IOT BASED SUPPLY CHAIN MANAGEMENT SYSTEM

Bachelor of Technology

in

Electronics and Communication Engineering

Submitted by

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CANDIDATE DECLARATION

I hereby declare that the work presented in this report entitled “IOT BASED SUPPLY CHAIN MANAGEMENT SYSTEM”, submitted towards 7th semester project report of B.Tech at Indian Institute of Information Technology Allahabad, is an authenticated record of our original work carried out under the guidance of Dr. Ashutosh Kumar Singh. Due acknowledgements have been made in the text to all other material used. The project was done in full compliance with the requirements and constraints of the prescribed curriculum.

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CERTIFICATE FROM SUPERVISOR

This is to certify that the statement made by the candidate is correct to the best of my knowledge and belief. The project titled "IOT BASED SUPPLY CHAIN MANAGEMENT SYSTEM" is a record of candidates' work carried out by him under my guidance and supervision. I do hereby recommend that it should be accepted in the 7th semester project report at IIIT Allahabad.

Dr. Ashutosh Kumar Singh

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ABSTRACT

The IoT-based Supply Chain Management System is a comprehensive solution that leverages the power of Internet of Things (IoT) technology to optimize and streamline supply chain operations. It encompasses a network of interconnected devices, sensors, and data analytics to monitor, track, and manage the flow of goods, information, and resources across the supply chain.

The proposed System with LDR and Ultrasonic Sensors is a cutting-edge solution designed to address the challenges of missing or replaced products within packages in the supply chain. Leveraging Internet of Things (IoT) technology, this system integrates LDR sensors and ultrasonic sensors to provide accurate monitoring and detection capabilities throughout the supply chain process.

The system utilizes LDR sensors to detect the presence of products within packages. These sensors measure the light intensity inside the package, enabling real-time monitoring of the package's contents. If a product is missing or incomplete, the system identifies the anomaly and triggers an alert to the relevant stakeholders.

ultrasonic sensors are deployed to determine the package's physical integrity. By emitting sound waves and measuring their reflection, these sensors can detect any changes in the package's shape or volume. If a package has been tampered with or modified, indicating a potential replacement, the system immediately alerts the appropriate parties for further investigation.

The collected sensor data is transmitted to a centralized IoT platform,The server then analyzes the data to calculate the distance of product in the package and check whether light is detected or not. If something indicates potential instances of missing or replaced products. The system then generates alerts, notifications, and reports, enabling quick and proactive decision-making.

By integrating LDR and ultrasonic sensors into the supply chain management system, organizations gain enhanced visibility, traceability, and control over their packages. This enables prompt detection of missing or replaced products, reducing the risk of fraud, theft, or mismanagement. The system facilitates efficient inventory management, accurate order fulfillment, and improved customer satisfaction.

In conclusion, the proposed system can be very effective in courier service With the use of various sensors and data analysis techniques robust solution to address the challenges of missing or replaced products in packages. By leveraging sensor technologies and real-time data analysis, it enhances transparency, security, and accountability within the supply chain, leading to optimized operations and improved customer trust.

Index Terms: LDR sensor , Ultrasonic sensor, Thingspeak ,REACT JS, CSS, JavaScript, and HTML are all important components of the Supply chain management system.

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INTRODUCTION

The proposed project aims to supply chain management using a LDR sensor and an Ultrasonic sensor. The LDRr sensor detects the light in the package and gives the level of brightness to the microcontroller. If the brightness level is observed high, The data will be sent to the website and then to Thingspeak 2.0 cloud and the Thingspeak 2.0 cloud will send an email notification to the admin and a mobile notification to all members of the group. The system also has a mobile application that shows the data. .

The Ultrasonic sensor detects the distance between sensor and product that is present in the package and sends a notification to the admin if the distance is above the threshold. The Thingspeak 2.0 cloud will send an email notification to the admin and a mobile notification to all members of the group. The system also has a mobile application that shows the data. .

Supply chain management plays a crucial role in ensuring the efficient flow of goods, information, and resources from suppliers to end customers. However, one persistent challenge in the supply chain process is the occurrence of missing or replaced products within packages. These issues can lead to significant financial losses, customer dissatisfaction, and reputational damage for businesses. To address this challenge, we present an innovative solution: the IoT-based Supply Chain Management System with LDR and Ultrasonic Sensors.

The Internet of Things (IoT) has revolutionized various industries by enabling the seamless integration of physical devices, sensors, and data analytics. Leveraging the power of IoT technology, our system combines LDR sensors and ultrasonic sensors to provide real-time monitoring and detection capabilities throughout the supply chain.

The LDR sensors integrated into the system enable the measurement of light intensity within packages. This allows for accurate detection of the presence or absence of products. If a product is missing or incomplete, the system promptly identifies the anomaly and triggers an alert to the relevant stakeholders. This ensures proactive action can be taken to resolve the issue and prevent further disruptions in the supply chain.

In conclusion, the proposed system can be very effective in the supply chain. With the use of various sensors and data analysis techniques, the system can provide real-time data to the admin and concerned authorities , which can help them more efficiently. Moreover, the system can help in reducing the number of failure cases that lead to customer dissatisfaction.

HARDWARE REQUIREMENT SPECIFICATION

To implement the proposed system, the following hardware requirements are needed:

LDR SENSOR : A Light Dependent Resistor, also known as a photocell or photoresistor, is a passive electronic component that exhibits a change in resistance based on the intensity of light falling on it, LDR sensors are typically made of a semiconductor material that has a high resistance in the dark or low-light conditions and a low resistance in the presence of light. The resistance of the LDR decreases as the light intensity increases.

ULTRASONIC SENSOR: Ultrasonic sensors utilize sound waves at frequencies higher than the human audible range to detect and measure the distance to objects. Ultrasonic sensors typically consist of a transmitter and a receiver. The transmitter emits high-frequency sound waves (usually around 40 kHz) that propagate through the air. When these sound waves encounter an object, they are reflected back to the receiver. By measuring the time it takes for the sound waves to travel to the object and back, the distance to the object can be calculated.

Microcontroller: A microcontroller NodeMcu is needed to process the data from the sensors and control the LED lights. The microcontroller should be powerful enough to handle the data processing and communication with the cloud and mobile application.

Wi-Fi Module: A Wi-Fi module is needed to send the data to the cloud and the mobile application. The Wi-Fi module should be reliable and have a good range to ensure seamless data transmission.

Power Supply: A reliable power supply is needed to power the sensors, LED lights, and the microcontroller. The power supply should be able to handle the power requirements of all the components and should be able to provide uninterrupted power.

Mobile Phone: A mobile phone is needed to receive notifications from the mobile application. The phone should be connected to the internet and should have the necessary software installed to receive notifications.

In addition to the above hardware requirements, a reliable internet connection is needed to send data to the cloud and receive notifications from the mobile application. The internet connection should be fast and stable to ensure seamless communication.

Overall, the hardware requirements for the proposed supply chain management system include a combination of sensors, microcontrollers, communication modules, and power supply components.

These components should be of high quality, reliable, and capable of handling the data processing and communication requirements of the system. Proper installation and maintenance of these components are essential for the effective functioning of the system.

SOFTWARE REQUIREMENT

The software requirements for the proposed supply management system:

Web Hosting: As you have directly hosted the system on 000webhost, it is important to ensure that the hosting provider supports ReactJS, MySQL, and other relevant technologies that the system requires. The hosting provider should also have a reliable uptime and offer sufcient storage space for the database and other fles.

ReactJS: ReactJS is a server-side scripting language that is used to develop dynamic web applications. The supply management system uses ReactJS to communicate with the database, retrieve data, and send notifcations to the Thingspeak 2.0 cloud and ThingSpeak

HTML/CSS/Javascript: HTML, CSS, and Javascript are used to develop the user interface for the supply management system. The interface should be easy to navigate and responsive, and should provide real-time updates on the supply conditions.

MySQL Database: The supply management system uses a MySQL database to store the supply data, vehicle numbers, and other relevant information. The database should be secure, well-structured, and optimized for performance. The system should be able to retrieve data from the database, process it, and store it back in the database.

Thingspeak 2.0 Cloud: The Thingspeak 2.0 cloud is used to send notifcations to the admin and mobile application users when there is heavy supply or high CO content from vehicles. The system should be able to communicate with the Thingspeak 2.0 cloud using the appropriate APIs.

Security Measures: The supply management system incorporates security measures to protect the system from unauthorized access,data breaches,and other security threats.Measures such as password protection, encryption, and access controls should be implemented to ensure the security.

FEATURES

The following features are provided by the system:

1. Real-time Monitoring: The system provides real-time monitoring of packages throughout the supply chain process, ensuring continuous visibility into the status of products.

2. Missing Product Detection: By integrating LDR sensors, the system can accurately detect the presence or absence of products within packages. This enables the identification of missing products in real-time.

3. Replaced Product Detection: The integration of ultrasonic sensors allows the system to assess the physical integrity of packages and detect any alterations or replacements. This helps in promptly identifying potential tampering or substitution of products.

4. Sensor Data Analytics: The system employs advanced analytics techniques to analyze the data collected from LDR and ultrasonic sensors. This analysis enables the identification of patterns, anomalies, and potential issues related to missing or replaced products.

5. Alerts and Notifications: The system generates alerts and notifications in real-time when missing or replaced products are detected. These alerts can be sent to relevant stakeholders, such as supply chain managers or logistics personnel, enabling swift actions to address the issues.

6. Centralized IoT Platform: The collected sensor data is transmitted to a centralized IoT platform, providing a centralized hub for data storage, analysis, and visualization. This platform facilitates efficient data management and enables seamless integration with other supply chain management systems.

7. Enhanced Supply Chain Visibility: By leveraging IoT technology and sensor data, the system offers enhanced visibility across the supply chain. Stakeholders can track the movement and status of packages, enabling better coordination and decision-making.

8. Proactive Issue Resolution: With real-time monitoring and detection capabilities, the system enables proactive issue resolution. Stakeholders can quickly identify and address missing or replaced products, minimizing disruptions and improving overall supply chain efficiency.

9. Integration with Existing Systems: The IoT-based Supply Chain Management System can be seamlessly integrated with existing supply chain management software or enterprise resource planning (ERP) systems, enabling enhanced data sharing and process automation.

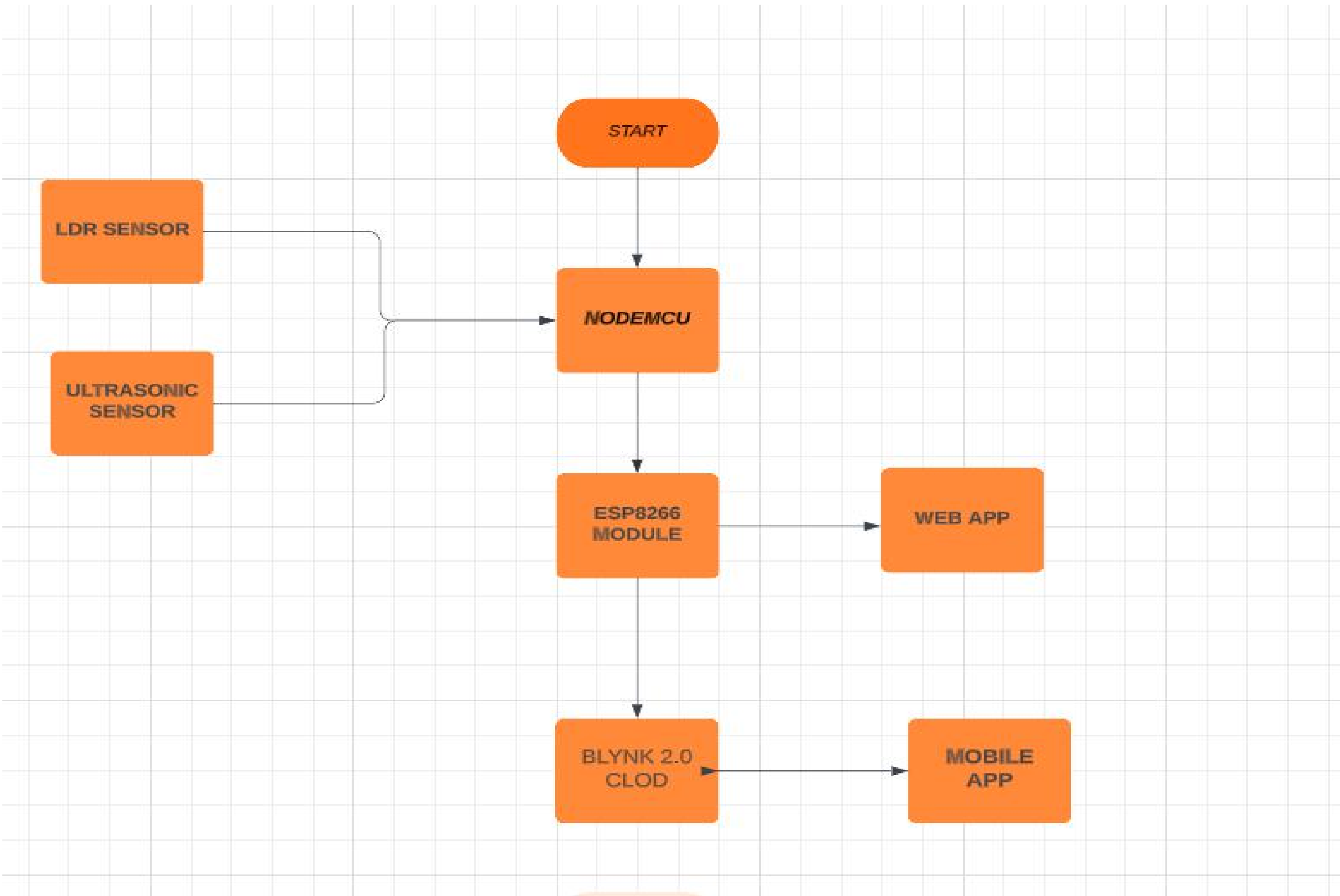
10. Scalability and Flexibility: The system is designed to be scalable and adaptable to different supply chain environments. It can accommodate various types of products, package sizes, and supply chain configurations.

11. Cost Reduction and Risk Mitigation: By minimizing instances of missing or replaced products, the system helps in reducing financial losses, preventing customer dissatisfaction, and mitigating risks associated with fraud, theft, or mismanagement.

12. Data-driven Insights: The system provides valuable data-driven insights through sensor data analysis. These insights can be used for process optimization, demand forecasting, inventory management, and overall supply chain optimization.

13. These features highlight the capabilities and benefits of the IoT-based Supply Chain Management System with LDR and Ultrasonic Sensors, enabling efficient handling of missing or replaced products within packages and improving the overall effectiveness of supply chain operations.

BLOCK DIAGRAM



The block diagram of the supply management system shows that the PIR motion detector sensor and ULTRASONIC sensor are connected to a NodeMCU microcontroller, which acts as the central processing unit. The NodeMCU is equipped with an ESP8266 WiFi module, which allows it to connect to the internet.

The NodeMCU collects data from both sensors and sends it to the web via the WiFi module. The web server is hosted on 000webhost, and it is programmed using ReactJS, HTML, CSS, and JavaScript. The web server collects data from the NodeMCU and stores it in a MySQL database using the ReactJSMyAdmin tool. The web server is also responsible for sending data to both Thingspeak 2.0 cloud and using API calls.

Thingspeak 2.0 cloud is a cloud-based platform that provides real-time data visualization and analysis.

Thingspeak 2.0 cloud is used to send notifications to mobile devices and email addresses.

The mobile application is also integrated with Thingspeak 2.0 cloud, which allows users to view real-time supply data and receive notifications on their mobile devices. The mobile application is developed using Java and Android Studio.

Overall, the block diagram shows that the supply chain management system is designed to collect data from various sensors, process it using a microcontroller, and send it to the web and cloud-based platforms for analysis and visualization. The system is designed to be scalable, reliable, and efficient in managing supply flow.

Management System with LDR and Ultrasonic Sensors, connected to a web app and mobile app through the NodeMCU (ESP8266) and Thingspeak cloud:

1. LDR Sensor and Ultrasonic Sensor:

- The LDR sensor is connected to one of the analog input pins of the NodeMCU. It measures the light intensity within the package.

- The ultrasonic sensor is connected to two digital pins of the NodeMCU: one for triggering the ultrasonic pulses and the other for receiving the echo pulses.

2. NodeMCU (ESP8266):

- The NodeMCU acts as the central control unit and interfaces with the LDR sensor and ultrasonic sensor.

- It reads the analog output from the LDR sensor to determine the presence or absence of products based on the measured light intensity.

- The NodeMCU triggers the ultrasonic sensor to emit ultrasonic pulses and measures the time it takes for the echo pulses to return. This time is used to calculate the distance to the package and detect any alterations or replacements.

- Once the data from the sensors is collected, the NodeMCU processes it and prepares it for transmission to the cloud.

3. Thingspeak Cloud:

- The NodeMCU is connected to the Thingspeak cloud platform via Wi-Fi.

- It uses the Thingspeak library and credentials to establish the connection with the Thingspeak cloud.

- The sensor data collected by the NodeMCU is sent to the Thingspeak cloud in real-time using the Thingspeak API or the Thingspeak-specific functions and commands.

- The Thingspeak cloud acts as a bridge between the NodeMCU and the web app and mobile app, facilitating data transmission and storage.

4. Web App:

- The web app provides a user interface accessible through a web browser.

- It connects to the Thingspeak cloud using the appropriate APIs or protocols to retrieve the real-time data from the LDR sensor and ultrasonic sensor.

- The web app displays the received data in a visually appealing and user-friendly format, providing users with the ability to monitor the status of packages, receive alerts, and access analytical insights.

5. Mobile App:

- The mobile app provides a user-friendly interface for accessing the system from mobile devices.

- It connects to the Thingspeak cloud platform, similar to the web app, to retrieve the real-time data from the LDR sensor and ultrasonic sensor.

- The mobile app offers features such as real-time package monitoring, alerts, and push notifcations, allowing users to stay updated on the go.

6. Cloud Integration:

- The NodeMCU establishes a connection with the Thingspeak cloud via Wi-Fi and securely transmits the collected sensor data.

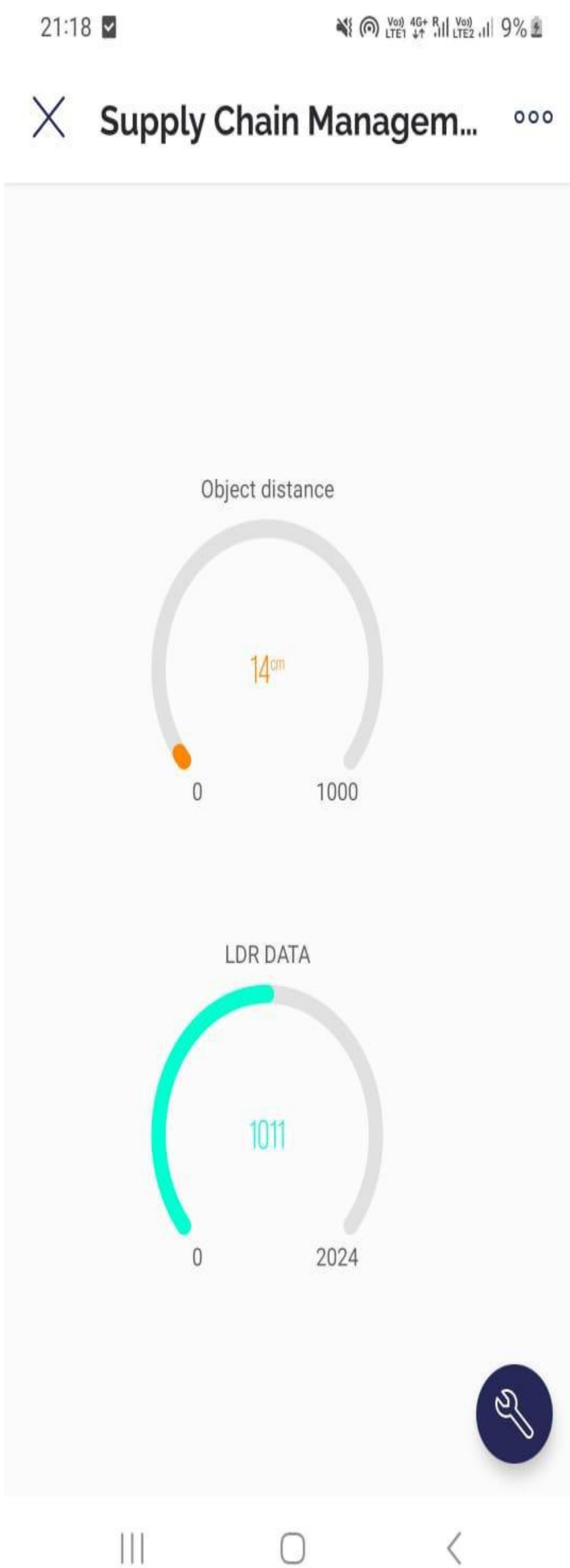
- The Thingspeak cloud acts as a central repository for storing the data, ensuring secure and scalable storage.

- The cloud platform provides functionalities for data analysis, visualization, and integration with other cloud-based services, enabling advanced data processing, insights generation, and integration with external systems if required.

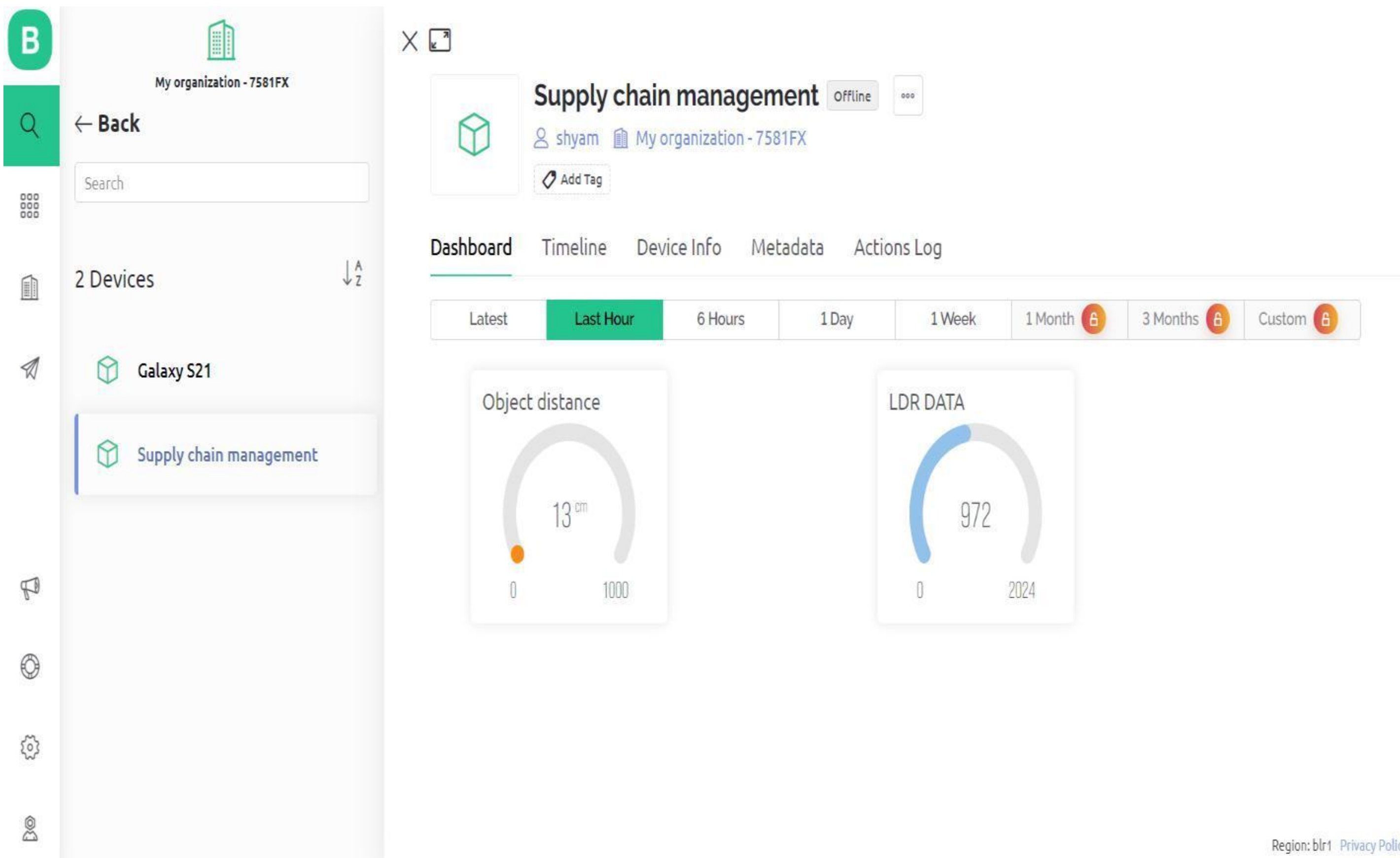
Overall, this connection and flow of data enable real-time monitoring of packages, detection of missing or replaced products using the LDR and ultrasonic sensors, and seamless integration with the web app and mobile app through the Thingspeak cloud. The system empowers users with valuable insights and actionable information to optimize supply chain management processes, enhance visibility, and mitigate risks.

OUTPUTS

Mobile application interface


21:18
9%
Supply Chain Managem...
Object distance
14cm
0
1000
LDR DATA
1011
0
2024

Thingspeak 2.0 cloud interface



Arduino serial monitor

```
[58250] Ready (ping: 118ms).
Distance: 8
Brightness of LDR1 is high
Brightness of LDR2 is Low
Distance: 8
Brightness of LDR1 is high
Brightness of LDR2 is Low
Distance: 8
Brightness of LDR1 is high
Brightness of LDR2 is Low
Distance: 8
Brightness of LDR1 is high
Brightness of LDR2 is Low
Distance: 8
Brightness of LDR1 is high
Brightness of LDR2 is Low
Distance: 8
Brightness of LDR1 is low
Brightness of LDR2 is Low
Distance: 8
Brightness of LDR1 is low
Brightness of LDR2 is Low
Distance: 8
Brightness of LDR1 is low
Brightness of LDR2 is Low
Distance: 4
Brightness of LDR1 is low
Brightness of LDR2 is Low
Distance: 6
Brightness of LDR1 is low
Brightness of LDR2 is Low
Distance: 8
Brightness of LDR1 is low
Brightness of LDR2 is Low
Distance: 12
Brightness of LDR1 is low
Brightness of LDR2 is Low
Distance: 18
Brightness of LDR1 is low
Brightness of LDR2 is Low
Distance: 8
Brightness of LDR1 is low
Brightness of LDR2 is Low
Distance: 19
Brightness of LDR1 is low
Brightness of LDR2 is Low
Distance: 25
Brightness of LDR1 is low
Brightness of LDR2 is Low
```

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```
#include <ESP8266WiFi.h>
#include <ThingSpeak.h>

#define MAX_ADC_VALUE 1029

const int thresholdDistance = 10;
const int thresholdLight = 600;

const char *ssid = "F41";      // Your WiFi SSID
const char *password = "123456798";  // Your WiFi password
const char *api_key = "2J52TPRIR1GYARS4";  // Your ThingSpeak API Key

WiFiClient client;  // Declare WiFiClient object

int channelNumber =2374374;  // Replace with your ThingSpeak channel number

void setup() {
  pinMode(A0, INPUT); // LDR input at A0 pin.
  pinMode(D5, OUTPUT); // Sets the trigPin as an Output
  pinMode(D6, INPUT);  // Sets the echoPin as an Input
  Serial.begin(9600);  // Starts the serial communication

  // Connect to WiFi network
  WiFi.begin(ssid, password);
```

```
  while (WiFi.status() != WL_CONNECTED) {
    delay(1000);
    Serial.println("Connecting to WiFi...");
  }

  Serial.println("Connected to WiFi");
  ThingSpeak.begin(client);
}

void loop() {
  loop1();
  delay(1000); // Add a small delay to make the output readable
}

void loop1() {
  // Clears the trigPin
  digitalWrite(D5, LOW);
  delayMicroseconds(2);
  // Sets the trigPin on HIGH state for 10 microseconds
  digitalWrite(D5, HIGH);
  delayMicroseconds(10);
  digitalWrite(D5, LOW);
  // Reads the echoPin, returns the sound wave travel time in microseconds
  long duration = pulseIn(D6, HIGH);
  // Calculating the distance
  int distance = duration * 0.034 / 2;
  // Prints the distance on the Serial Monitor
  Serial.print("Distance: ");
  Serial.println(distance);

  // Read LDR input.
  int LDRReading = analogRead(A0);

  // Invert the LDRReading to represent light intensity.
  int lightIntensity = MAX_ADC_VALUE - LDRReading;

  Serial.print("Light Intensity: ");
  Serial.println(lightIntensity);

  // Update ThingSpeak channels
  updateThingSpeak(distance, lightIntensity);
}

void updateThingSpeak(int distance, int lightIntensity) {
  // Create a ThingSpeak update object
  ThingSpeak.setField(1, distance);
```

```
  ThingSpeak.setField(2, lightIntensity);

  // Write the update to ThingSpeak
  int status = ThingSpeak.writeFields(channelNumber, api_key);

  if (status == TS_OK_SUCCESS) {
    Serial.println("Update sent to ThingSpeak");
  } else {
    Serial.println("Error sending update to ThingSpeak");
  }
}
```