Computer Aided Maintenance Management System for the Research Facilities in Tsukuba, Japan

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KEYWORDS

Computer system, Government building, Maintenance, Repair, Research facility

ABSTRACT

The Ministry of Construction (MoC) constructed some 40 different government owned reserach facilities in Tsukuba from 1968-1979, the total amount of floor area of them reached some 1.2 million m^2. MoC had established a new branch in 1981, of which in charge of maintaining these fair amount of special facilities by introducing the computer-aided maintenance and management system (BICAS-T), that was the new system approach to maintain the government building in Japan. This paper introduces the outline of the ongoing system, its effectiveness and the future application.

Système d'entretien et de gestion assistés par ordinateur pour les équipements de recherche de TSUKUBA, Japon

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Mots-clés:

Bâtiments publics, Entretien, Equipements de Recherche, Réparation, Système Informatique.

Sommaire:

Le Ministère de la Construction a construit à TSUKUBA quelques 40 différents équipements publics de recherche entre les années 1968 et 1979. La superficie totale de ces équipements représente près de 1,2 millions de m^2. Le Ministère de la Construction a créé en 1981 une nouvelle direction pour l'entretien de ces équipements de type particulier. A cette occasion, l'introduction de l'entretien assisté par ordinateur ainsi que du système de gestion: BICAS-T ont été le reflet d'une nouvelle approche dans le mode d'entretien des bâtiments publics au Japon. Le présent rapport introduit les grandes lignes du système actuellement utilisé, son efficacité et ses applicastions futures.

1. INTRODUCTION

The total amourt of floor area of government owned buildng is some 70 million m^2, and the Ministry of Construction (MoC) is in charge of 10 million m^2 out of the total. The Government Building Department (GBD), one of the departmert of MoC, staff 1200, including 10 regional branches is responsible for the planning, surveying, construction and maintenance works. In early '60, The Japanese Government decided to concentrate the most of government owned research organizations including national universities into the Tsukuba New Achademic City for advancing new technology. According to the policy GBD had constructed 37 different research facilities in that area from 1969 to 1979, the role of each facility is completely different, likely, electronics, mechanical, biological, civil and building technology, totaled 1,500 buildings, 1,2 million m^2 in floor area. When it comes to the maintenance works of each building, it has been carried out by the nominated responsible staff in the occupied research organization in accordance with "Law concerning construction etc. of government and other public office facilities" enforced 1956, and "Technical standard of maintenance and modernization for government buildings" enforced 1982 [1], and several guidelines issued from GBD. To cope with the fair amount of facilities, MoC had established a new local branch of GBD, of which in charge of maintaining the facilities by introducing the computer - aided maintenance and management system - developed by GBD called BICAS-T (Building Information Computer - Aided System in Tsukuba). In view of the introduction of computer system into the maintenance of government building, BICAS-T is the first system in Japan.

2. AIMS OF BICAS-T

Fundamentally the aim of developing the system is to ensure the rational approach to the maintenance and management of the research facilities in Tsukuba, however, the concept of the system could be expanded to the another ordinary government buildings.

The aim can be roughly divided into as follows;

1) Analyses of problems and their causes on maintenance works based on the collected and storaged data from various facilities on inspection, cleaning, operation etc. likely, inspection interval vs. frequency of breakdown, running hour vs. breakdown or maintenance cost etc.

2) Data storage for establishing the rational maintenance plan for each facility based upon the collected data, likely, deterioration process & rate of building components and/or material, breakdown of building, history of repairing and its cost etc.

3) Data storage for setting the long range maintenance plan for the whole research facilities in Tsukuba.

4) Application of available data to the maintenance of ordinary government building.

3. BICAS-T SYSTEM

3.1 Outline of system

Block diagram and the function module of the system is shown in Fig. 1 and 2. Input data as in Fig. 1 is from research facilities in the form of unified maintenance operation sheets, and these are stored in the floppy disc, the duty of CPU is data processing into the maintenance information and its retreaval.

3.2 Data bank

Content of initial data file can be outlined as shown in TABLE 2. in liaison with initial data. The periodical data file is a filing of data in regular interval as every month or year in liaison with initial data, the part of it is shown in TABLE 3. for the DBMS (data base management system).

4. EFFECTIVENESS OF BICAS-T

There already many types of computer aided maintenance systems [2], however, the effectiveness of the systems might seems to be owned by the qualitity and scale of the data base in their systems, and this was the stressed point in the developing stage of BICAS sysem. From the view point of the final goal of this system, this stage could be said as "the age of data storage" even if the whole hardware system itself is resonably functioning, at present, 12 types of regularly processed data on maintenance has be able to be output, such as, "failure sheet" - containing mode of failute, degree, cause, repairing method, expenditure and rate of repairing, breakdown, etc. can be calcurated based on above. On the basis of above fundamental data base various analyses can be done, likely rate of breakdown vs. inspection interval or expenditure, reliability calcuration, life time of parts, statistical analyses for the factors applicable to the total maintenance problems as in Fig. 3.

5. FUTURE PROBLEMS

It could be said that the hardware system of BICAS-T could be almost completed however, there still several problems to be solved in due consideration for getting the intended final goal of the system, not mainly due to the hardware aspects but truly due to the "Ploblems of systematization of maintenance", in other word as it were "making it qualitative from quantitative". Taking the simple example of quantitative decision making to be repaired or not into account, decision making so far is completely owned by the experienced personnels in charge - one of the fatal influential to maintenance -, however, his decision making was timely and contributed in due consideration of the total life of the building. A part from the problem of BISCAT-T, GBD had an intention of establishing several counter measures to cope with present stage, as the decision making system on the basis of fairly long time surveying, which enable to be applicable for the in charged staffs by the short term training. The system has been completed on the basis of the proposal of the special committee set up in 1984 by GBD, consisted of expertise, architects, constructors and research engineers. This system covers building, electric equipments and mechanical installations, this could

contribute the increase of reliability of the whole BISCAT-T system, and naturally this affect the minor revision of the hardware system.

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REFERENCES

[1] K. Yoshida, "The technical standard of maintenance and modernization for government buildings." proc. of 9th CIB Congress, CIB 83, Vol. 1b, pp. 303-314.

[2] "Systems of Maintenance Planning," CIB / W70 Seminar, March 1983, Edingburgh, Scotland, U. K.

TABLE 1. Developed programmes

types of programmes	language	scale
general computer programmes	cobol	85 programmes 60,000 steps
terminal programmes	special terminal language	60 programmes
OCR programmes		12 OCR sheets

TABLE 2. Initial data code file

Name		Coding
identification data		name of institute, site area, etc.
building, facility data		type of building, structure, floor area, storey, surface finishing, etc.
equipment data		type, location, capacity, data, manufacturer etc.
building code		use of buildings
room code		use of rooms
component code		buildings system, sub-system, assembly, components etc.
inspection code		type of inspection work
failure code	type	mode of failure, degree and causes
	degree	
	causes	
repair code		counter measure against failure above
expenditure code		cost
inspector code		details on inspector in charged

TABLE 3. Periodical data

No.	name	coding	input interval
1	building, expanding, demolition	detailed record of works	every year
2	repair, modification	detailed record of building and equipment	every month
3	failure	types of failure and expenses	every month

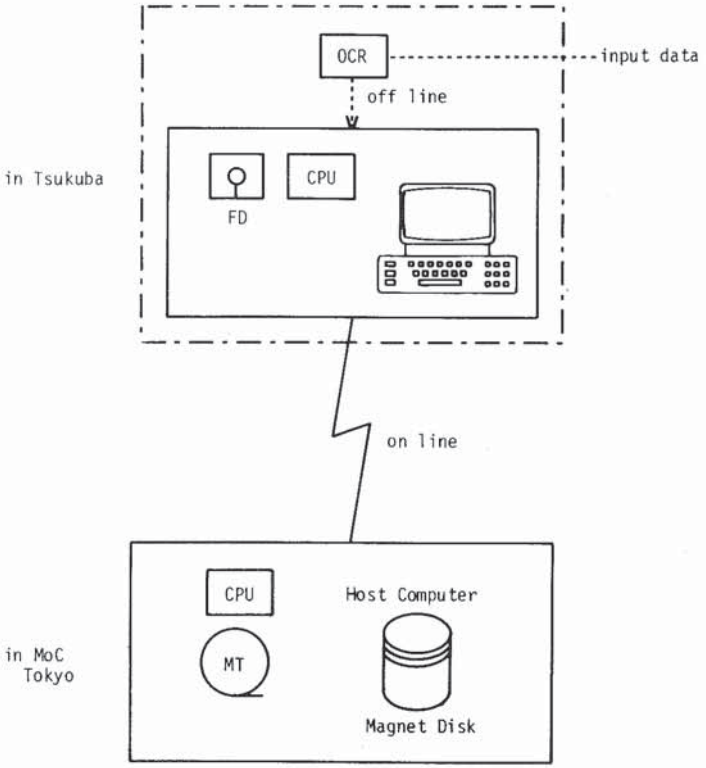

Fig. 1. Block diagram of BISCAT-T

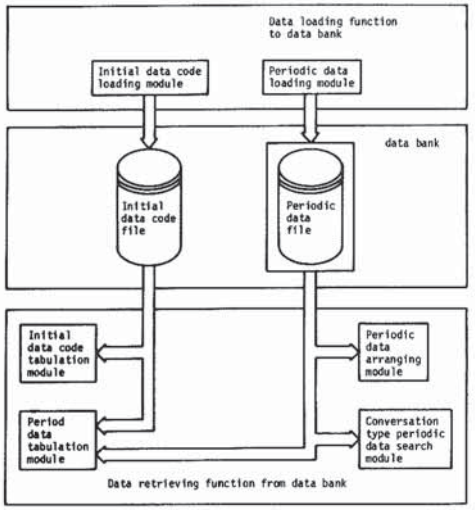

Fig. 2. Function modules of BICAS-T

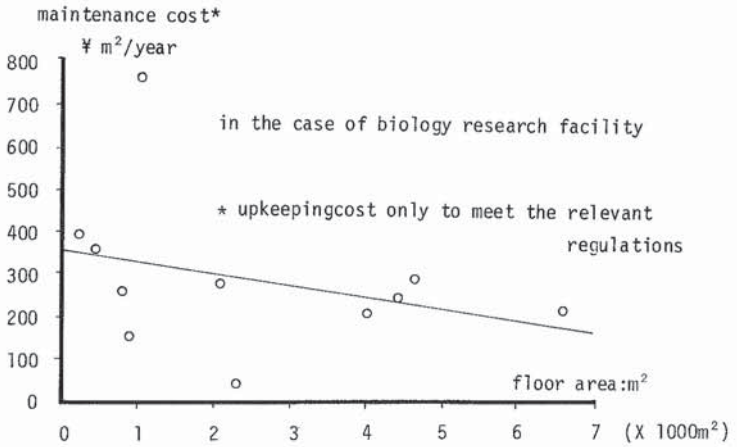

Fig. 3. Relation between scale of building and maintenance cost