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Research Article

Impacts and Disadvantages of the Components used in the Rain Detection Device's Implementation

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Abstract

A microprocessor, a rain sensor, and an output device such as a buzzer or light-emitting diodes (LED) are all used in a rain detector. The output device notifies the user or initiates a certain action when the microcontroller processes the data from the rain sensor's detection of rainfall. The use of sensors and software to collect and exchange data on how devices are being used and how the environment is changing has greatly enhanced the Internet of Things (IoT). Data analysis has the ability to both predict possible issues before they arise and offer remedies. This technology can be used in a variety of fields, including wearables, automation, and healthcare. To address the issue of people becoming stuck in unexpected downpours, we may use the Bosch BMP280 environment monitor to predict rain and high temperatures. Using an Internet of Things interface and a magnetic switch sensor, we gather and transmit the temperature, altitude, and atmospheric pressure data to Firebase. We beep to alert the user if they need to bring an umbrella. When it rains, a switch known as a rain sensor is activated. Automatic irrigation systems and automatic windshield wiper modes are the two primary applications for rain sensors. This study will investigate several design techniques to create a rain detection system that detects rainfall using a rain sensor. The rain sensor detects any rain that falls on it, analyzes the situation, and responds accordingly. The components used in the rain detection device's implementation, as well as its benefits and limitations, have all been examined in this study.

Keywords: *Microcontrollers, Impacts, Drawbacks, Rain Sensor Detector, Internet of Things (IoT), Components.*

I. INTRODUCTION

Since a few years ago, electrical and electronic engineers have developed a number of systems for the detection of rainwater. The themes covered by these projects range from automatic rain detecting windows, which use rain detectors and sensors in cars to automatically operate the power windows and roof whenever they detect moisture, to the use of rain detector circuits and devices in irrigation. Oyubu (2017) described in his work how automatic rain-sensing windows were utilized to create a mechanism that would allow car windows to automatically roll up when it rained, safeguarding the interior from injury. Cars were the main target audience for the design. Campbell (2000 created a scientific rain detector, the output of which was utilized to activate or deactivate a different circuit. Whether it is raining or snowing is detected by the rain detector. A rain detector designed to automatically collect rainwater and store it in a reservoir for residential usage was incorporated into Mohammed's (2012) work. Prabhakar H. and others invented a gadget in 2016. In their project, there are trays that react to sunlight by opening and closing. An 8-bit microcontroller that can recognize this weather situation controls the tray, which is attached to a roof. The method designed by Imran and Gupta (2015) aims to reduce interior damage, make the gadget user-friendly, and enable automobile windows to automatically roll up when it

rains. The objective is to develop a dependable rain sensing device that a substantial market of car owners can purchase. 2020: Emeasoba and others Modern technology, such the Internet of Things, enables users to swiftly and effectively operate hardware devices across a wide area while consuming little power (Baballe et al., 2019; 2023). This energy is necessary for many different devices, including those in businesses, homes, and industrial settings. It's important to effectively monitor the energy consumption of home appliances. Home appliances are regulated online in this project. A system that could control several electrical loads linked to different terminals was created from the initial concept. The user interface was developed to engage with the system as soon as the connection was made, allowing consumers to easily control these household appliances online. Remote users can simply access home appliances using the system when it is routed through an IP address. As a result, the time delay present in home automation systems using technologies like Bluetooth, Zigbee, and Z-wave that require remote control or transmission (SMS) is abolished in Internet of Things (IoT) devices and designs based on the technology in question. However, the user may simply adjust the appliances, which proportionally lowers the energy use. Raju (2017) employed an Arduino microcontroller, temperature sensor, and rain sensor module for automated agricultural watering. Ruby and Jawahar (2017) worked on smart agriculture to prevent crops from rotting during rain and efficiently recycle rainwater for irrigation. In addition to other parts, they made use of the Arduino microcontroller, the Wi Fi module, the rain sensors, and the GSM module. Latha and Murthy (2016) created a GSM-based rainfall detector using Arduino. Rainfall was measured in their study using a rain sensor module with an LM393 interface. A specified mobile number was then text messaged with the measured values for analysis. When its sensor comes into touch with water, a self-contained electronic gadget known as a water/rain alarm detector sounds an alarm. It has a rain sensor and a microprocessor (Jayant, 2015). 2016 (Hernando). It is safe to use in close proximity to high-efficiency water pumps, washing machines, toilets, and dishwashers (Beard et al., 2010). They might be used to alert consumers about moisture problems (Becker & Gudesen, 2000). The design of an IOT rain detector device with a GSM notification is shown in this work. It can detect rain and instantly transmit a notification to a GSM handset. Using an embedded system for rain detection and its microcontroller programming, the gadget was able to detect any moisture or liquid drop on the rain sensor panel or board. The system automatically tries to establish a connection with a network provider as soon as it is turned on. It continuously scans the rain sensor for the presence of water; if it does, it sends an SMS to a pre-registered number and waits one minute before checking again (Grace et al., 2023). According to our research, there is a link between atmospheric pressure, humidity, and rainfall. We have employed the Bosch BMP280 environment monitor to forecast rain and high temperatures in order to address the problem of people being trapped in sudden downpours. We collect and send the data to Firebase by using an IoT interface with a Magnetic switch sensor to measure temperature, atmospheric pressure, and altitude. If the user needs to carry an umbrella, we alert them with a beep (Karuna et al., 2023). For IoT applications, Amado Gutierrez-Gomez conducted a propagation study of LoRa P2P links for near-surface measurements over semitropical rivers. A method for estimating rainfall quantity and intensity that is based on Gamma-Dose Rate Monitoring has been proposed by Valentina Yakovleva. Retrieval of raindrop size distribution using dual-polarized microwave signals from low-earth orbit satellites: a feasibility investigation through simulations is a project by Xi Shen. Mattia Stagnaro employed dynamic calibration to adjust the readings from the drop counter rain gauge. Investigation of the wind-induced airflow pattern near this LPM precipitation gauge was Enrico Chinchella's idea. In this work, a rain sensor is used to measure the amount of precipitation that is falling, and the sensor's output is connected to a signal conditioning unit. The Arduino microcontroller is then used to process it. The personal computer shows the measured results. To manage the sensitivity, compare, and convert the analog values to digital values, the sensor is connected to the rain control module (Yogesh S et al.).

II. COMPONENTS UTILIZED IN THE RAIN DETECTOR DEVICE'S IMPLEMENTATION ITS ADVANTAGES AND DISADVANTAGES

2.1. Components:

i. Rain Sensor:

This component detects the presence of rain. Common types include capacitive sensors, resistance-based sensors, and optical sensors.

ii. Capacitive sensors: Detect changes in capacitance caused by water droplets.

a) **Resistance-based sensors:** Detect changes in resistance when wet.
b) **Optical sensors:** Use light to detect the presence of water.

iii. Microcontroller:

This is a small computer that processes the data from the rain sensor. Common examples include Arduino, Raspberry Pi, or dedicated microcontrollers.

iv. Output Device:

This component alerts the user or triggers an action when rain is detected. Examples include a buzzer, an LED, a relay, or a device that can control an irrigation system.

v. Power Supply:

A battery or a power adapter provides the necessary voltage to power the device.

2.2. Advantages of the components utilized in the rain detector device's implementation:

i. Water Conservation:
Rain sensors can be used to optimize irrigation systems, reducing water waste.
ii. Enhanced Safety:
Rain sensors can be used to automatically adjust windshield wipers, improve visibility, and enhance safety during rain.
iii. Real-Time Data Collection:
Rain sensors can provide real-time information about rainfall, which can be used for various applications.
iv. Reduced Maintenance:
Rain sensors can automate tasks like irrigation, reducing the need for manual adjustments.

2.3. Disadvantages of the components utilized in the rain detector device's implementation:

i. Sensitivity to Environmental Factors:
Some rain sensors can be sensitive to temperature, humidity, and other environmental factors, potentially leading to false positives or negatives.
ii. Small Rainfall Error:
The accuracy of rain sensors can be affected during very small rainfall events.
iii. Maintenance:
Rain sensors may require periodic calibration or cleaning.
iv. Cost:
Some rain sensors, especially those with advanced features, can be expensive.

III. ELEMENTS USED IN THE RAIN DETECTOR'S INSTALLATION

3.1 Rain Control Module – LM393 Comparator

In order to detect water outside the range of a humidity sensor, rain sensors are utilized. When a raindrop hits the rain board, it can be utilized as a switch, and it can also be used to gauge how hard the rain is falling. The module has a separate rain board and control board for convenience's sake, a power indicator LED, and a potentiometer-controlled adjustable sensitivity. In conclusion, the control board module is used to adjust the sensitivity, compare, and convert the analog values to digital values. The rain board module detects the rainwater.

3.2 Arduino Board UNO Model

Is an ATmega328P-based microcontroller board (datasheet). It has a 16 MHz ceramic resonator (CSTCE16M0V53-R0), 6 analog inputs, 14 digital input/output pins (of which 6 can be used as PWM outputs), a USB port, a power jack, an ICSP header, and a reset button. It comes with everything required to support the microcontroller; to use it, just plug in a USB cable, an AC-to-DC adapter, or a battery to power it. With your Uno, you can experiment without too much concern that you'll make a mistake. In the worst event, you can start over by replacing the chip for a few dollars. The Italian word "uno" (which translates to "one") was chosen to signify the 1.0 release of the Arduino Software (IDE). The Uno board with the Arduino Software (IDE) version 1.0 served as the foundation for later generations of Arduino. The Uno board, the first in a line of USB Arduino boards, serves as the platform's benchmark. See the Arduino index of boards for a comprehensive list of all active, retired, or out-of-date boards.

3.3 Buzzer

A beeper or buzzer, for example, may be electromechanical, piezoelectric, or mechanical. The signal is converted from audio to sound as its primary function. It is often powered by DC voltage and used in timers, alarm clocks, printers, computers, and other electronic devices. It can produce a variety of sounds, including alarms, music, bells, and sirens, depending on the varied designs.

4. CONCLUSION

This essay discussed a number of studies that focused on the design and development of a simple rain sensor system that uses an Arduino microcontroller, a rain sensor detector, and a buzzer to indicate rainfall (Isa A.I., & Muhammad A. B. 2024). Rain and resistance can be detected by the installed equipment. One inexpensive and user-friendly method of monitoring precipitation is the short-range rain sensor system. As a result, the gadget can accurately measure the resistance to a satisfactory degree. Analog data is converted to digital data. The parts of the rain detector are explained (Abdulrahman Y. A., Mukhtar I. B., Sadiku A. S., & M. A. Baballe, 2023).

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