The Logistics Equipment Carbon Emission Monitoring System for a Green Logistics

Hyungrim Choi[1], Byoungkwon Park[2], Byungha Lee[1], Yongsung Park[2], Changsup Lee[1], and Jeongsoo Ha[1]

[1] Seunghak campus Dong-A university, 840 hadna2dong, sahgu, busan, Korea
[2] Bumin Campus Dong-A university, 1 bumindong 2ga, segu, busan, Korea
{hrchoi,bpark,ys1126,cslee}@dau.ac.kr,
{leebh1443,charismaya}@naver.com

Abstract. Recently, due to the global enforcement of obligations to reduce green house gases and various environmental regulations, low carbon green growth strategies are required. Currently, in our country, environment friendly logistics activities are staying in the early stage compared to advanced countries because of our country's large energy consumption type industrial structures. As a measure to respond to the trend of the reinforcement of international environmental regulations in the sector of logistics, active green logistics systems should be established and to solve this problem, this study is intended to develop a monitoring system that can manage the carbon emission of logistics equipment(container truck, discharging equipment etc) in real time using a new technology named IP-RFID. The monitoring system developed in this study can actively manage the carbon emission of individual logistics equipment by attaching IP-Tags that can measure the carbon emission of individual logistics equipment in real time and transmit the information obtained from the measurement directly to users through IP communication. Since carbon emission can be managed by logistics equipment and drivers can check the carbon emission of equipment through this system, the carbon emission generated in the logistics sector may be reduced by using this system.

Keywords: Green Logistics, Monitoring system, Carbon Emmission, IP-RFID, i-tag.

1 Introduction

Globally, the average temperature on the earth has increased by 0.7℃ over the last 100 years and the average temperature is expected to increased by maximum 6.4℃ in the 21st century and thus global attention to and concern about climate changes are rising. These climate changes are working as a threatening factor on the survival of mankind with meteorological disasters or the destruction of ecosystems and resultant economic loss is increasing every year.

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In the midst of the rising attention to global warming after the Kyoto Protocol, advanced countries and developing countries decided to allocate the amount of reduction of green house gas emission by country in order to reduce the emission of green house gases such as carbon dioxide and methane in particular among many factors that cause environmental pollution in order to prevent global warming. In the case of our country, total yearly green house gas emission was ranked around the tenth in the world and according to OBCE IEA data, carbon dioxide emission in Germany has decreased by 15.9% for 15 years from 1990 to 2005 while carbon dioxide emission in our country has increased by 97.6% for the same period and thus the increase rate was the second highest in the world next to China and it was expected that it would increase by maximum 38% by 2020. Although our country is not a country of obligatory reductions now, it is expected that our country will be imposed with the obligation to reduce the emission from 2013 and thus it is expected that carbon emission reductions will approach businesses in Korea as a new cost burden.[1][3][4][5]

Accordingly, the government became to declare the low carbon green growth vision and thereafter, various related government departments including the Ministry of Knowledge Economy(green IT industrial strategy, January 15, 2009), the Ministry of Public Administration and Safety(green information system plan, January 16, 2009) and the Korea Communications Commission(master plan for implementing green broadcasting and communication, April 8, 2009) have been developing environment friendly technologies and introducing environment friendly policies.

In the sector of logistics too, the air pollutants emitted from concentrated discharging equipment and trucks have been assessed to be at quite high levels and it is expected that of the entire CO2 emission in our country, the part attributable to the transport sector will increase from 20.3% in 2002 to 23.9% in 2020. This means the importance of environment friendly logistics activities in transport which is an important function of logistics and thus efforts to improve the state are necessary.

Therefore, this study is intended to discuss a monitoring system that can manage carbon emission by logistics equipment(container truck, discharging equipment etc) in real time to reduce green house gas emission by applying a new technology named IP-RFID.

2 Carbon Emission Calculation Methods

There are two carbon emission calculation methods including a direct method that directly measures the concentration and flux etc of carbon at the outlets of emission sources using measuring devices to calculate carbon emission based on the results and an indirect method that theoretically estimates emission considering the kinds and amounts of burnt fuels, their combustion efficiency and emission coefficients etc. Although the direct method has an advantage that accurate information on the final emission can be obtained as fuel burning processes are reflected, great deals of time and money are required for the installation and operation of necessary equipment and there are limitations in measuring. The indirect method has an advantage that calculations using this method are easy but has a disadvantage that the accuracy and reliability of data are low as the method calculates data through coefficients.

Table 1. Comparison between the carbon emission calculation methods

Calculation method	Advantage	Disadvantage
Direct	Accurate information on the final emission can be obtained	The installation and operation of necessary equipment require time and money
Indirect	Easy calculation	Low accuracy and reliability of data

Currently, most countries measure carbon emission with the indirect method and due to the inaccuracy of data presented above, some opinions are being raised that measures to accurately measure carbon emission are necessary.[2] This is because certificated emission reductions are currently transacted and have functions like those of cash. Therefore, in this study, a monitoring system that will enable accurate management of carbon emission will be presented.

3 IP-RFID Based Carbon Emission Monitoring System

3.1 Concept of IP-RFID

IP-RFID is a method that combines the advantages of RFID(Radio Frequency Identification) and USN(Ubiquitous Sensor Network) technologies and minimal IPv6 technology it is a technology intended to ensure wide expandability and mobility by loading IPs on tags in order to maximize the synergy effect of the combination of existing IP infra and USN & RFID infra and to directly manage and control the tags.

In the case of existing RFID Systems, user could not firsthand access to RFID Tags to obtain desired information. In addition, multiple users could not access to a single RFID Tag to register their information nor could enter the time to receive certain information and kinds of data to be received in order to receive the requested information at the time intervals to receive the information and there was no function to set threshold values for certain information so that users are notified when the information exceeds or falls shorts of the threshold values either.

When providing RFID services, IP-RFID uses the code information of existing RFID Tags as the IP address(or IP address and contents index) of the contents server that provides contents so that contents services can be provided quickly/easily and it can provide RFID Tags for IP address based RFID services that will enable fast responses to changes in the contents provided and methods for IP address based RFID services at RFID terminals or contents servers using the RFID Tags.

It was attempted to develop a system that can measure carbon emission utilizing these characteristics of IP-RFID that directly provides the information required by users.

3.2 System Concept Diagram

In this system, in order to manage in real time, the carbon emission of various types of logistics equipment that are used in the area of logistics, IP-Tags are attached to

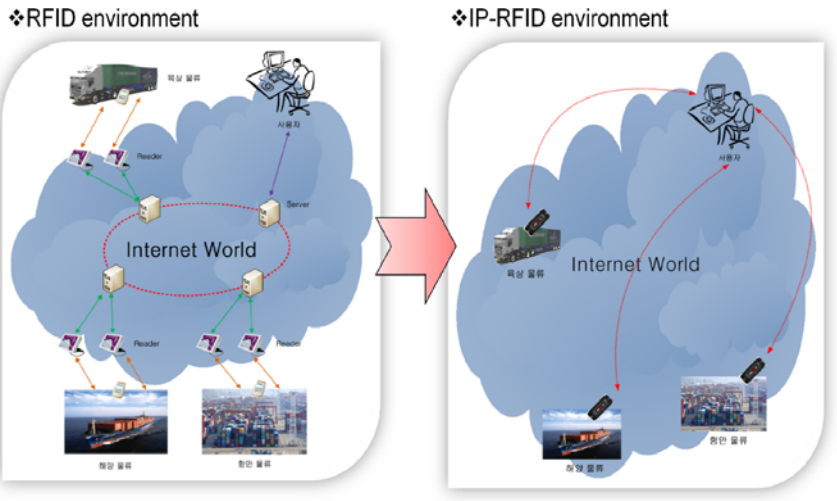

Fig. 1. Difference of RFID and IP-RFID environments

areas near the outlets of the equipment and the location information and carbon emission information of the logistics equipment are collected in real time through communication with the SPs(Smart Points) installed in the region to enable the management of carbon emitted in the area of logistics. A related conceptual diagram is shown in <Figure 2>.

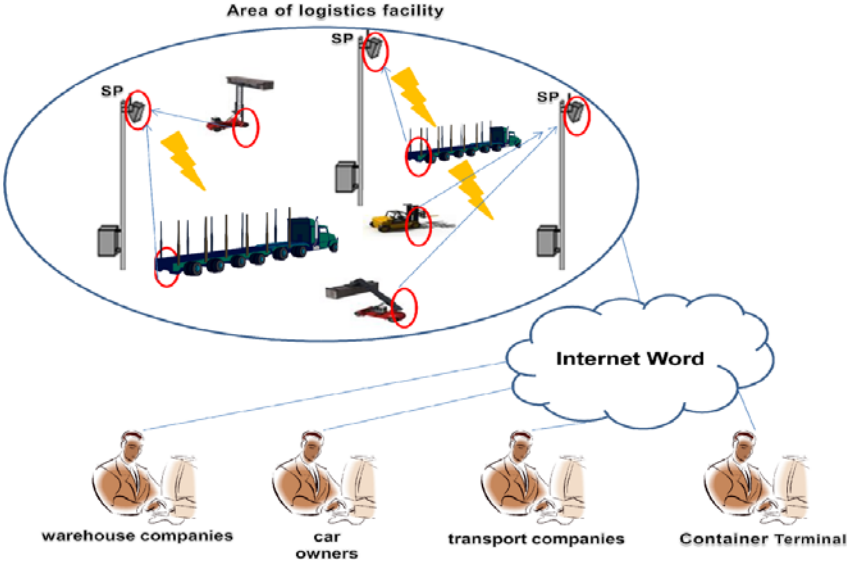

Fig. 2. System concept

3.3 User Interface

This system is characterized by the fact that user interfaces vary by party due to differences in the information to be utilized by different parties. First, container terminal operating companies have diverse types of logistics equipment and thus they should manage carbon emission by equipment. As shown in <Figure 4>, daily, weekly, monthly and quarterly pieces of emission information are managed depending of the types of equipment and through this, the carbon emission from each unit of logistics equipment occurring in the port is managed.

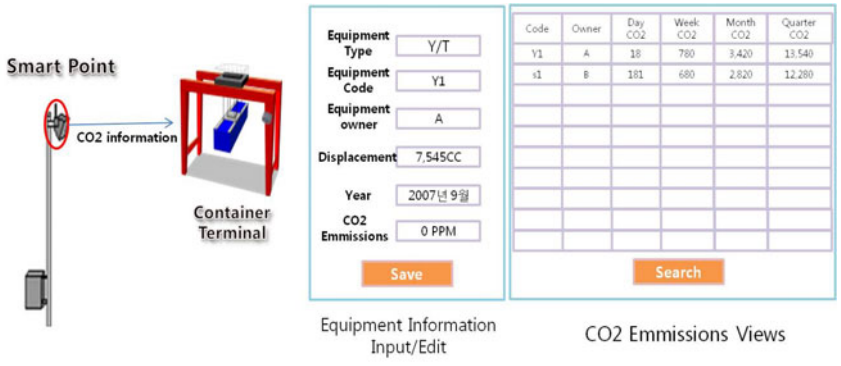

Fig. 3. Container Terminal User Interface

Secondly, in the case of transport companies, since they own and operate multiple cars, they should manage their total carbon emission through the management of the carbon emission of each car. These data can also be used when cars with similar mileages and specifications show different carbon emission values for follow-up actions such as car maintenance.

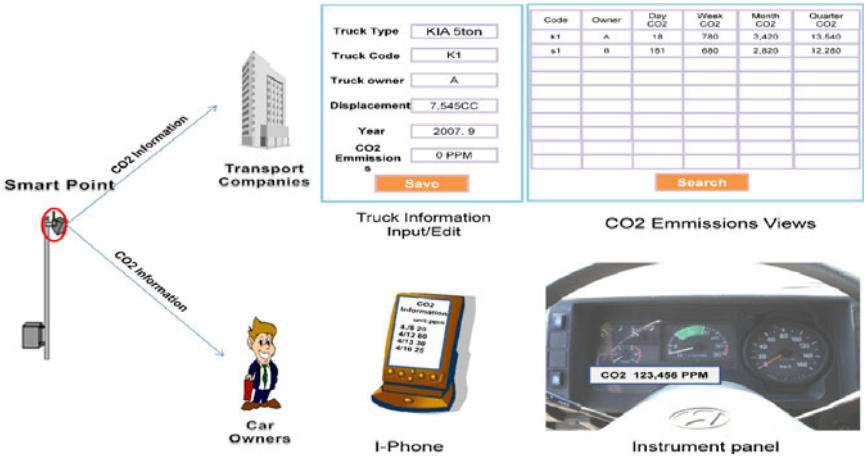

Fig. 4. Transport Company & Car Owner User Interface

Finally, car owners (drivers) that drive cars should be also provided with information because they perform activities related to carbon emission. As with total mileages that can be identified from instrument panels, carbon emission should be also identifiable and it is necessary to enable the drivers to identify information through mobile devices such as mobile phones when they wish to identify daily or monthly carbon emission.

4 Conclusion

In this study, a system that can measure and monitor the carbon occurring in the area of logistics was presented for the management of green house gases that are becoming an issue recently.

Existing methods indirectly manage carbon emission information through emission coefficients and they have problems in the accuracy and reliability of the carbon information resulting from the carbon emission coefficients that vary every time they are measured and other factors. As regulations on green house gases are being increasingly reinforced, these problems should be solved and to this end, carbon emission should be accurately managed through directly measuring methods.

In this respect, this study presented a system to provide information to parties in logistics through directly measuring method by attaching IP-Tags to the outlets of logistics equipment to sense carbon emission information and transmit it to parties in logistics through the SPs installed at many places in transport regions. Since different parties in logistics have different types of equipment to be managed and even the same equipment can emit different amounts of carbon depending on the situations of operation and management, the parties are enabled to immediately respond to changes through the monitored carbon emission information. They can screen out those units of equipment that emit large amounts of carbon in ordinary times to receive maintenance services and it can be expected that the information can help parties in logistics in their decision making for matters such as buying certified emission reductions if carbon has been emitted more than expected.

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