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IOT Forest Fire Detection using Solar Power

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Abstract: LoRa is a radio frequency and wireless technology generated over long distances or ranges. Theoretically, The primary purpose of these projects is to develop, create, and deploy a forest fire detection system using solar power, LoRa, and sensors. The diversity of forest location fires that are lost is possible every year in certain factors of the arena, causing an increase in problems in the population, as the consequences of such fires extend beyond the destruction of the ecosystem. But, with the proliferation of the Internet of Things (IoT) employers, the answer to early fireplace detection should be made in advance. The evaluation of the health risk of an area and the communique of this truth to the populace may want to decrease the kind of fires that originated via accident or because of the carelessness of the clients. From time to time, technology is increasingly advanced and needs to be improved for more manageable human tasks. The objective is to develop a solar power supply system for Lora and the sensor. Next, a solar-powered Lora and sensor are used to detect and quickly detect a precise location to prevent forest fires from spreading and to study energy consumption. The result will test three methods: the solar panel, without solar panel and the function of the DHT11 sensor, Flame Sensor, and Mq2 sensor solar panel with speed 4000ms a. The result shows different speeds make the LoRa and sensor drain the battery more. It can be seen that, the overall objective has been to create the solar panel, study the consumption of Lora with or without a solar panel and the function of the DHT11 sensor, Flame Sensor and Mq2 sensor.

Keywords: Long Range, solar panel DHT11 sensor, Flame Sensor and Mq2 sensor

1.0 INTRODUCTION

In the current scenario, the IoT industry is rising rapidly. The purpose of the Internet of Things is known to all today. The IoT is used in all industries during this period. It has become a regular need now. We can simplify our lives by using these innovations and making us great in time. This would reduce the time and effort of human beings and reduce mistakes. Forests are vital to the atmosphere of the earth. It's inseparable from the characteristics of the forest, at the same time as the predicate is retained using the earth's lungs. The worry is that after the wooded area encounters a fire, there might be several damages to humanity, ranging from air pollution and the lack of natural ecosystems in the wooded area itself, beginning with animals dying plenty and live animals may additionally lose their vicinity of the house. Zigbee, Bluetooth and Wi-Fi are brief-distance networking networks related to indoors. From current studies using Zigbee, the verbal exchange stages among concentrators and sensor nodes are too constrained, especially when applied in a wooded area. Alternatively, diverse wireless networks may be used for lengthy distances. Lora generation is considered one of them. The Lora wireless community's lengthy variety facts link range is equal to 15km at the ground.

2.0 LITERATURE REVIEW

The author "Hariprakash B, Gaffoor S A and Shukla A K" said that lead acid batteries' greatest enemies are overcharging and over-heating. For charging lead acid batteries, three methods of charging: at constant current, constant voltage, or mixed (which is the best option). In this paper, were used two methods: mixed charging by using an intelligent charging source (source K 8012) and the constant voltage (stabilized power supply). Intelligence source K 8012 ensures joint charging: at constant current (a length of time) and then at the constant voltage. Power supply K 8012 has protection for current limiting through the battery. This allows for setting the level of the battery voltage and battery capacity. Next, the author "Sandra Sendra, Laura García, Jaime Lloret, Ignacio Bosch and Roberto Vega-Rodríguez" uses three sensors that measure four different parameters. Additionally, it will be powered by a solar panel and a battery. Arduino UNO Rev3 development board incorporates an ATmega328P microchip microcontroller. To connect the Arduino node to the LoRa network, a Dragino LoRa Shield board compatible with our Arduino development board is used. The Dragino LoRa Shield board incorporates the RFM95W transceiver with the SX1276 chip (manufactured by Semtech), which allows using the LoRa modulation with the three working frequencies specified on the regulation, i.e., 915 MHz, 868 MHz, and 433 MHz. Our model is pre-configured to work in the 868 MHz frequency band. Figure 8 shows the Dragino LoRa Shield coupled with the Arduino UNO module. For data collection from the environment, adding as many sensors as parameters are required to measure is required. This LoRa node can measure relative humidity, wind speed, and CO2 concentration. Firstly, the system includes a DHT11 sensor to measure temperature and relative humidity. This sensor offers a digital output due to a small 8-bit microcontroller which the factory already calibrates. The DHT11 sensor can measure temperature in the range of 0°Cto 50°Cwith an error of ±2°C and relative humidity in the range of 20% to 90% with an error of ±5%.

3.0 METHODOLOGY

Block Diagram

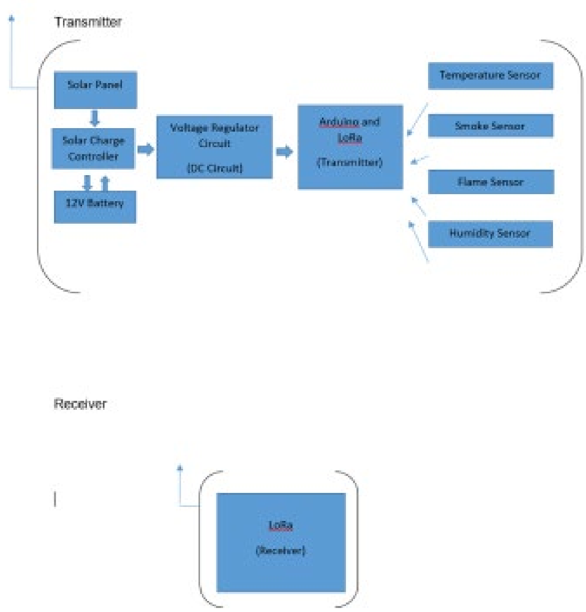

Figure 3.1: Block diagram

The solar panel is the only main input for this research. The solar panel will collect the source from sunlight and convert it to DC electrical. The DC converters to DC will stabilizer the source from DC to DC to generate input for LoRa and battery. This is because the battery and LoRa use DC as source power. This research uses the battery as the main storage for supply or backup supply. At night, the solar panel does not receive any energy from sunlight to convert to electrical. The battery becomes the main supply at night to source DC power to the LoRa. The LoRa will transmit the data from transmitter to receiver. This system creates for LoRa, running 24 hours to keep transmitting any data from one place to another.

Circuit Design

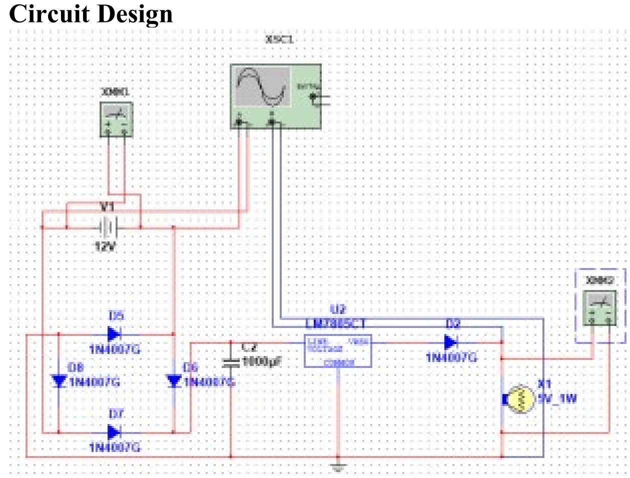

Figure 3.2: Circuit design

In Figure 3.2, the input becomes input from the solar panel. The solar panel will generate 12V DC. It will go through stage by stage to stabilizer DC. The output is 5V to supply the Lora source power.

Figure 3.3: Completed project

According to figure 3.3, the part of the transmitter consists solar panel, Lora transmitter, DC converter, battery, solar charge controller, DHT22 sensor, flame sensor and mq2 sensor.

4.0 RESULTS AND DISCUSSION

In this paper, four methods were involved, including Lora and sensor with solar panel with the speed of 4000ms, Lora and sensor without solar panel with speed 4000mS, the function of DHT11 sensor, and flame Sensor and Mq2 sensor with 4000ms. As mentioned, the purpose of this work is to study the energy consumption of LoRa and sensor with solar and without solar, to ensure the solar keeps charging and supplies the transmitter and to detect and precise location quickly to prevent forest fires from spreading.

4.1 ANALYSIS OF RESULTS

The project uses solar panels, and without solar speed 4000Ms. According to Figure 4.1, the result shows the solar keeps charging the battery. This graph shows an increase in voltage as the solar keeps charging the battery from 11.30 AM to 3.30 PM. At that time, the battery increased by 1.2V. From 3.30 PM to 5.30 PM, there was a drop in battery voltage of 0.8V due to not being able to get much
sunlight.

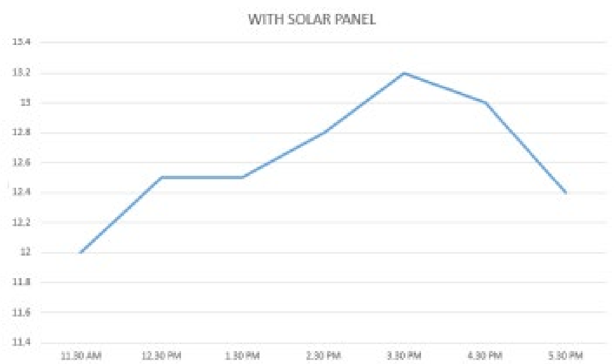

Figure 4.1 is data from solar panel

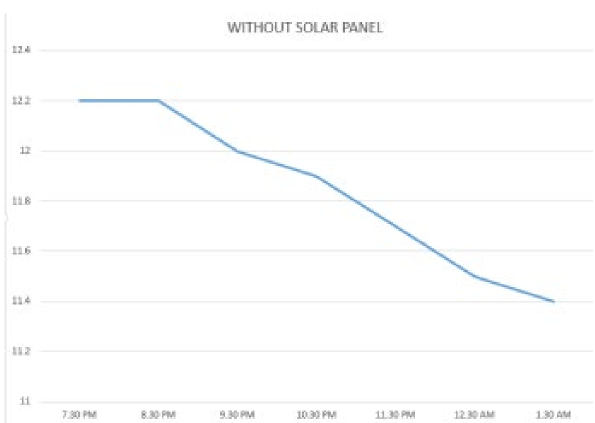

Figure 4.2 is data without solar panel

According to Figure 4.2, the result shows the battery keeps the LoRa and sensor supply. Data were recorded starting from 7.30 PM to 1.30 AM. The data showed there was a decrease from 8.30 PM to 9.30 PM. 0.2V had dropped at that time. From 9.30 PM to 1.30 AM, it continued to show a reduction until a voltage loss of 0.6V.

It takes 6 hours to drop to 0.8V. If there is a fire, the temperature around the fire will change. DHT22 will detect the temperature in the fire area and directly send a signal to the receiver, as shown in Figures 4.3 and 4.4.

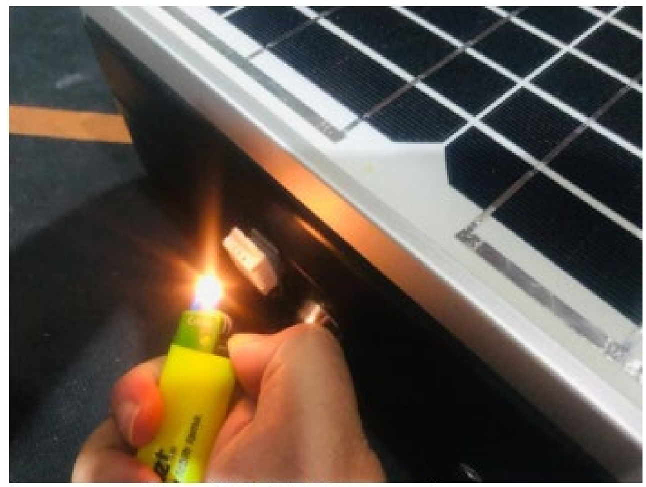

Figure 4.3: DHT22 demonstration

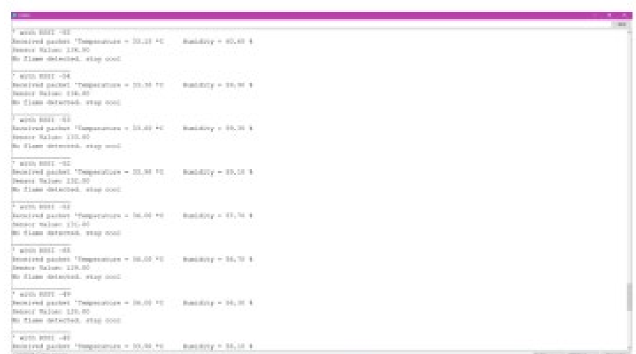

Figure 4.4: Temperature has increased shown in the serial monitor

For flame sensor, this sensor detects if there is a flame in the fire area. It will also send a signal to the receiver. When the sensor can detect the flame, the green light on the sensor flame will turn on. During the project, it was only placed 10cm from the lighter, as shown in Figure 4.5 and Figure 4.6.

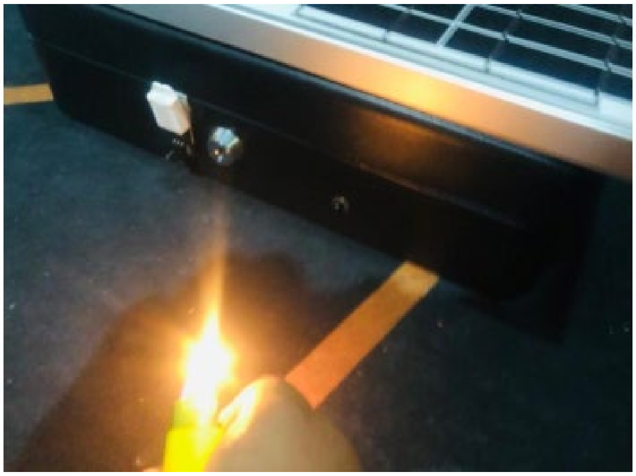
Figure 4.5: Flame sensor demonstration

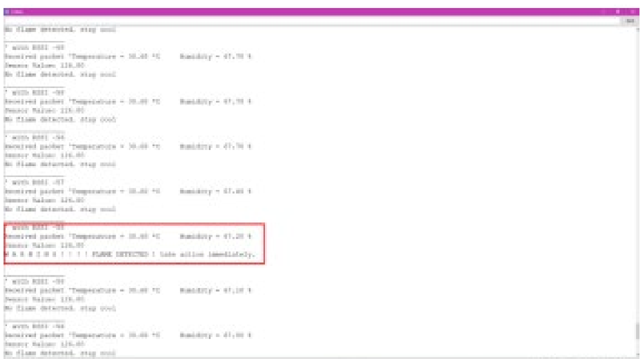
Figure 4.6: Serial monitor display for flame sensor

The MQ2 sensor, it is to detects smoke in the fire area. MQ2 sensor has been set 291ppm and above, and it will send a signal indicating smoke in the area. It will send a signal to the receiver, as shown in Figures 4.7 and 4.8. If the reading is below 290ppm, no smoke can be detected in the area.

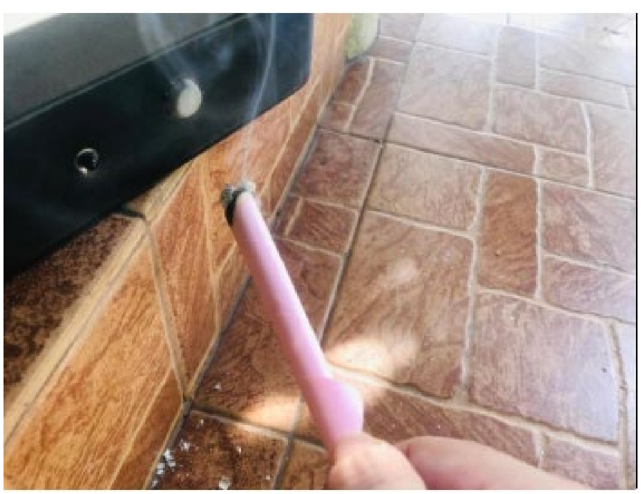
Figure 4.7: MQ2 sensor demonstration

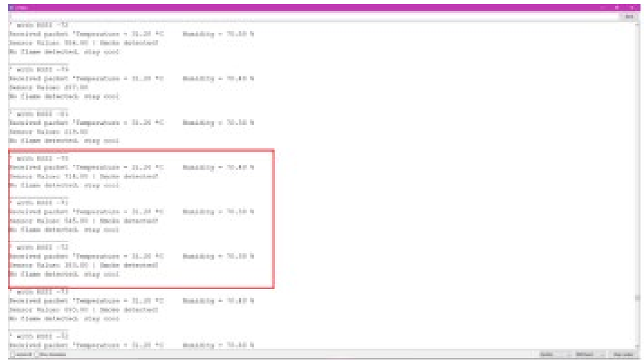
Figure 4.8: Serial monitor display for MQ2 sensor

5.0 CONCLUSION

In conclusion, this research first achieves the objective first to createpower supply using solar energy to power up the project system. The system solar has solar panel solar, solar charge regulator and a battery. The solar can produce max to voltage 22V to 24V. The solar charge controller can display the capacity of,battery. The battery becomes a secondary supply to project and store the energy produced by solar.
Next, the study achieves the second objective is to detect and precise location quickly to prevent forest fires from spreading. The result showed all sensors for this project work well. This indicates it has achieved the desired objective. The expected distance for this project is 5 to 10 meters from the fire area, depending on the size of the fire. MQ2 sensor is capable of achieving readings up to 10000ppm. So it is enough to detect forest fires. DHT22 can detect temperatures from -40 degrees Celsius to 125 degrees Celsius. Flame sensors can detect flames depending on the distance and magnitude of the flame. The project was also tested at night by placing the project 5 meters from the fire area.
Next, the study achieves the last objective: the energy consumption of a solar-powered Lora and the sensor needed. The result shows the Lora and sensor test by power solar and without solar. The method proves the LoRa and sensor consumption stabilizes supply using a solar panel. The solar panel charge the battery back before being drained by the project. LoRa will drop the battery voltage if it doesn't get enough sunlight. The next method is to study the Lora consumption without solar panels. This method is used to study the LoRa consumption drop the battery without solar panel. It can record the project need power supply by battery.

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