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Development a Rain Sensor With Alarm System

Muhammad Aqeil Eiman Sharifudin[1], Mohammad Solihin Halid[1], Nur Azliza Ahmad[1*]

[1]Department of Electrical Engineering, Centre for Diploma Studies,
Universiti Tun Hussein Onn Malaysia, Pagoh Higher Education Hub, 84600 Pagoh, Johor, MALAYSIA

*Corresponding Author Designation

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Abstract : The Water Rain Sensor with Alarm is a technology device that detects and alerts users when rainfall is present. It aims to provide an early warning system for potential dried clothes on a clothesline or flooding in a variety of locations, especially properties. This abstract highlights the Water Rain Sensor with Alarm's primary features and functionalities. The Water Rain Sensor detects the presence of rainwater using advanced sensor technologies. It has high-precision moisture sensors strategically located in places prone to water collection, such as roofs. These sensors constantly monitor the moisture levels in their surroundings and immediately sound an alarm if they detect an abnormal increase, showing the presence of rains. The alarm systems built into the Water Rain Sensor is an efficient way of informing consumers about dry clothes on a clothesline or flooding issues. When the rain sensors detect rainwater, the alarm is triggered, emitted a loud sound and visual indicators are displayed to draw quick attention. The alarm acts as an early warning system, allowing users to take immediate action to prevent the cloth from keep drying, save precious items and secure the safety of others on the premises. Additional features are included to improve the utility and convenience of the Water Rain Sensor with Alarm. Wireless connectivity capabilities, for example allow customers to receive real-time notifications on their smartphones or other linked devices. The sensor's data can be transmitted by Wi-Fi or a dedicated mobile application, allowing users to know whether there is rain or no rain and to switch off the alarm straight from their phone, even when they are not near the place.

Keywords: NodeMCU, Blynk, Wireless Fidelity (Wi-Fi), Sensor, Rain

1. Introduction

Water management and proper water usage has to be maintained in the recent years [3]. To maintaining proper usage of water, we need to save the water in every aspect. In agriculture field, rain is a basic need but intense rain can affect the crops root growth. Irrigation is enough cover the water

**Corresponding author: nurazliza@uthm.edu.my*

need of crop but if intense rainfall occurs it may damage the crops, growth of the crops. This project are focusing on upgrading a basic rain sensor which only have LCD before this to the rain sensor with alarm [1][3]. When rain detector detects rain it will trigger the alarm. Rain detector alarm is an efficient way to stop irrigation whenever rain occurs [1]. In some situations, we can collect some rain water for personal use such as for washing a car. When rain falls without any hint, it will make somethings that dried before become wet back such as clothes on clothes line, especially when the materials being sun dried are not retrieved quickly [2].

Thus, designing and constructing this project hopefully will give you time to retrieve the materials being sun dried, close your windows and bring all the clothes or carpet or other into the house. After doing some observations, the decision to work on a project upgrading a rain sensor to rain sensor with alarm has been made. It is a combination of a rain sensor with an alarm [1]. This rain sensor with alarm have alarm and Liquid Crystal Diode (LCD) which can make an alarm sound whenever rain and display the type of raining either heavy rain or drizzle on the LCD [1]. The goal of this project is to recommend that all type of building especially residential area are using this technology in the future.

2. Materials and Methods

2.1 Materials

Table 1: Hardware requirements

NAME	FUNCTION
NODEMCU ESP32	ESP32 can function as a full standalone system or as a slave device to a host MCU, which minimises the burden on the primary application CPU caused by communication stack overhead. Through its SPI/SDIO or I2C/UART interfaces, the ESP32 may connect to other systems to provide Wi-Fi and Bluetooth capability.
Rain Sensor Module	A simple tool for detecting rain is the rain sensor module. When raindrops pass over the rainy board, it may be implemented as a switch, and it can also be used for measuring the intensity of the rainfall.
Buzzer	Typically used as alarm and warning tones. It is an integrated structure that produces sound and provides electricity using DC volts.
Liquid Crystal Display (LCD)	Because of anti-glare technology, it works better in brighter environments. Lighter in comparison to screen size. Energy-efficient because it uses less electricity. Due to the excessively wide brightness range and high peak intensity, exceptionally brilliant pictures are produced.
Light Emitting Diode (LED)	Electrical energy is immediately converted into light through light-emitting diodes, resulting in effective light generating with minimal electricity waste.
Servo Motor (SG90)	Servo motor is a small motor, inexpensive servo motor that has a maximum torque of 1.8 kg/cm and can rotate 180 degrees. It is perfect for small-scale robotics and model control applications because it runs at 4.8–6 volts and weights only 9 grams.

Temperature Sensor (LM35)	Temperature sensor is a tool used to measure temperature. This might refer to the temperature of the surrounding environment, a liquid or a solid.

Table 1 shows the hardware requirements for Rain Sensor With Alarm systems with connection of NODEMCU ESP32, Rain Sensor Module, Buzzer, LCD, LED, SG90 & LM35 together with Blynk application for IoT applications.

2.2 Methods

The hardware in the system is diverse as shown in **Figure 1**. One rain sensor module (RSM), one power supply module (PSM) and the NodeMCU ESP32, an open-source microcontroller board are all included in this device. Next, the another part are in the house which is buzzer, LED, LCD and temperature sensor. All of these component are connect with Blynk which can give user a notification through phone. As we know, NodeMCU ESP32 is built with Wi-Fi [1], from that we can link it to the Blynk and the Blynk will give the notification to the user's phone[1]. The weather will be know either raining or not by looking the indicator directly [10]. Lastly, for the automatic roof we used SG90 sevo motor for lift and unload the roof [5]. All of these component are connected with one microcontroller only to make all the component works as project main purpose. The project flowchart is begin with input which is presence of rain water and temperature sensor, then rain sensor will detects the rain and give the signal to alarm and automatic roof to be turn ON. Then the rain sensor will give range of of the rain from 0 to 4095, if the rain below 2800 it will display to LCD "Its Raining" and the red LED will light up while if the range above the 2800 it will display "No Rain" and green LED will light up [1]. After that, the microcontroller will give a notification of the situation to phone via WiFi [1]. Then the project can be control through the Blynk application for alarm button and the alarm can be turn OFF. Next it will display the temperature value through LCD and towards the end of the process. This method can be design and implement in Proteus software using the Arduino then it can be test to develop a prototype.

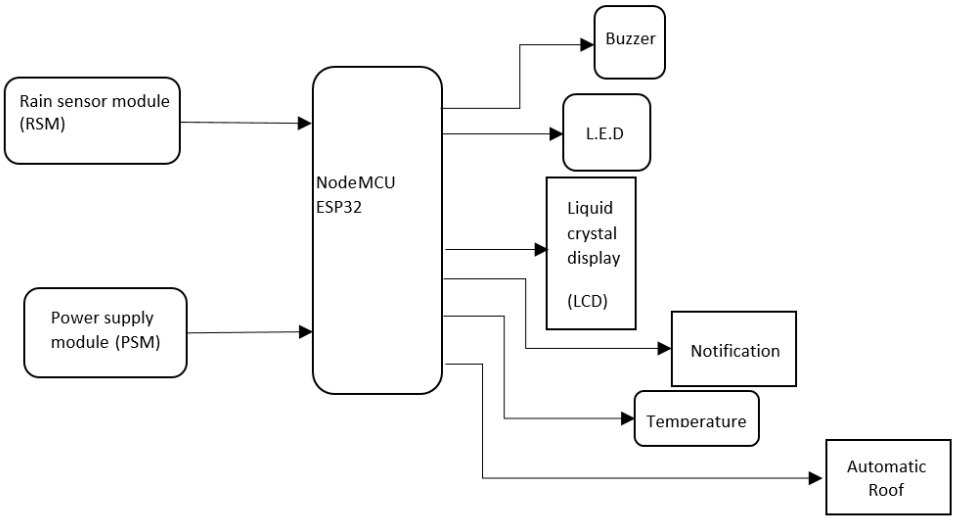

Figure 1: Block Diagram of Rain Sensor With Alarm

2.3 Implementation

Using the Arduino UNO as a microcontroller, LED 1, LED 2 and buzzer as indicators, rain sensor and relay as the input and source of this simulation. Then connect all the components to create a model

that can be tested before proceeding to the prototype [1]. This simulation will only display the output for LED 1, LED 2, buzzer and virtual terminal, which will display "No Rain" and "Its Raining" and it can be controlled by the relay, which acts to sense the presence of rain.

2.4 Testing

This Development A Rain Sensor with Alarm System will be used as a prototype after the simulation system that has been tested functions successfully. This testing is aim to obtain the results and making a discussion based on the functionality of the prototype. In order to test this prototype, some test has been conducted and a variety of monitoring suggestions will be looked into such as output from the indicator which is LED 1, LED 2, LCD, roof, temperature sensor and buzzer in order to improve the Development A Rain Sensor with Alarm System prototype.

3. Results and Discussion

3.1 Simulation Result

This simulation using Proteus is to aim for the main part of the project which is to obtain the result based on the several indicator that had been used such as rain sensor, LED 1, LED 2, relay and buzzer. **Figure 2 (a)** show that in the simulation when the relay is "0" as the input in the rain sensor. It will present no rain situation. In this condition, only green led will turn ON. Virtual terminal then will show "No Rain" statement. While red led and buzzer will remain silent and turn OFF up until the value "1" as the input in the rain sensor [1].**Figure 2 (b)** shows that when the relay switch to "1" as the input in the rain sensor. It will present raining situation. In this condition red led and buzzer will turn ON. Buzzer will make noise as a warning to the user. Virtual terminal then shows "Its Raining" statement and green led will turn OFF immediately [1].

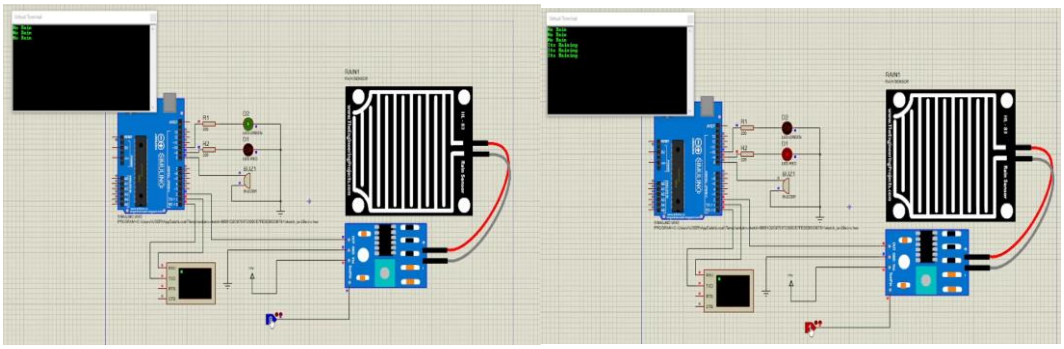

Figure 2 (a) "No Rain" situation result in simulation & (b) "Its Raining" situation result in simulation

3.2 Prototype Results

Results for the prototype of project are based on the analysis that have been made which to find the Detection, Range and Efficiency of the indicator. **Table 2** shows the output of each indicator based on the trial that has been conducted. A number of conclusions can be drawn about the making of this prototype based on the testing that has been conducted. From the first test that came up with the result in **Table 2**, which shows the majority of the indicator works perfectly fine, There are some of the trials that show results that are not the same as the other indicators, such as trials 1, 5, and 9. These trials show that the rain detector detects the presence of rain, but the other indicator shows the opposite of the results that can be caused by the error.

Table 2: Detection and Output of Rain sensor

Trial	Buzzer	LED	Rain detector	LCD
1	×	GREEN	✓	No Rain
2	✓	RED	✓	Its Raining
3	✓	RED	✓	Its Raining
4	✓	RED	✓	Its Raining
5	×	GREEN	✓	No Rain
6	✓	RED	✓	Its Raining
7	✓	RED	✓	Its Raining
8	✓	RED	✓	Its Raining
9	×	GREEN	✓	No Rain
10	✓	RED	✓	Its Raining
11	✓	RED	✓	Its Raining
12	✓	RED	✓	Its Raining
13	✓	RED	✓	Its Raining
14	✓	RED	✓	Its Raining
15	✓	RED	✓	Its Raining

Table 3 shows the results from the same test as the first test for the range of time of the rain sensor. All the ranges of each trial come out with satisfied results. The majority of the trials times are below 1 second, and some of the trials show times above 1 second that cause the delay. The average time for this test is 0.85 seconds, which is good for the overall results of this test.The second test is to aim for the capability of our prototype to detect rain in a certain range based on the rain sensor. The rain sensor can be used to detect the presence of rain; at the same time, it can also measure the range of rain through the pressure applied to the sensor. This prototype can detect rain from 0 to 4095, which is also based on the ESP32 range. This test can be done by using the sprayer to obtain the results. The sprayer will act as the rain that can find different ranges for this test. Trials 1 to 4 show the range from 4095 to 2903 that gives the condition "No Rain". Trials 5 to 11 show the range from 2502 to 2780 with the condition "It's Raining". And trials 12 to 15 are showing the range from 3002 to 4003, when it switches to the condition "No Rain"[1]. Based on this, the prototype can only detect rain below the range of 2800, while if it is above 2800, it still detects rain, but that might be light rain or dew.

Table 3: Range of time (seconds) of Rain Sensor & Detection Range of Rain Sensor

Trial	Rain detector	Time (second)	Rain detector (range)	Condition
1	✓	1.00	4095	No Rain
2	✓	1.25	3559	No Rain
3	✓	0.56	3029	No Rain
4	✓	1.12	2903	No Rain
5	✓	0.81	2502	Its Raining
6	✓	0.87	2034	Its Raining
7	✓	0.68	1887	Its Raining
8	✓	0.56	1302	Its Raining
9	✓	0.93	988	Its Raining
10	✓	0.62	450	Its Raining
11	✓	1.12	2780	Its Raining
12	✓	0.43	3002	No Rain
13	✓	1.37	3890	No Rain
14	✓	0.75	3995	No Rain
15	✓	0.68	4003	No Rain
	Average(second):	0.85		

For the third test is to focus on an automatic roof which also installed and tested for the addition of the project scope in this prototype. **Table 4** shows the efficiency of the automatic roof to open and close the roof from the signal from the presence of rain. This test come out with satisfied results which can be seen through the time for the automatic roof to be close. There are some trials that the time range is above 1 second and may cause of the delay but the majority of the trials are below 1 second that make the average time of this test is 0.82 second.

Table 4: Range of time (seconds) for roof

Trial	Roof Close (Its Raining)	Roof Open (No Rain)	Roof Close Time (second)
1	✓	✓	0.72
2	✓	✓	1.09
3	✓	✓	0.52
4	✓	✓	0.81
5	✓	✓	0.78
6	✓	✓	1.02
7	✓	✓	0.56
8	✓	✓	0.97
9	✓	✓	0.49
10	✓	✓	0.87
11	✓	✓	0.85
12	✓	✓	0.93
13	✓	✓	1.04
14	✓	✓	0.91
15	✓	✓	0.75
		Average(second):	0.82

This prototype have an addition project scope which is to develop an automatic roof and the temperature sensor. Automatic roof is made for the clothes line that attach to the side or wall of the house. This roof can prevent from the rain that can cause the clothes to be wet. This automatic roof are using servo motor SG90 for this prototype and it functionally well which when the rain sensor detect the presence of rain, the roof will automatically close.[5] The servo motor that attach with the roof are working with angle from 0 degree to 180 degree that had been set in the code so that it can change the position of the servo motor to make the roof is closed or open. When the rain sensor does not detect the rain, the roof will automatically open.

From the **Figure 3 (a)**, it shows that the display from the LCD of temperature and "No Rain" is to focus on the temperature sensor that had been add in this prototype.[6] The temperature sensor is to sense the temperature of the surrounding of the prototype purposely to obtain weather temperature of prototype and it can be implement in a real house. Then the temperature will signal to the display the range of the temperature on LCD in unit of Celsius "°C". **Figure 3 (b)** shows the notification from the prototype to Blynk and Email. This action will constantly give the notification every 1 minute to alert the user. The notification can be stop when the alarm is off through the control in Blynk application.

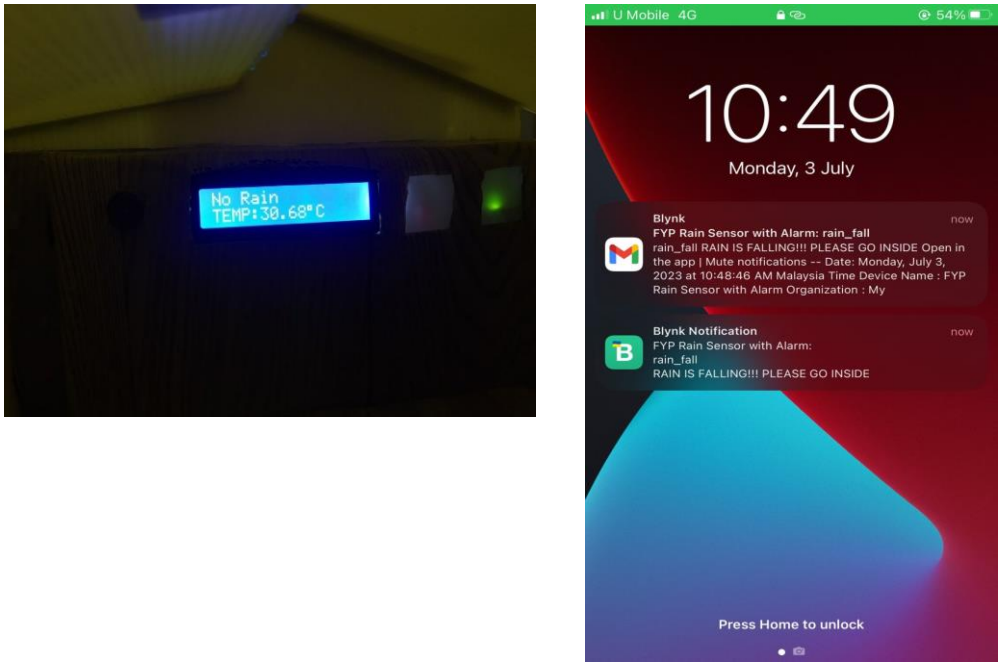

Figure 3: (a) Display of LCD of temperature and "No Rain"(b) Notification of the project via Blynk and email

4. Conclusion

An important development in weather monitoring and safety systems is the development of a rain sensor with an alarm. This innovative technology has a wide range of uses in a variety of industries and environments. First of all, our technology provides real-time detection and measurement of precipitation, empowering people and organisations to decide wisely and take the necessary steps. This sensor can play a critical role in reducing risks and assuring safety, whether it's a home user looking to safeguard their property from water damage and more. By using alarm system which is buzzer, it will make a beep when the rain sensor detect the precense of raindrops. It is to ensure users that can more alert with the presence of raindrops and can take an appropriate action such pick up the clothes on the hanger. Next, our technology also use Light Emitting Diode (LED) which is red and green to show to the user the condition either its raining or no rain. Another indicator we use is Liquid Crystal Display (LCD) which is display either its raining or no rain. By connecting with Blynk, we can make a notification about the wheater through user's phone. Whenever the user are far away from their home, they still can turn of the alarm directly using their phone. Next, we used temperature sensor to measure the temperature surrounding in the building and the last one is we also implemented automatic roof which can save the clothes on the clothes line from raining hit it.

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