Real-time Monitoring and Controlling of Cold Storage Truck using IoT

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ABSTRACT

Refrigerator transportation is an important part of cold chain. Aiming at monitoring the temperature and humidity inside the refrigerator trucks and managing information of the refrigerator trucks internal. In this system, there is a design of an intelligent monitoring system based on the Internet of thing, realized monitoring temperature and humidity inside the refrigerator trucks , and tracking the location of refrigerator trucks real-time in the entire transportation process by using advanced technologies like MQTT, Cloud Computing, sensor technology and the wireless communication technology. The proposed system used an ESP32 as main control unit, DHT22, E18 Infrared sensor, RTC, and GSP module. The system is very powerful to monitor refrigerated truck from anywhere and anytime using mobile application. This system will be capable to do control and monitoring through mobile and web application. We will achieve the good result to data monitoring such as Temperature, humidity, and door status with MQTT. It is satisfied with the performance through the analysis of monitoring system and experiment results for the designed refrigerated truck monitoring system. Moreover, this proposed system has main advantages which are minimize the human effort for the manual monitoring and loss due to uncontrolled environment.

Keywords: Refrigerator Trucks, Internet of Things, Intelligent Monitoring, MQTT

I. INTRODUCTION

With the continuous development of society, people pay more and more attention on the food safety in daily life, especially fruit, dairy, and meat food's preservation problem. In the food cold-chain process, the transport process of refrigerator trucks is an important segment to ensure food safety. In this segment, the temperature and humidity conditions within the refrigerator trucks, the state of door switch and the location of refrigerator trucks must be real-time monitored. The Internet of things is a combination of the Internet and all kinds of information sensing devices such as radio frequency identification devices (RFID), infrared sensors, global positioning systems, laser scanners, etc. Meanwhile, it based on the simple RFID technology and combined the existing network technology, database technology and middleware technology to form a huge network including lots of networking reader and countless mobile labels. This technology is widely used in intelligent transportation, environmental protection, public security, peace household, intelligent fire, industrial monitoring, and many other areas, which greatly improved the social intelligence and automation level. Appling the Internet of things technology in refrigerator trucks' transportation can track the position of refrigerator trucks and monitor the temperature and humidity etc. real-time and monitor the whole transport process Intelligently to improve transport efficiency.

The system is based on the concept of thing networking, and used the advanced RFID technology, humidity sensor technology, door switch monitoring device, GPRS/GPS technology, wireless communication technology and the Internet to form a remote monitoring intelligent system for the refrigerator trucks. The remote intelligent monitoring system based on this networking technology can have a Realtime monitoring of the temperature and humidity, gate switch state, cargo information and the location of refrigerator trucks, all that make the whole monitoring process reach informatization.

II. LITERATURE SURVEY

The agri-food chain is facing significant new challenges nowadays. Among others, monitoring and controlling temperature along supply chains emerges as a key aspect to deal with food waste [1–3], as well as increasing both food safety and the quality offered to consumers [4–6]. Whereas the early stages of processing and distribution compliance with the temperatures established for food safety was reached [6], however, in the last three stages (considering here transport, retail, and households), temperature control and maintenance have become particularly complex [4,7,8]. In the retail sector in particular, the scarcity of data available on the fulfilment of cold chain control is highlighted [9,10]. In addition, there are many studies confirming that the temperature of display cabinets in refrigeration units is not always the appropriate one, according to safety standards [11–14].

In Europe, there is a regulation by the European Council and Parliament assigning food companies the responsibility for complying with temperature control requirements and microbiological criteria applicable to food products, as well as cold chain maintenance [15]. Concerning this last aspect, the regulation establishes the importance of controlling temperatures and proper operation of refrigeration equipment, considering that daily temperature reading is a valid method to control the cold chain in retail establishments. However, there are studies proving that this method cannot guarantee compliance with the perishable food safety specifications, especially in southern Spain [9].

III.   PROPOSED ARCHITECTURE
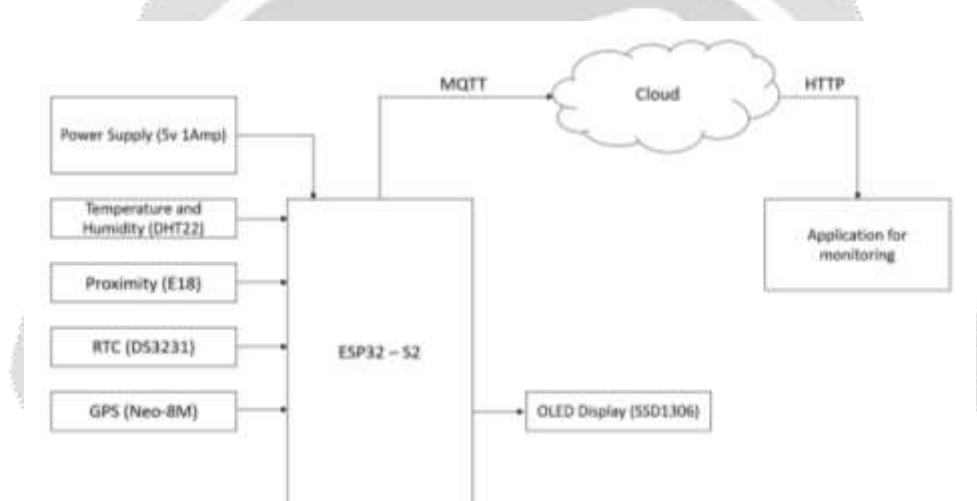
Figure 1 - System Architecture

Because of the refrigerator trucks' wide transportation range and some are still in areas with bad environment, which causes management difficulties in the process of transportation. The transport goods are mostly fresh meat, fruit, vegetables and dairy products, cold drinks, health food, which need high requirement of environment. Combined with the characteristics of transportation process refrigerator trucks above, this system puts forward refrigerator trucks remote intelligent monitoring system based on the Internet of things. The system adopts modular design and be constituted by multi-point temperature and humidity acquisition module, the door switch (proximity sensor) monitoring device, monitoring module in trucks , wireless network, remote monitoring center, and so on. The system composition diagram was as shown in Figure 1. This system relies on advanced content networking technologies and combines existing technology to achieve real-time and accurate monitoring purposes. The temperature and humidity acquisition module constituted by high performance temperature and humidity sensor can be used to read the temperature and humidity conditions data within the refrigerator trucks real-time. To measure more accurate temperature and humidity data, more temperature and humidity acquisition modules can be placed in the box according to actual needs. The door switch is used to monitor the monitoring device switch state in the process of goods transportation to avoid goods loss. And the refrigerator tracks position is located and tracked by the GPS satellite and returns its positioning information with temperature and humidity data, door switch state and cargo information to monitoring center through GPRS network Intelligent Monitoring System on Refrigerator Trucks Based on the Internet of Things. Using intelligent analysis software on the remote monitoring center terminal to display refrigerator trucks temperature and humidity data, door switch state and cargo information real-time to

locate and track the location refrigerator trucks to implement intelligent monitoring management and make the whole system constitute a real-time, intelligent thing networking.

IV. CONCLUSION

The refrigerator trucks intelligent monitoring system which put forward by this proposed system is based on content networking technology. And combined with cloud, sensor technology and wireless communication technology, etc. to realize purposes such as monitoring the transport process intelligently, improving the refrigerator trucks' transport efficiency, preventing the deterioration of goods in transit, and avoiding the loss of goods during transportation, and so on. The proposed system is very powerful to monitor refrigerated truck from anywhere and anytime using mobile application. This system will be capable to do control and monitoring through mobile and web application. We will achieve the good result to data monitoring such as Temperature, humidity, and door status with MQTT. It is satisfied with the performance through the analysis of monitoring system and experiment results for the designed refrigerated truck monitoring system. Moreover, this proposed system has main advantages which are minimize the human effort for the manual monitoring and loss due to uncontrolled environment. Though we can achieve all the goals of our project but still we think that lots of advancement can be done on this project. We have provided the platform and the platform is ready for everyone to work on it. For advancements, we need more time, money, and hard work. Money would remain the critical issue cause to upgrade the project many of the stuff would need an up gradation.

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