Cloud-based LCA Management System for Environment-efficient Society

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Abstract

Recently year, the environmental problem has been the one of most important problem in the world. Bio Diesel Fuel from waste oil is now marked around the world and is in place in Bogor city. Meanwhile, it is needed to visualize for the executing of efficient policy. Thus, in this research, cloud based environmental load estimation system is proposed. The cloud based system is widely available for all business scales. In addition, for visualization of the effect from the recycling of waste oil and its collection, a method using the Smartphone is proposed. Some of cordially projects for the environment can be inefficient as regards of whole life cycle of the project. From a perspective of Life Cycle Assessment, boundary conditions about consumer behavior for the project are set appropriately to estimate of effect. We propose the measuring method contribute to the efficient execution of the biodiesel project using waste oil.

Keywords: Bio-diesel fuel, Waste cooking oil collection, ICT Solution, Certification, Social system

1. INTRODUCTION

Nowadays, bio-diesel fuel is focused as a carbon neutral energy for environmental protection. Bio-diesel fuel can be used like ordinal diesel fuel, and produced from palm oil or waste cooking oil. To produce the bio-diesel fuel, there are several way. In this paper, we focused on the bio-diesel production using waste cooking oil. There are three stages in the process of bio-diesel fuel production: storing, collecting and producing. It can be seen in many countries. It is important to collect the waste cooking oil efficiently, and to promote such productive projects.

On the other hand, we developed a web based LCA management system called eL-Platform. It is one of ICT for realization of the environmental impact evaluation. It is a web system that is a labor saving technology without additional cost when a company introduces and manages. It can contribute the environmental load curtailment by visualization. In order to spread a user friendly LCA system for sustainable society, we must develop the web-based LCA system that is high reliability, easy to use and low-cost. eL-Platform can estimate kg-CO2e of environmental loads, under given scenarios of selected row materials (intermediate products), energy use and waste disposal, retrieving environmental load labels of materials, when the environmental labelling is formerly made. Figure 1 shows the concept of system as a common platform for environmental management.

In this paper, we discuss how to promote the bio-diesel production with the waste cooking oil collection. Through the discus, a certification system and application of our web system to estimate the personal reduction on GHG emission is proposed.
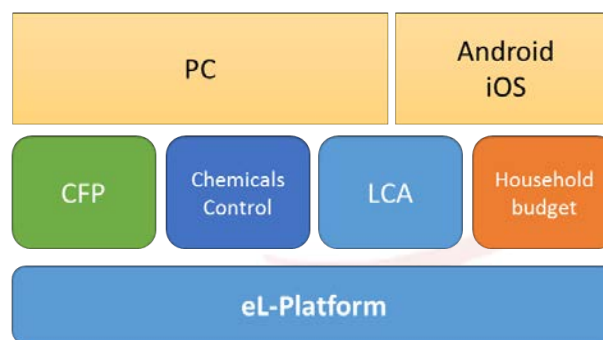

Figure 1: Common platform for environmental management certification of waste cooking oil collection

To promote the bio-diesel production project, it is needed to visualize the personal contribution for the project through the waste cooking oil collection. For example, such identification of them allows us to prize with GHG credits.
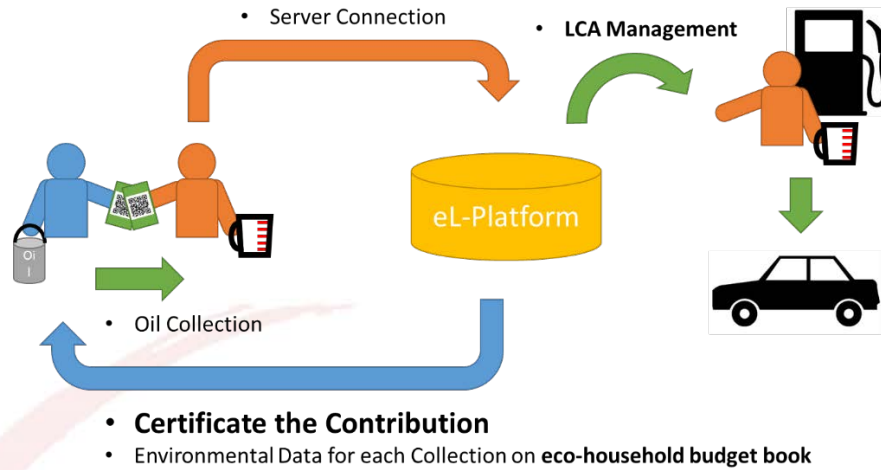
Figure 2: Certification in the Bio-diesel fuel project using eL-Platform

2. WASTE COOKING OIL COLLECTION WITH ASYNCHRONOUS COMMUNICATION TYPE CERTIFICATION

Certification is always hoped to be speedy and easy. Considering such condition to promote the collection of waste cooking oil, ordinal certification style with some papers or documents is not desired. In this paper, we propose a simple certification style using mobile phone connected to Internet. Sometimes we don't have the connection to Internet is offline, and sometimes it is very slow. In this paper, we propose a method which independent on the environment of connection to certificate each collection. Table 1 shows a process for the certification of collected cooking oil information on central server.

Table 1. Process of asynchronous communication type certification

Step	Collaborator	Collector	Server
1	Show the QR Code(A) to identify users.		
2		Read QR Code(A), and input the result of collection.	※ detailed algorithms such as encryption omitted
3		Show the QR Code(B) for notification of result.	
4	Read the QR Code(B), and store the data.		
5	Input conditions for waste cooking oil.		
6	Estimation of environmental load (or reduction).		
		(established communication)	
7		Notification the information to the server	**Certify** the information of QR Code(B).
	(established communication)		
7	Notification the condition of waste cooking oil to the server		Store the statistical data.

3. ESTIMATION OF GHG REDUCTION FROM WASTE COOKING OIL COLLECTION BASED ON LIFE CYCLE ASSESSMENT

Using a difference of environmental load between recycling case of bio-diesel fuel and regular using case, we can obtain a following equation to estimate the reduction of GHG emission:

$$\text{Dif} = r_c\{f(r) - 1.844\} - g(x_c, r_c, r_s, m)\{f(r) - 0.0419\},$$

where x_c is an initial amount of the cooking oil, r is remnant ratio, r_c is amount of collected oil, r_s, m are the parameters about timing and times filled up. Function f and g are given by the following equations:

$$f(r) = 0.1387 \times (1 - r)^{-1},$$

$$g(x_c, r_c, r_s, \quad) = \frac{r_c^2}{x_c} \times \frac{1 - r_s^{2m+1}}{1 - r_s}.$$

As there is a substantial variation in cooking oil use in households as well as in restaurants, food factories, and food shops, it is of difficulty to simulate an exact GHG emission in every case. However, the visualization in GHG reduction by mobile applications might make a substantial social influence to promote recycling practices, as people want to visualize a simulated value to change their activities. Mobile applications, in Android conducting the GHG reduction simulation in kg-CO2e under

a simplified model, were recently developed [7] (see Fig. 3), and the former one has a series of additional functions of recycling registration and authentication using the QR codes as well as of an environment household accounts.

Figure 3: Actual applications for the collection and estimation on Android OS

4. CONCLUSION

Visualization of GHG relating personal behaviors such as consumptions, contribution for the bio-diesel production project is important. To promote this project, a certification system using mobile phone has been developed. The system makes it possible to assign a unique number to 1 for each waste cooking oil collection. The certification system develops a consistency of project. By visualizing of personal contribution, we can apply some kind of credit system to it without national system.

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