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System for Preventive Maintenance of U-City Infrastructure

Yoojung Jo, Hyongsuk Lee and Donyun Kim *

Sung Kyun Kwan University, #83485 Research Complex 2, 2066 Seobu-ro Jangan-gu,
Suwon 440-746, Gyeonggi-do, Korea

* Author to whom correspondence should be addressed; Tel.: +82-31-290-7575; Fax: +82-31-290-7570; E-mail: dnkim@skku.ac.kr

Abstract: Though Korea has established and operates a variety of urban infrastructure under the name of U-City, it has failed to unify infrastructure operations, which can be considered the biggest difference between existing city and U-Cities. In light of the growing need for active maintenance, there is a need to improve both the simple historical management and passive post-management. The aim of the study is to suggest algorithm not only for unified operation but also for preventive maintenance of U-City infrastructure. The methods of study are as follows. First, the improvement of infra maintenance was deduced by analyzing the maintenance condition and the existing material of Dongtan U-City. Second, the systematic DB establishment was deduced by considering infra life cycle for preventive maintenance. Third, the importance level of the infra was deduced based on both the public interest and residents' opinion in Dongtan. Lastly, the final maintenance algorithm was deduced, considering the above deductions. The infra maintenance algorithm this study suggests is available at the field immediately in Dongtan and accepted in other U-City areas as well. It means that the algorithm can serve as a basis of preventive maintenance in U-City infrastructure.

Keywords: Preventive maintenance; U-City infrastructure; Algorithm.

1. Introduction

The U-Cities which have been constructed so far have established and operated various urban infrastructure in the name of the U-Services. However, it is true that the integrated operation and management of facilities or the biggest difference between existing cities and the U-City has not been

maximized. The integrated system which may communicate the site and central control system shall be established for the efficient management of the U-City. In addition, it is required to seek out preventive maintenance plans to upgrade the operational efficiency in the national infrastructure management because the maintenance cost for facilities takes the largest share in the whole facility lifecycle from the installation to the disposal. [1-2] The purpose of the study is to propose the improvement in the maintenance of U-City infrastructure. The study covered Dongtan U-City and performed the status analysis and survey focusing on the U-City infrastructure in Dongtan. To achieve the purpose of the study: First, it found out the improvement in the maintenance through the status analysis. Second, it found out how to establish the systematic DB by reflecting the preventive maintenance. Third, it found out the importance level in the infrastructure reflecting the public interest and resident opinions. Finally, it expressed the research result as the maintenance algorithm.

2. Results and Discussion

2.1. Improvement direction

The current status analysis of U-City infrastructure management shows that it just simply managed the history and provided passive post-maintenance rather than maximizing the central command center. This is not largely different from the current maintenance system. [3] However, it is required to consider the introduction of the preventive maintenance to existing cities, as well as the U-City in the situation where the importance in the preventive maintenance rather than the post-maintenance has been emerged owing to wide understanding of the maintenance. [4] The infrastructure maintenance data shall be integrated, established and managed by introducing the preventive maintenance scheme based on the central management or the most outstanding feature in the U-City for its maintenance improvement. In addition, the basic concept of the maintenance, continuous management, shall be implemented through the continuous feedback.

2.2. Direction in establishing the systematic DB

It is required to establish the proper classification system for the maintenance to systematically manage the information on the infrastructure maintenance. The classification system is the basis for the infrastructure maintenance to make more systematic and scientific method. [5] The Cost Breakdown Structure (CBS) is used to categorize functional elements of the lifecycle cost as a useful method to provide the analysis frame for the lifecycle. The cost breakdown structure shall consider all the cost elements regarding the infrastructure and clearly classify cost elements to be included in the CBS to avoid the cost omission and redundancy. [6] The data accumulation for the infrastructure maintenance for the U-City classifies the 3-layered cost breakdown system to manage the cost for each part in the infrastructure. The parts specifics may not exist depending on the parts and the code shall be granted based on the final parts unit to avoid the cost element omission and redundancy. (see Table 1) The table interlinked with the correlation based on the 3-layer cost breakdown table for the infrastructure or the foundation for such DB to establish the integrated management DB. [3]

Table 1. Cost Breakdown Structure (CBS): example.

Code	Infra(1st)		The parts (2ed)		The final parts (3rd)		Each cost (won)	Life cycle (M)
FAC01PT0101	FAC01	Security CCTV	PT01	Camera	01	Body	360,000	72
FAC01PT0102					02	Housing	200,000	60
FAC01PT0103					03	Lens	300,000	60
FAC01PT0201			PT02	Video server	01	Body	360,000	72
FAC01PT0202					02	Mercury board	200,000	60
FAC01PT0203					03	Carrier board	200,000	60

2.3. Importance in the infrastructure

The public interest of a city shows similar development trend in the hierarchy of needs classified by Maslow [7] and it means that the entity and method of achieving the urban public interest change due to the state of a period but the pursuing public value is always the same. The purpose of the first public interest, sanitation, is to propose the minimal standard for urban elements to protect the city from diseases and disaster in the aspect of the survival and the goal of the safety is to propose minimal standard for the urban element to secure robust and safe urban activities. The public interest as an efficiency takes the direction in equal and efficient use and benefit for all the environment resources of a city and the freshness is to upgrade the quality of living conditions in the aspect of the sanitation, safety and efficiency. The infrastructure maintenance plan considering dwellers is the element as a foundation for realizing the urban public interest, as well as meeting the citizen satisfaction or the most important element of forming a city. The study classified established infrastructure in Dongtan based on the concept of the urban public interest and granted weighting factors depending on the importance. Then, it integrated the importance from dwellers' survey to find out the final importance of the infrastructure. (see Table 2)

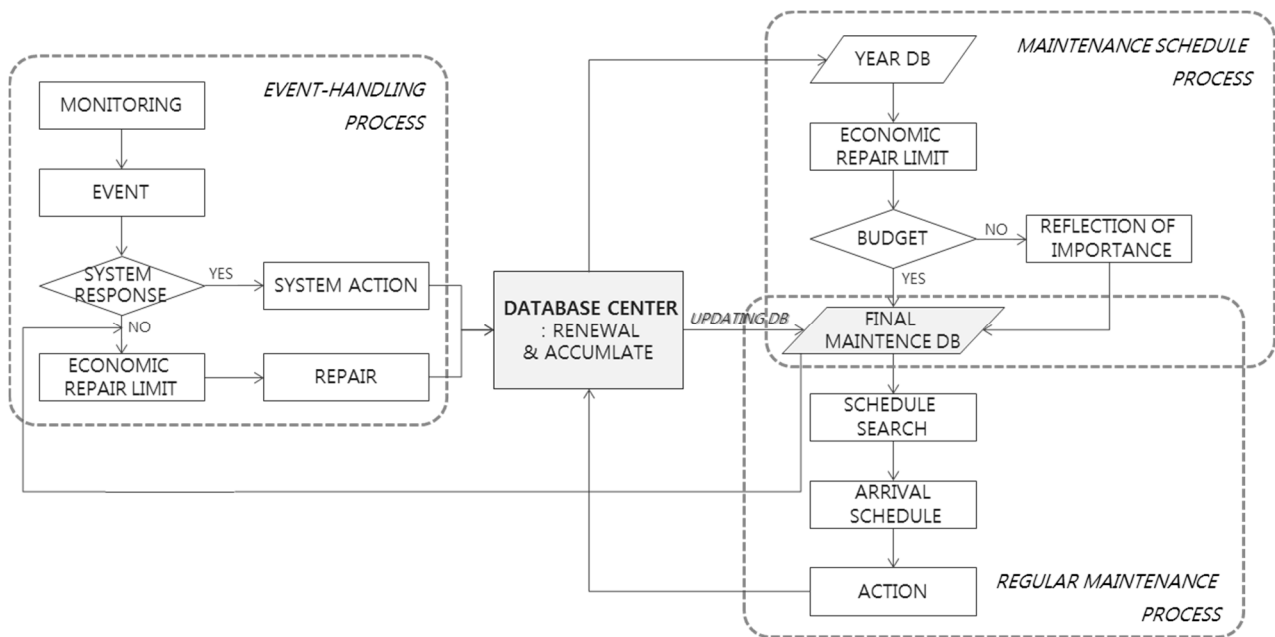
Table 2. The deduction of importance level in the U-City infrastructure.

Rank	1	2	3	4	5	6	7
infrastructure	Pressometer	Flowmeter	Streetlight	Security CCTV	VIN CCTV	Illegal parking crackdown CCTV	Signal controller
importance	0.3789	0.3789	0.3712	0.3608	0.3584	0.3064	0.2947
Rank	8	9	10	11	12	13	14
infrastructure	Video detector	Traffic information display	Traffic CCTV	Media board	U-placard	BIS	Environment pollution display
importance	0.2947	0.2744	0.2674	0.2303	0.2247	0.1696	0.1568

2.4. Algorithm deduction

The basic premise for the systematic maintenance is "The record renewal is required after the maintenance". The case for the record renewal consists of the regular maintenance due to reaching the lifecycle and the maintenance due to an event without reaching the lifecycle. [6] The lifecycle schedule changes and applies if record updates due to an event. Overall, the maintenance system consists of establishing the maintenance schedule, regular maintenance, and event-handling process and each phase contains interlink and circulation system by the integrated record keeping. (see Figure 1)

Figure 1. The maintenance algorithm.



3. Conclusions

It is important to keep seamless services and required to establish the systematic maintenance system because the infrastructure forming a city is directly related to the quality of life for citizens. [3] In particular, the U-City may maximize the efficiency by utilizing the strength for the integrated infrastructure management. The DB shall be established for the successful preventive maintenance of the infrastructure and continuously managed. It is important for the maintenance system based on the infrastructure DB to systematically interlink the urban infrastructure data for the U-City development.

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Conflict of Interest

The authors declare no conflict of interest.

References and Notes

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