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IoT-based Weather Monitoring System

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Abstract
In the modern world, weather monitoring has an important and indispensable role as the performance of especially agrarian economies depends on the weather conditions. Further, real-time weather monitoring and conveying information to the users on a real-time basis is also an important task. A three-tier Architecture is proposed in the present work. Various sensors are used to collect information regarding temperature, humidity, light, and rain. This information is sent to the Arduino-Uno platform where the raw sensed data is processed to extract useful information. Further, the information is transmitted to the specific user through an IoT module that is interfaced with the Arduino-Uno platform. This weather information can be accessed on the smartphone using the mobile App.

Keywords: Weather monitoring, Sensors, Arduino-Uno, IoT

I.Introduction

The Internet of Things is a versatile technology where it integrates different technologies. It uses the Internet, Embedded systems, and Information and Communication technologies whereby it combines devices like sensors, Embedded platforms like Arduino-Uno, and using the internet a smartphone is connected to these devices at the other end no matter the distance. In fact, IoT technology has redefined the term UBIQUITOUS- any place, any time, and any device.

The parameters viz., temperature, humidity, and rainfall are vital in deciding the weather condition of a particular location. With temperature and humidity parameters it is possible to predict the time of rainfall. The Indian economy directly depends on Monsoons. There are two types of Monsoons viz., Southwest monsoon and Northeast monsoon. While the Southwest monsoon brings rain major part of the country spans from June to October and the Northeast monsoon gets the rain to Tamil Nādu and some parts of Andhra Pradesh. Temperature over the Pacific Ocean plays a vital role and decides the quantum of rain received by India. Elnino and Lanin0 are two phenomena that are connected with the Pacific conditions. If Monsoon fails then the Economic condition of the country goes down. Thus the temperature plays a vital role.

Further, smog is a common phenomenon in India affecting the lifestyle and routine of the people living in cities like Delhi. A pollutant sensor helps in predicting the time of occurrence of smog based on which Governments can take appropriate actions. And also nowadays cities are flooded by rain waters, drains overflow resulting in traffic jams making the life of commuters pathetic. An early prediction of rainfall can be an important input to the commuters living in cities.

Based on the light conditions during the daytime and humidity conditions it is easier to provide the rain forecast.

Sensors, Arduino-Uno, and IoT provide a holistic approach to providing weather parameters to remote locations using the Internet.

II.Literature Survey

Weather Monitoring Systems have been the focal point of research during present and past times. The present systems are developed using embedded platforms like Arduino, Node MCU, and Raspberry Pi.

Authors [1] implemented a weather monitoring system based on IoT using the Raspberry Pi platform. Here they have used a PM2.5 (Particulate Matter of size 2.5µm)sensor to sense the pollutants in the atmosphere resulting in smog.

The implementation proposed in [2] is based on Raspberry Pi and Arduino Nano. Apart from temperature, pressure, and humidity, carbon monoxide concentration in the atmosphere is also monitored.

An IoT node-based framework was proposed by [3] to monitor particulate matter in the atmosphere. This system used a PM 2.5 sensor and monitors it periodically and stores the information in a cloud server.

A Raspberry Pi-based weather monitoring system is implemented in [4]. This gets basic parameters like temperature and humidity.

A weather monitoring framework for agriculture was proposed by [5] with Node MCU. They used a temperature, humidity sensor, and soil moisture sensor for monitoring the weather.

A higher resilience-based weather monitoring system using a microcontroller was developed by [5]. This was done mainly to target underdeveloped and developing economies. This used temperature, humidity, and rain gauge systems to obtain data in real-time.

A data logger-based weather monitoring system is proposed by [6] which uses a microcontroller and sensors to sense temperature, humidity, light, and CO.

Researchers have come up with many weather monitoring systems using simulation [7], [8], [9] based on LabVIEW.

Countries like India, China, and Thailand have tropical weather conditions and are affected by air pollutants. Researchers have conducted studies on the IoT implementation using pollution monitoring sensors also. They have proposed [10] the post-processing of pollutants data and their effect on the weather.

III.Present work

Arduino-Uno Arduino UNO platform is used in present work which is a low-cost, flexible, and easy-to-use programmable open-source microcontroller board that can be integrated into a variety of electronic systems. It uses a Microchip Atmega328P microcontroller. The board is facilitated with digital and analog (I/O) pins that can be interfaced with various expansion boards and other circuits. The board has 14 digital I/O pins (six capable of PWM output), and 6 analog I/O pins, and is programmable with the Arduino IDE (Integrated Development Environment), via a type B USB cable. It can be powered by a USB cable or a barrel connector that accepts voltages between 7 and 20 volts.

The MAX232 converts signals from an RS-232 serial port to signals suitable for use in TTL-compatible digital logic circuits. The IoT module extends Internet connectivity from computers and related devices to other physical devices or common objects and leverages technologies such as embedded systems, wireless sensors, and automation. The ESP8266 is a system-on-a-chip (SOC) Wi-Fi microchip for Internet of Things (IoT) applications, used in the present work.

A rain sensor is a low-cost electronic sensor and is used to detect rainfall or water drops. It operates as a switch. When not operated the switch is in open condition. This sensor is consisting of two parts, one is Sensing Pad and another is the Sensor Module. When rainfall or water drops fall on the Sensing Pad surface, then the switch will be closed due to an increase in conductivity. The Sensor Module reads data from the sensor pad and processes the data and converts it into a digital/analog output. This sensor can provide Digital output as well as Analog output.

The Rain Sensor Module's Sensing Pad consists of two nickel-coated series copper tracks. Also, it has two Header pins, these are internally connected to the two copper tracks of the Sensing Pad. These pins are used to connect the Sensing Pad to the rain sensor module circuit through two jumper wires. Always, one pin of the rain sensor circuit provides a +5v power supply to one track of the sensing pad, and another pin is received the return power supply from another track of the sensing pad.

Normally under dry conditions, the sensing pad provides high resistance and low conductive. So, the 5v power supply cannot be passed from one track to another track. Its resistance varies according to the amount of water on the surface of the sensing pad. When water drops fall on the sensor pad surface its resistance will decrease and conductivity will increase. So, when water drops increase on the pad surface it can pass more power supply through one track to another track.

Since temperature and humidity are closely related to physical quantities a sensor integrating temperature and humidity is manufactured. A temperature and humidity sensor refers to a device or device that can convert temperature and humidity into electrical signals that can be easily measured and processed.

In the present work a DHT11temperature and humidity sensor is used. It is a basic ultra-low-cost device that provides digital output directly. It uses capacitive and thermistor variations to measure the relative humidity and temperature of the atmosphere.

Light sensors are also called photosensors. There are different types of light sensors to detect and measure illuminance, respond to variations in the amount of light received, and convert the same to electricity. In the present work, an LDR module is used. The block diagram is shown in Fig.1. Proposed prototype is shown in Fig.2.

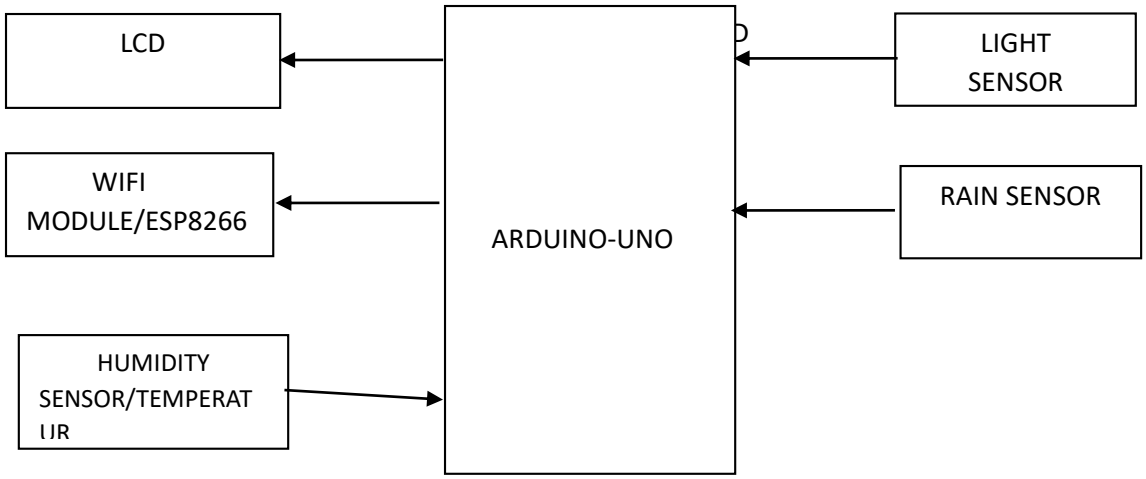


Fig.1 Block diagram of the proposed IoT based Weather monitoring System

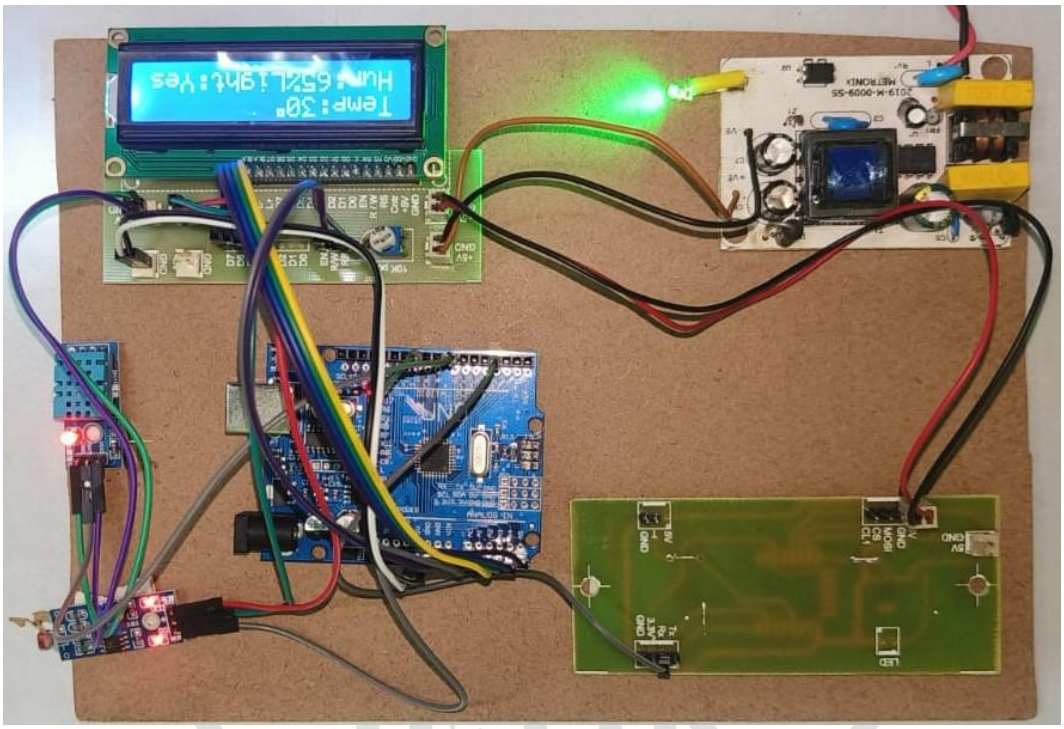
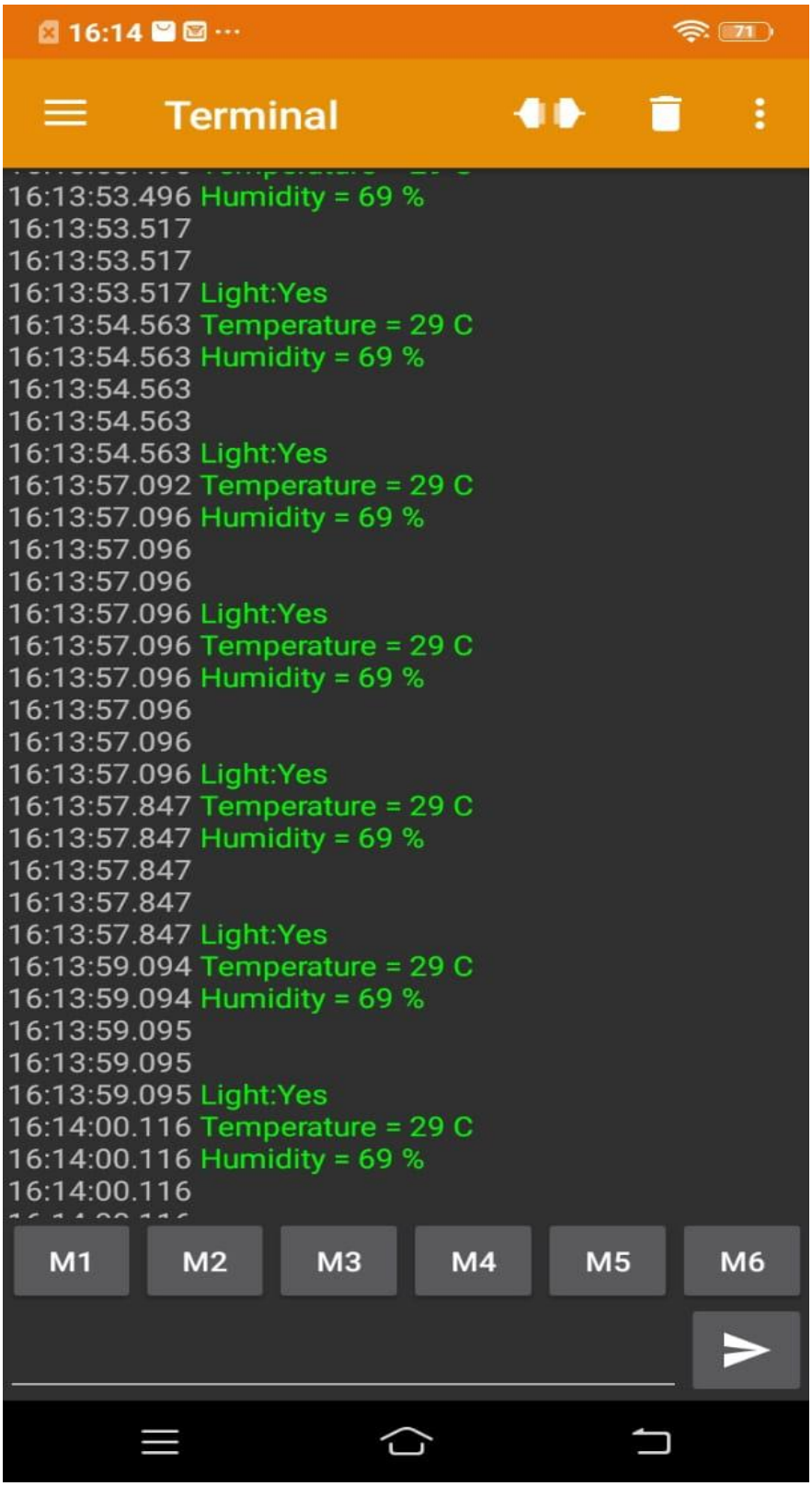


Fig.2 Prototype of IoT based Weather monitoring System

IV.Results



Above shows the real time measurements of the weather parameters

V.Future scope

In the present work Temperature, Humidity, Rain, and Light sensors are used to monitor the weather parameters. However, particulate matter and Carbon monoxide sensors can be added to estimate the pollution levels of the atmosphere and their impact on the weather conditions of the region can be studied. As the data collected by the sensors will be voluminous over a period and this is essential for the analysis to predict the future weather patterns of the regions being monitored. Further, the system can be made self-intelligent by adding Artificial Intelligence algorithms whereby different weather prediction models can be synthesized.

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