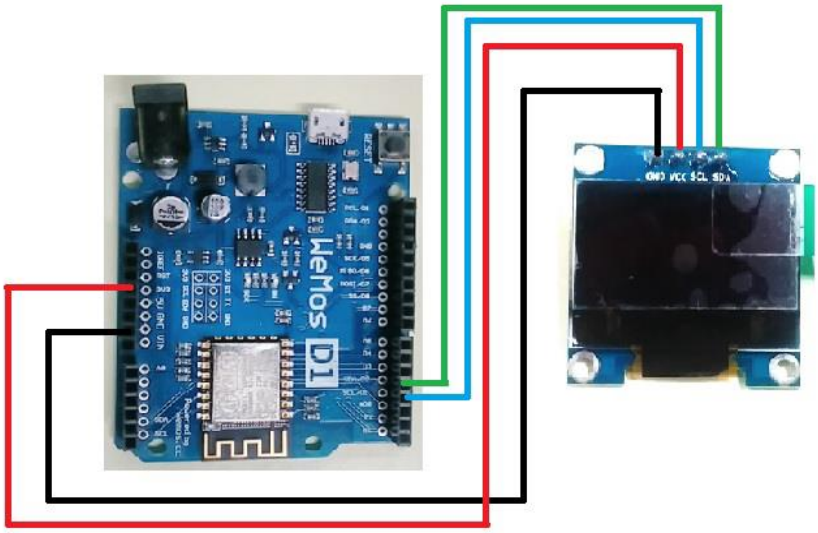

Fig. 7- Schematic Diagram

5. Software Realiation

Now after everything has been set up, we prepared to upload climate data to cloud. In this proposed system, we are leveraging Arduino code developed in the Arduino IDE to update and get data from cloud services. The following piece of the Arduino code must be set for weather station configuration:

- For WiFi settings, we must enter SSID name and password for our WiFi network.
- We must change the offset between our local time zone and UTC in the Time Client Setting section.
- The API key that we obtained from the cloud database needs to be entered in the wunderground area together with the name of the nation and the location's city.
- The read API key and channel ID in the Thingspeak section need to be modified.

After creating the code and flashing on the board, we can save and retrieve the weather information on our little OLED display.

6. Results and Discussion-

The hardware and software realisation section has completed the whole hardware and software configuration. To access cloud services and a microcontroller, a client creates a WiFi network. OLED display began configure WiFi connection after flashing and updating the proposed system, and after updating the data to Thingspeak and Wunderground, it displayson OLED. We tested the weather at Solapur City, and the findings saw on our OLED monitor, as follows-

Fig. 8-Day, date and time display

Fig. 9- Temperature Display

Fig. 10-Three days weather forecasting display

7. Conclusion-

On the OLED display, we display the date, time, temperature and weather. We also display the three days weather data which is predicted and calculated by our system. This system helps for monitoring the weather data as per given by stander weather information systems. IoT helps for making system more feasible from user point of view. In future, we use the Artificial Intelligence along with IoT for making the system smarter called as smart weather monitoring system. Also with the help of ML approach, can predict the one week weather. In future instead of using the readymade data from the sources, anybody will use the sensors.

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