Study on the Potential Demand of Windows Cleaning by Survey

Kyoon-Tai Kim

Abstract—In recent years, window cleaning services have been in demand among luxury shops including clinics, beauty shops, esthetic, and banks. However, as the demand exists only for the shops in specific buildings, the precise level of demand has not yet been figured out. Therefore, the technical demand from potential clients has not yet been clearly defined. For this reason, this study aims to understand the demands of potential clients in this area of technology through a survey. In this study, building owners, managers and tenants were surveyed on the current status of their window cleaning, and their intent to invest in window cleaning in the future. Through the study, the potential clients for window cleaning were identified.

Index Terms—Construction automation, window cleaning, cleaning robot, maintenance, survey analysis.

I. INTRODUCTION

In recent years, many multi-purpose high-rise buildings have been constructed. To secure a clear view and enhance aesthetic aspects, the facades of the high-rises are finished with glass. In addition, the high-rises have attempted to attract various businesses in the luxury category, including clinics, beauty shops, aesthetics, and banks in their lower stories; in this case, the façades are also done with glass to make them look more luxurious [1].

To support a clear view and good building aesthetics, the facades should be cleaned on a regularly basis. However, façade cleaning including the cleaning of windows is usually performed only once a year. This is not only because the cost of cleaning is expensive, but is also because it is difficult to recruit cleaning staff, let alone staff to clean the windows of a specific shop [1]. For these reasons, while the number of potential clients who want a clean environment has been on the rise, the demand has not been satisfied. In addition, a specific shop wants to keep only its windows clean so that it is hard to figure out exact demand as a whole, and the technology demanded by the clients has also not been yet clearly defined [2].

The goal of this study is to understand the demand for window cleaning machines and the related technology through a survey. In other words, as preliminary research to develop automated device for window cleaning on the façade, this study aims to identify the current state of window cleaning and future intention to invest in the technology by building owners, managers and tenants. Through this, it is expected that the difficulties of cleaning and maintenance

companies can be resolved, and a new market will ultimately open in the area of building maintenance.

II. TECHNICAL LEVEL OF COMMERCIALIZED CLEANING MACHINE

Various cleaning machines have been developed in Korea as well as in foreign countries to improve cleaning methods. As shown in Fig. 1, Nihon Biso developed and commercialized a window cleaning machine that runs along a rail on the wall. However, this type of machine has limitations, as it can only be applied when a rail is incorporated into the building wall during construction. In addition, as it is a cleaning machine for the entire façade of a building, its high price has been pointed to as a disadvantage. As such, it is insufficient to satisfy the increased demand of some specific businesses that put a greater emphasis on a clean image and want to clean their windows more frequently.

Fig. 1. Building maintenance unit [3].

As illustrated in Fig. 2 (a) and (b), there are various window cleaning machines for specific purposes. However, to clean a window façade using the existing machines, the machine must be added manually from the outside with the windows open. That is, when the windows are fully finished with glass or opened within a limited range, it is impossible to clean the windows.

(a) Absorption-type   (b) Magnetic-type [4]
Fig. 2. Window cleaning machine for specific windows.

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III. CONCEPT OF THE WINDOW CLEANING MACHINE TO BE DEVELOPED

For the window cleaning machine to be developed in this study, as shown in Fig. 3, the guiderail will be attached on the façade of a building in advance. The window cleaning machine is optimized compared to existing building maintenance units, by eliminating unnecessary function including water injection, up and down movement etc. In other words, the cleaning machine is safely docked on the guiderail and operated, which is the main difference from conventional commercially available absorption-type and magnetic type of cleaning machines.
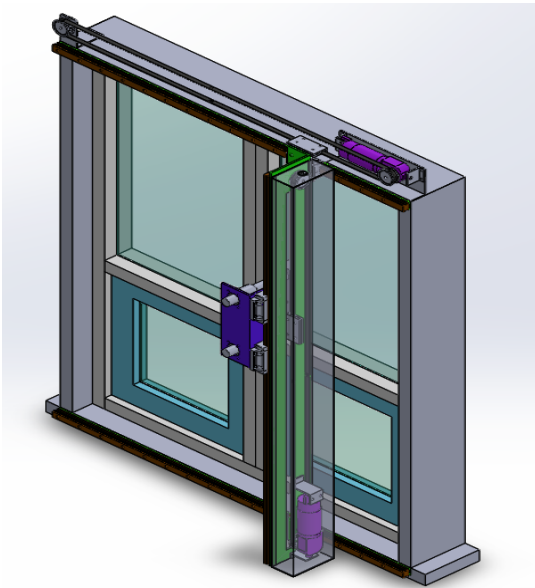
Fig. 3. Comparison between the two working processes.

IV. PRELIMINARY SURVEY

In this study, preliminary surveys were conducted to improve the completeness of the survey. The survey was conducted for building owner, building managers, and tenants. Those who have experienced cleaning windows or who are interested in the window cleaning device were selected as preliminary questionnaires.

A. Survey Outline

The questionnaire for the preliminary survey of the demand and demand technology of the automation equipment for window cleaning consisted of 18 questions in three parts as follows.

・General information: General status such as respondent status, type of building, experience of window cleaning, cleaning method, cleaning cost, cleaning time, working group composition

・Demand: Potential demand due to investment intentions for window cleaning, the desired cleaning frequency, the need for window cleaning device, intent to use, and possible investment costs

・Suggestions: Other features such as the desired function of the cleaning device

As shown in Fig. 4, there were 25 respondents in the survey,

14 in the tenants, 8 in the building manager, and 3 in the building owner. As shown in Fig. 5, most of the buildings owned and managed or occupied by the respondents were cleaned (72%) but 28% were never cleaned. As shown in Fig. 6, more than half of the cleaned jobs were cleaned by their own manpower. However, many respondents were not satisfied with the results because there remain stains. Also, the fact that the cleaning work was difficult and time-consuming was also a complaint.
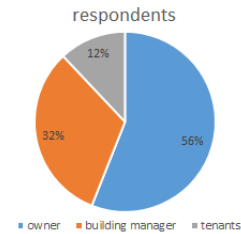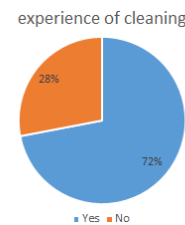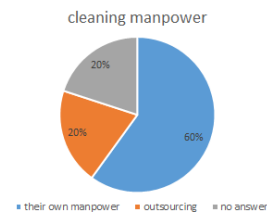
Fig. 4. Respondents.

Fig. 5. Experience.

Fig. 6. Manpower.

B. Results of Preliminary Survey

As Fig. 7 shows, most respondents (88%) said they should invest to additional window cleaning. As shown in Figure 8, 40% of the respondents said that the frequency of cleaning should be 'monthly', and 28% of respondents answered 'weekly'. Therefore, the potential demand for a particular window cleaning can be considered sufficient.
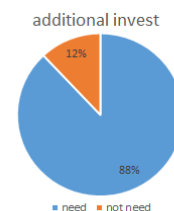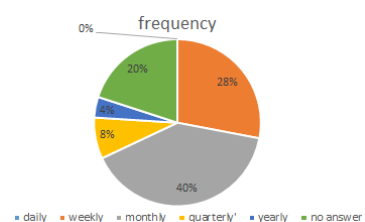
Fig. 7. Additional invest.

Fig. 8. Frequency.

96% of the respondents answered that the necessity of automatic window cleaning system was needed. 68% of respondents said that they would pay up to 20% of the cost of the cleaning service if the additional cost was required to use such device. And 24% of the respondents said they would add 50% extra cost (See Fig. 9). As Fig. 10 shows, most respondents (96%) preferred the rental method in terms of the use of the device.
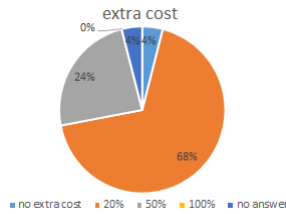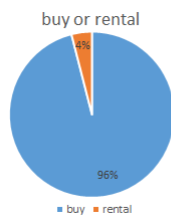

Fig. 9. Extra cost.

Fig. 8. Buy or rental.

V. SURVEY ON THE TECHNOLOGY DEMANDED BY POTENTIAL CLIENTS

A. Survey Outline

A survey was conducted to determine the demand and the technology demanded by potential clients. The survey outline is indicated in Table I.

TABLE I: SURVEY OUTLINE

Item	Contents
Region	Buildings in the central commercial area in Gangnam-gu, Mapo-gu, Jongno-gu, Gwangjin-gu, and Seodaemun-gu, Seoul
Targets	Building owners, managers and tenants in the buildings in the central commercial area where the window cleaning is expected to be demanded.
Sample	297 persons
Method	Face-to-face survey
Period	Dec.1, 2016 ~ Mar. 21, 2017 (including survey planning and preparation period)

B. Basic Information

Table II includes the basic information on respondent type, building type, the building story, windows installed, and windows needed to be cleaned. Tenants account for 85 percent of all respondents. In terms of building type, multi-purpose buildings consist of 77 percent. Most of the buildings have more than 2 stories, and 90 percent of respondents stated that they have windows that need to be cleaned.

TABLE II: BASIC INFORMATION

Survey	Response rate	Item
Respondent type	2%	Building owner
	6%	manager
	85%	Tenant
	7%	Others
Building type	15%	Multi-purpose buildings
	62%	Commercial buildings
	9%	Offices
	1%	Apartments
	13%	Other facilities
Floor that the respondent is on. ('5th floor' category includes all floors higher than the 5th floor)	9%	1st Floor
	42%	2nd Floor
	27%	3rd Floor
	6%	4th Floor
	15%	Higher than 5th floor
	1%	No answer
Window	97%	Installed
	0%	Not installed
	3%	No answer
Cleaning	90%	Needed
	6%	Not needed
	4%	No answer
Business type/field	11%	Clinics
	11%	General offices
	48%	Retailers (including clothes shop)
	21%	Service (Restaurants)
	9%	No answer

C. Outside Window Cleaning Status and Satisfaction

In terms of the status of window cleaning from the outside and the satisfaction of those surveyed, the responses are indicated in Table III. To get a detailed grasp on the respondents' preferences, response rates were calculated after responses of 'Don't know' were excluded. In terms of window cleaning from the outside, more than 80 percent of respondents said that they had the experience of performing window cleaning from the outside of the building. More specifically, about 66 percent used in-house cleaning. It takes one or two people to clean the windows, and mostly takes one to three hours to get it done. Therefore, when in-house cleaning was performed, it is done as soon as possible by deploying the minimum number of staff. On the other hand, in terms of outsourced cleaning, cleaning cost and the staff input were not clearly grasped. In terms of satisfaction after cleaning, 44 percent of respondents answered that they were more than satisfied; 48 percent rated their satisfaction as mediocre; and 8 percent were dissatisfied. In terms of the

nature of complaints after cleaning, poor cleaning quality including remaining stains was mentioned most frequently. In terms of future investment intention, 47 percent, or approximately half of respondents, said they would invest in window cleaning in the future. In addition, the most frequent reason why they intended to invest in window cleaning was to maintain a clean appearance, which was given by 63 percent of all respondents.

TABLE III: CLEANING EXPERIENCE AND SATISFACTION

Survey	Response rate	Item
Window cleaning from the outside	80%	Experienced
	20%	Not experienced
Satisfied after cleaning	8%	Very satisfied
	36%	Satisfied
	48%	Mediocre
	8%	Dissatisfied
	0%	Very dissatisfied
Main complaints about the cleaning	40%	Poor cleaning quality such as remaining stains
	1%	Difficulty in cleaning the parts which hands hardly reached
	3%	Short duration of cleanness
	38%	Others
	18%	Nothing dissatisfying

D. Future Investment Intention Related to Window Cleaning

In terms of additional cost for a cleaning device as shown in Table IV, 63 percent of all the respondents said that they would be willing to pay an additional 20 percent compared to what they pay currently. In terms of method, most of the respondents preferred a rental plan, and 42 percent of the respondents indicated that a charge of USD100 per month would be appropriate.

TABLE IV: FUTURE INVESTMENT INTENTION RELATED TO A CLEANING MACHINE

Survey	Response rate	Item
Future use of a cleaning device	45%	Intended
	55%	Not intended
Additional cost paid for a cleaning device	63%	20%
	30%	50%
	3%	100%
	4%	Others
Expected price to purchase a cleaning device	55%	Less than USD1,000
	29%	More than USD1,000 ~ Less than USD3,000
	3%	More than USD3,000 ~ Less than USD5,000
	13%	More than USD5,000~less than USD 10,000
	0%	More than USD10,000

Expected monthly fee for a cleaning device	42%	Less than USD100
	24%	More than USD100~ less than USD200
	14%	More than USD200 ~ less than USD300
	17%	More than USD300 ~ less than USD500
	3%	More than USD500
Functions and opinions on an automated window cleaning device	20%	Clean appearance
	8%	Safety/noise
	10%	Cost/after-sales service
	19%	Promotion/design
	43%	Others/None/Don't Know

E. Summary of Survey Results

The survey results can be summarized as follows.

1. If a window cleaning device is released, 45 percent of all respondents seem to have an intention to buy or rent a cleaning device, which implies that there are potential clients for such a cleaning device.
2. A number of respondents hoped to be able to rent a window cleaning device.
3. These respondents preferred a rental fee between USD100-USD200 per month.
4. The respondents wanted to clean their windows without any noise to keep their windows clean. They demanded a safe cleaning device that does not leave any water or stains behind.

VI. CONCLUSION

The demand for window cleaning has been on the rise among high-end shops in newly-built buildings. However, not only has the demand not been precisely grasped, but its related technology has also not been defined. For this reason, this study aimed to understand potential clients' demand for a window cleaning device and its related technology.

In a survey of building owners, managers and tenants, 45 percent of all respondents answered that they would intend to use a window cleaning device. They also responded that they would be willing to pay a fee between USD100 and USD200 per month for such a device. From this, it can be interpreted that there are potential clients for a window cleaning device. In a future study, we will establish sales strategies through more concrete research on the demand of potential clients.

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