Weather Detector for Motorcyclist with Notification from GSM/GPRS Module

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***Abstract*—This paper presents a weather detector for the motorcyclist. The device notifies the user by sending SMS and turns on the emergency light during rain. The device will detect three different weather conditions which are rain warning, heavy rain and sunny day. Water drop sensor will measure the resistance of the sensor if the water drops at the surface of the sensor and send data to the Arduino. Arduino will make a decision accordingly; then it will command the GSM/GPRS module to send a message to the user regarding the weather condition. The message will be sent for every 30 minutes throughout the rain. If the user were riding the motorcycle when the rain started, the emergency light would be turned on to alert another vehicle. Results showed that the system could differentiate three different weather condition and able to send out a warning message to the user when it would rain or heavy rain.**

***Index Terms*—About; Emergency Light; GSM/GPRS; Motorcyclist; Raindrop Sensor.**

I. INTRODUCTION

53% of road users are motorcyclists, and the percentage of a fatal road accident is the highest among all [1]. The combination of reduced road friction and poor visibility during heavy rain increases the possibility of road accident [2, 3]. Therefore it is a need to develop a system that can notify motorcyclist about raining condition and alert another road user about the existence of the motorcyclists.

Dey, Mishra and Chowdhury [3] had reviewed current intelligent transportation systems (ITS) such as road weather information system (RWIS) to reduce road accident due to weather condition. El-Tawwab [4] has developed a real-time weather notification system using the intelligent vehicles smart sensor. The system informs the driver regarding the bad weather conditions such as frosty or foggy conditions. They combined all cases by setting sensors consistently to the street with intelligent vehicles that communicate with the surrounding vehicles and the street itself.

The use of a raindrop sensor is to identify the presence of rain. For instance, Xianzhang [5] designed a smart home using the raindrop sensor installed at the windows. The windows are automatically closed when the sensor detected raindrops. Besides that, C. N. Lee et al. [6] developed an automatic window washer that a robot automatically washes windows after rain with the help of raindrop sensors.

This paper presented the development of a weather detector for the motorcyclist. The system will send SMS to the user when it was about to rain and keep on sending the SMS for every 30minutes during rain. If the user happened to be riding the motorcycle during the rain, the emergency light would be turned on to alert other road users. A rechargeable power bank 20000 mAh was used to power up the Arduino. DHT22 sensor and raindrop sensor were used to detect rain, temperature and humidity. There are two different kinds of rain that sensor will be detected, rain warning and heavy rain. Raindrop sensor will detect and send data to the Arduino; then it will command the GSM/GPRS module to send the message to the user about rain condition. While if the user rides motorcycle and rain is occurring, the emergency light will switch on to alert another vehicle.

A detail of system description used in this paper is explained in Section II. It includes the experimental setup of the system. Then, the following section, Section III, describes the methodology of this work. In Section IV, results are discussed and analysed, whereas Section V concludes the overall findings of this paper

II. SYSTEM DESCRIPTION

An experimental setup was developed using DHT22 sensor and raindrop sensor to detect changes in temperature, humidity and rain reading. The Arduino was programmed to switch on the LED which acts as an emergency light to alert another vehicle with the presence of motorcyclist. Besides that, the GSM/GPRS module will be used to notify the motorcyclist by using phone about the rain condition. Figure 1 and Figure 2 represent the system block diagram and schematic diagram respectively. Table 1 explains the function of each component briefly.

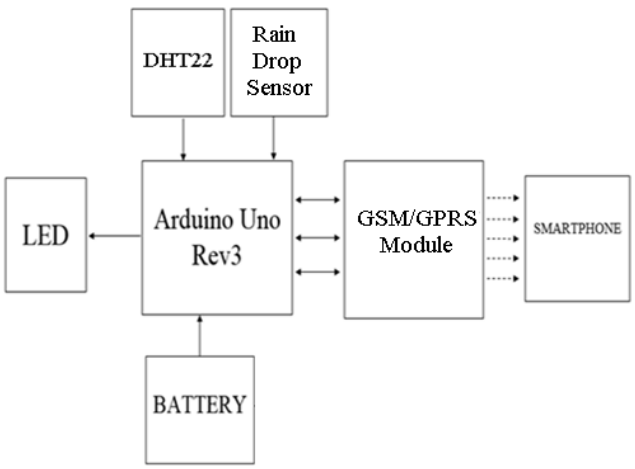

Figure 1: Block diagram of the weather detector circuit

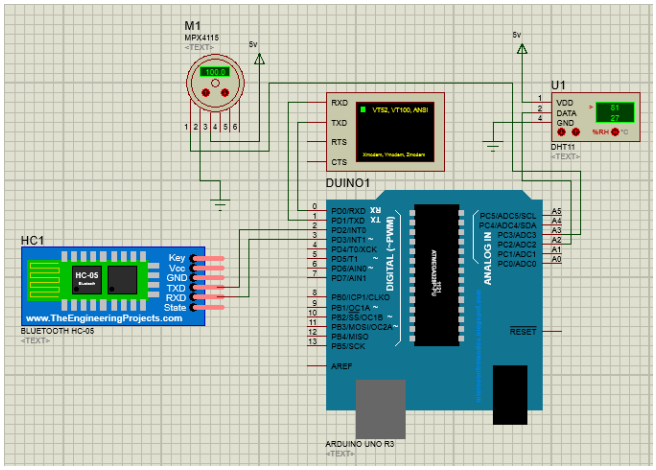

Figure 2: Schematic diagram of the weather detector circuit

Table 1
Components Description

Component	Description
Arduino Uno	• As the main board for this project • All parts must connect to microcontroller work properly • Burning the program in the microcontroller • Using microcontroller Arduino UNO
DHT22 Humidity and temperature sensor	• Detect changes temperature and humidity surrounding • The sensor will display the data changes temperature and humidity to LCD.
Rain Drop Sensor	• Detect two different rain condition • The sensor will display the data changes rain reading to LCD and send a signal to the GSM/GPRS module.
GSM/GPRS Module	• Send messages to mobile phone sight after sensor sends data to Arduino board
Power Bank 20000 mAh	• The renewable power source to power up the board
LCD	• Display temperature, humidity and rain reading
LED light	• To notify another vehicle with the presence of motorcyclists in rain • After Arduino gets data from a sensor, Arduino will activate the LED to notify the user. • Only ON in rain condition
Smartphone	• Receive notification from weather device

III. RESULTS AND DISCUSSIONS

The raindrop sensor will detect the water that drop at the surface of the sensor and the GSM/GPRS module will send the message. Water drop sensor will set to read three different readings. Namely are rained warning, heavy rain and sunny day. To achieve that, raindrops are collected on the circuit board. It creates paths of parallel resistance that are measured via the op-amp. More water drop to the sensor will lower the resistance and voltage output. GSM/GPRS module will send a message for every 30 minutes if the rain is continually dropping. To set it up, a delay will be used. In Arduino IDE, 1000 milliseconds represent 1 second, so to set 30 minutes, it must be set to 1 800 000 milliseconds delay. During the sunny day, the GSM/GPRS module will not send anything.

Water drop sensor was programmed to three different ranges which are a sunny day, rain warning and heavy rain. As for the sunny day, the range set to 500 – 1024 which equivalent to 2V – 5V. When humidity is low and no water detected by raindrop sensor, the system identified it as a sunny day. Meanwhile, the sensor reading range for rain warning condition was set to 300 to 499 which represented the value of 0.5V to 1.99V. During rain warning condition, the DHT22 detected the increment of humidity value, and there was a little water on the raindrop sensor. Lastly, heavy rain condition was set to the range of 0 - 299 which equivalent to 0V – 0.5V

Table 2
Weather Condition Setup on Raindrop Sensor

Condition	Sensor range	Voltage range (V) [a]
Sunny day	500 - 1024	2 – 5
Rain warning	300 – 499	0.5 – 1.99
Heavy Rain	0 - 299	0 – 0.5

A. *Sunny day*

During a sunny day, the condition is dry, and humidity is low with no presence of water. Therefore, the sensor was in a dry condition, and the system took no action. A serial monitor was used to read the sensor value. Figure 2 shows the sensor value is 1015+, and for the measured voltage is 4.8V. It complies with the range setting before the experiments.

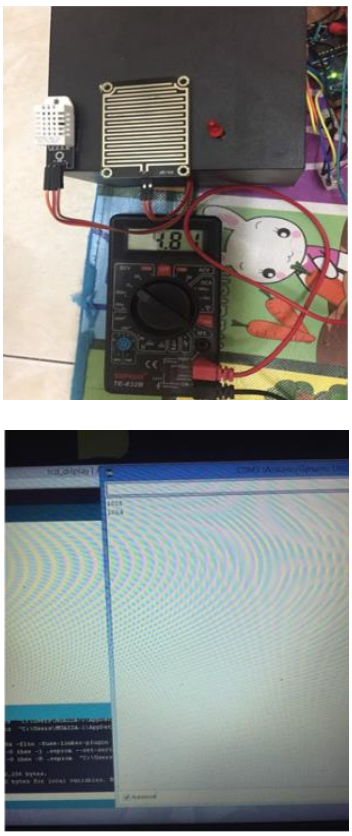

Figure 2: Voltage reading when the sensor is dry

B. *Rain warning*

For the rain warning experiment, a small drop of water was put on the surface of the sensor as a shown in Figure 3. The result shows that the sensor reading dropped to 366 which equivalents to 1.83V. The system sent an SMS to the user to notify that it was about to rain. The notification was successfully delivered to the user smartphone within three seconds.

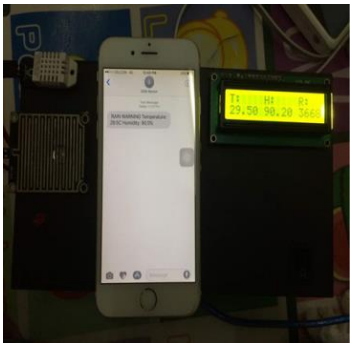

Figure 3: Rain warning result with voltage reading

C. Heavy rain

Figure 4 represents the conducted experiment for heavy rain condition. To carry out this experiment more drops of water were put on the surface of the sensor as shown in Figure 4. The measuring voltage was 0V because water can act as a conductor to electricity and the presence of water connected nickel lines on top of the raindrop sensor. Thus it reduced the resistance and voltage drop across it. GSM/GPRS module started sending SMS to the user for every 30minutes throughout the rain. LED for the emergency light will be turned on if the switch button is turned ON. The switch button function is to distinguish the motorcycle engine is ON or OFF.

D. GSM/GPRS Module

Table 3 shows the properties of the GSM/GPRS module to send a message to the user and the power consumption of the GSM/GPRS module respectively. It showed that in both conditions it only took about 3 seconds to send a message to the user with low power used.

E. Battery Consumption

Table 4 shows the duration and percentage of the power bank to empty and the utilisation of power consumption. On Day 1, the device uses 10% percentage of power to run in 24 hours, and it can run 11 days nonstop. The voltage is consistent at 4.78V in 11 days, more precise is ten days and 13 hours.

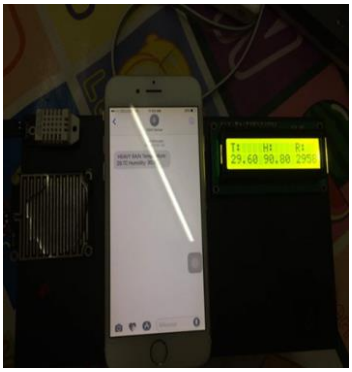

Figure 4: Heavy rain result with voltage reading

Table 3
GSM/GPRS Module Properties

Condition	Time is taken to send a message (s)	Power consumption (W)
Rain warning	3	0.96
Heavy Rain	3	0.96

Table 4
GSM/GPRS module properties

Battery percentage (%)	Duration (days)	Voltage (V)
100	1	4.78
95	1	4.78
90	2	4.78
85	2	4.78
80	3	4.78
75	3	4.78
70	4	4.78
65	4	4.78
60	5	4.78
55	5	4.78
50	6	4.78
45	6	4.78
40	7	4.78
35	7	4.78
30	8	4.78
25	8	4.78
20	9	4.78
15	9	4.78
10	10	4.78
5	10	4.78
0	11	4.78

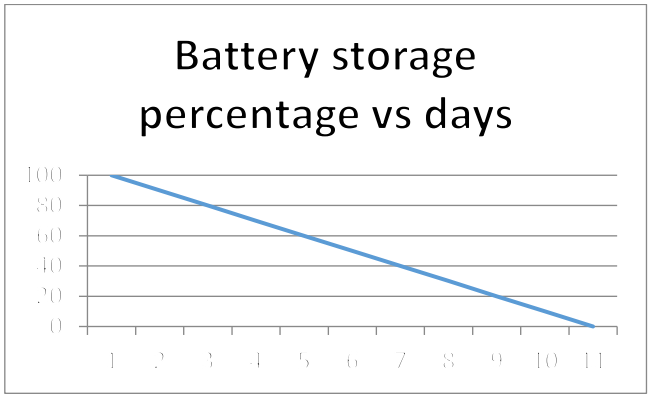

Figure 5: Battery usage versus day

IV. Conclusion

The development of a weather sensor device that detects rain to notify a user about rain condition was successfully achieved. Water drop sensor was able to identify three weather conditions which were a sunny day, rain warning and heavy rain. Meanwhile, the 900 GPRS/GSM module was successfully sent a notification message to the user about rain condition. The combination of the hardware and software part was done to achieve the objectives of the paper. In the software part, amount of water drop sensor was set to 3 conditions which were a sunny day, rain warning and heavy rain. When the system detected heavy rain, a LED which represented as motorcycle's emergency light will turn on when the switch button was turned ON. The switch button function represented as motorcycle engine, hence the LED or emergency light will only turn on when the switch button or motorcycle engine was ON. The DHT22 sensor was used to read temperature and humidity at surrounding. Meanwhile, an LCD display was used to show the ambient temperature and humidity as well as battery power warning message. Every 30 minutes a message will be sent to inform the user if the rain still continued. For the electrical part, the task to develop the circuit was done and smoothly working. From the result of this project, all the sensors are functioning well.

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