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# Design of DC Cold Storage Unit with Sensor and IOT Based Safety Audit and Reporting System

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## Abstract

The Internet of things (IoT) attempts to use the internet to connect various things and objects. We are motivated to apply for the food preservation domain, such as maintaining the quality of fruits and vegetables, by the Internet of Things. A cold storage system has been suggested for this project in order to examine the environmental conditions in which the food item is being stored. The suggested approach measures the surrounding environment's temperature, moisture, and gas characteristics because they have an impact on food products' nutritional properties. In this project, we designed and implemented an Arduino that serves as a sensor node for the cold storage building and a central base station that is connected to the cloud to facilitate data storage functionalities. By establishing a connection to the database via its IP address, the sensor values are delivered to the base station from the cloud and stored there. Then, a data fusion model that uses many sensed data as input and one fused piece of information or action to be taken as output is tried. Thus, numerous inputs, such as temperature and humidity, were combined and averaged to generate a single, consolidated output on the basis of which judgments might be made in the future. In order to facilitate user engagement and connectivity between an IoT-based station/gateway and the internet, this project is integrating an Android mobile application. The distant cold storage live positions are tracked using GPS.

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## INTRODUCTION

It is crucial to manage unique supply chain risks, i.e., maintaining excellent environmental conditions and guaranteeing occupational safety in the cold environment, because handling environmentally sensitive products needs close monitoring under prescribed circumstances throughout the supply chain. This paper proposes for an Internet of Things (IoT)-based risk monitoring system (IoTRMS) for managing occupational safety and product quality hazards in cold chains. Through the entire cold chain, real-time product monitoring and risk assessment for personal occupational safety can subsequently be formed. The wireless sensor network is set up to automatically gather data on ambient environmental conditions, which is then controlled and used to run a model of product quality degradation in a cloud database. Essentially, "cold storage" refers to refrigerated or frozen storage facilities. For a variety of uses, including the storage of groceries, pharmaceuticals and medicines, ambient products, chilled produce, and frozen goods, cold stores can be utilized in rooms, residences, supermarkets, and warehouses. Small-scale cold storage options include walk-in coolers, freezers, and large warehouses. It might also be portable, as a reefer trailer (a refrigerated semi-trailer) or a shipping container. Although it can also refer to colder temperatures, cold storage often refers to freezing temperatures or below. When the need for more storage arises or if a facility wants to move, the entire system may be moved easily thanks to the flexibility of custom cold storage. The adaptability can accommodate site growth, a rise in production, and any legislative changes. A cold room/store, as the name suggests, is a specific type of room where very low temperature is maintained at all times. This definition will help you understand what makes up a cold room and how it functions. Precision tools and other comparable machines assist this particular sort of space maintain its temperature. It is not unexpected that cold room facilities are continually being constructed and enhanced given the cutting-edge technology we currently possess. They significantly affect our daily lives and influence the volatile game of supply and demand for perishable goods. The food industry is the first on the list of businesses in need of these specialized facilities, while other industries also employ cold rooms. Perishable commodities are frequently built into these cold storage facilities to be kept there for a while. Producing perishable items like fruits and vegetables is expanding as a result of the rising need for food. These commodities must be kept in cold storage facilities to ensure their preservation and prevent spoilage. Because they serve to extend the shelf life of fresh items, cold rooms are crucial. They also successfully extend the time needed to market these items and minimize waste.

## 1.2 DANGERS IN COLD STORAGE

Facilities for cold storage and cold storage maintenance come with a unique set of risks and issues. In addition to a few unique risks and fire hazards that must be managed, cold storage facilities contain all the same potential concerns as a typical warehouse. The type of strategy a cold storage warehouse might adopt is demonstrated via risk assessment. Use it as a guide to consider some of the risks present and the actions required to reduce the risks in order to safeguard people. The following threats are possible to run against.

## 1.3 INSULATED METAL PANELS

The installation of insulation in the facility's walls and ceilings typically removes the challenge of effectively maintaining acceptable temperature ranges in refrigerated warehouses. While performing cold storage maintenance, it's crucial to avoid using exposed spray-on foam padding to reduce the likelihood of a fire quickly spreading to the building's roof and walls.

It's crucial to pick metal panels that have either been certified in accordance with approval criteria or that have non-flammable cores (such those composed of mineral wool).

### 1.4 AMMONIA

Ammonia is typically the favored coolant in cold storage facilities. The highly flammable gas anhydrous ammonia has the potential to start catastrophic flames and booms. Because regular ammonia is also regarded as toxic, it must be used in cooling systems in accordance with safety regulations.

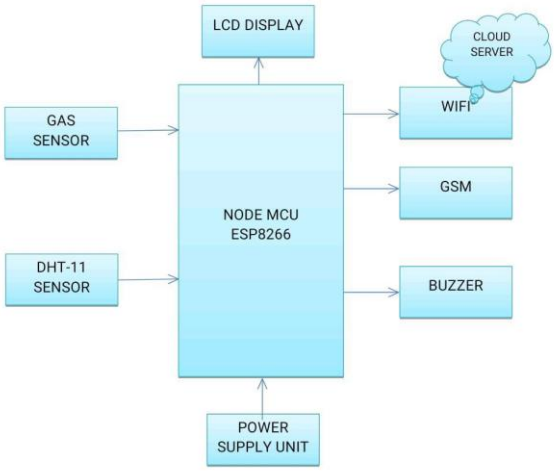
### 1.5 MOISTURE

Moisture levels in cold storage units and warehouses are quite important, in addition to temperatures. Relative humidity levels that are too low cause products to dry out and shrink. When condensation levels are excessively high, devices may malfunction, items may decay, and products may become contaminated with mold, bacteria, or insects, posing a health concern to consumers and workers. When exposed to humidity and condensation, electronics made expressly for cold storage locations encounter problems that affect workers, such as a lack of productivity and device malfunction.

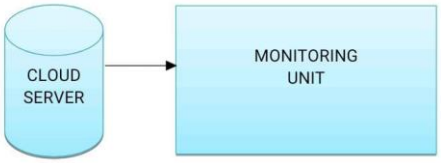
### 1.6 FIRE RISKS

Despite what might seem counterintuitive given the bitter weather, cold storage facilities really pose a considerable fire danger. This is caused by a variety of variables, including chemicals, the composition of the air, and even just the storage of packing and combustible products. Obviously, reducing this risk is essential for anyone running such a facility.

**DESIGN OF DC COLD STORAGE UNIT**




**DESIGN OF MONITORING UNIT**




**EXISTING SYSTEM**

In this study, we developed and put into use a monitoring system that uses WSN ZigBee and Firebase to track the number of characteristics that define the cooled containers. Container characteristics like temperature and humidity are updated in

real-time on a website, as well as the localization. The data is transmitted to a remote server using a 4G router in this setup. Additional temperature and humidity testing was carried out using the AURIOL weather station, and the results were contrasted with those obtained using Si7021. The accuracy level was assessed together with the calculation of the absolute errors. In order to improve the location data, we also process the data collected by the Adafruit Ultimate GPS Logger Shield. Future work will focus on creating a routing algorithm that will use less energy and prolong the battery life of the end node.

DISADVANTAGES

- Data processing was quite sluggish.
- Less precise.
- Not receiving the right outcome.

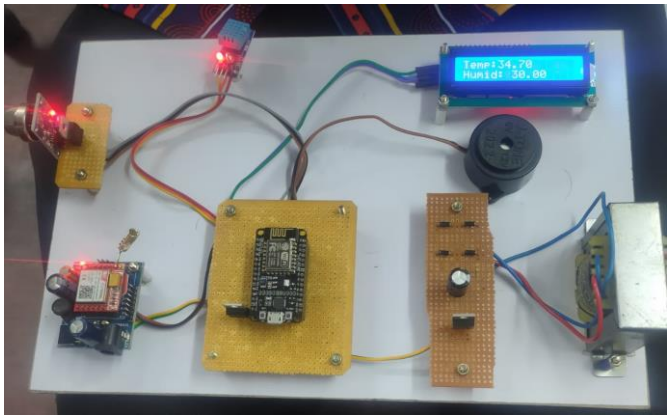
## PROPOSED SYSTEM

The project's goal is to manage internal information for refrigerated trucks and monitor the temperature, humidity, and gas inside of them. The Internet of Things (IoT) is used in this system to realize the design of an intelligent monitoring system that can monitor the temperature, humidity, and gas levels inside refrigerator trucks as well as track the location of those trucks in real-time throughout the course of transportation. The suggested system made use of a DHT11, a GAS SENSOR, a GSP module, and an ESP8266 as the primary control unit.

ADVANTAGES

- Quicker
- Condition monitoring systems use sensors
- Greater dependability and precision.

## OUTPUT




## CONCLUSION

The goal of this project is to create an innovative IoT-based system that can track data from several sensors and provide report analysis after getting the data from the threshold. It involves designing, analyzing, and tracking data in real-time utilizing GPS from a variety of sensors. The device employing node mcu develops a wireless monitoring system using a wireless protocol to accomplish this. A data monitoring system is being developed using base station integration.

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