

INTRODUCTION OF WORKFORCE DATABASE SYSTEM FOR EFFECTIVE PRODUCTION PLANNING

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ABSTRACT

Workforce information is important in production planning because production planning is a job matching a production unit's capacity to loads of assignments. However, tracking and managing workforce information such as skills and accident history is not an easy job. This paper aims to describe a prototype workforce database system using RFID (radio frequency identification) with emphasis on tracking workforce capacity on daily production on sites. It is noted that the study presented in this paper is a part of on-going research on using workforce information for production planning.

KEY WORDS

workforce information, database system, workforce capacity

INTRODUCTION

The contractor deals with several formidable tasks during construction. One of the important challenges is project control. Effective project control involves a multitude of tasks including production planning, procurement, cost, schedule, quality, workforce, and safety management.

Production planning in lean construction plays an important role in providing reliable work flow that impacts on cost, time, and even safety performance (Ballard et al 2007). Workforce information is important in production planning because production planning is a job matching a production unit's capacity to loads of assignments (Ballard 2000; Ballard et al. 2007). However, tracking and

managing workforce information such as the level of skill and accident history is not an easy job. Fatcher (2001) showed that the need for data entry and management at the project level was the major obstacle to the success of the system. If a project is large, tracking workforce information (i.e., what skills each labor has, the level of skills each labor has, the accident history) takes immense time and efforts. Consequently, efforts are being made at GS E&C and the Lean Construction Lab at the University of Washington to trace and manage workforce data entry. The prototype was developed and applied to some construction projects in Korea.

This paper describes the prototype of a workforce database system using RFID (radio frequency identification)

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with emphasis on tracking workforce capacity on daily production on sites. It is noted that the study presented in this paper is a part of on-going research on using workforce information for production planning.

PRODUCTION PLANNING AND WORKFORCE INFORMATION

Production planning, as distinct from project scheduling, appears to have

been introduced into construction with the Last Planner® system (Ballard, 1994; Ballard & Howell, 1998). Production planning is a job making the best match of capacity and load achievable in given conditions (Ballard et al, 2007). A production planner needs information not only on task loads but also on resource capacity as shown in Figure 1.

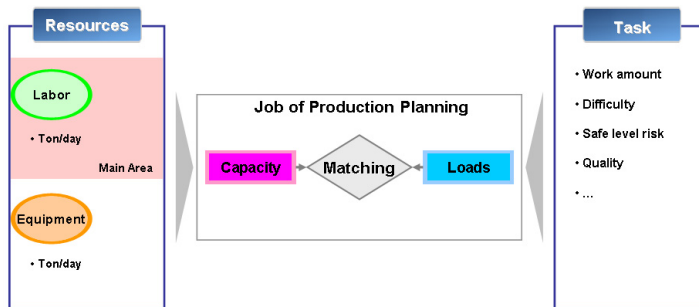


Figure 1. Production Planning Mechanism

Traditionally, task loads can be analyzed easily comparing to uncertainty of resources. Information on workforce capacity remains unknown in production planning in many cases while information on equipment capacity can be easily accessed. For example, the level of difficulty and demands of resources that each task carries can be measured and managed while information of labor capacity is limited. The crew size and average productivity are examples of information on labor capacity. However, there is more information on labor capacity needed for best matching job. The prototype database system discussed in this paper uses three types of workforce information to be managed: safety records, the level of skill, and work experience.

WORKFORCE DATABASE PROTOTYPE

Usually, there are more than thousands of labors on a construction site, most of them are hired by subcontractors. As mentioned, workforce management has an important impact on construction quality and safety. If the workforce is of high quality (i.e., skilled and experience workforce), for example, the quality of that construction project will be increased. Therefore, a general contractor is usually concerned over the quality of workmanship on sites no matter who hired them.

In an attempt to achieve transparent and efficient workforce management, the Manpower Management System (MMS; the name of the system for workforce management) is combined with mobile

technology. First, a new worker should register a basic personal information, professional skills and safety issues to the MMS. A safety training education is required for an every new worker. An ID card, then, is issued to each worker before tasks are assigned to him/her. Through mobile technology connected with MMS, check-in/out data is recorded and transferred to the system in real time.

Figures 2, 3, 4, and 5 give actual screen dumps from the MMS database system. Figures 2 and 3 show data input screens regarding general personal information. The Entry Form under the section of “general” allows the user to enter information about each labor’s job, contact information, evidence of work eligibility, and work location (Figure 3). In the same manner, information about safety records is entered using data entry form (Figure 4). Three types of safety data are updated and managed to

prevent the safety accident. The first one is health status. Periodically or occasionally, all workers have to get a health test such as a blood pressure test. The second one is a safety violation. If a worker does not wear a safety helmet, the violation record will be updated in MMS by MMS window or PDA. The third one is a safety training status. If a worker attends the safety training class, that record will be registered in MMS by MMS window or PDA.

The database system also allows the user to enter work experience and the level of skill for each labor (Figure 5). Sometimes managers have workforce information such as the level of skills. However, such information is properly not managed and maintained in many cases. The MMS builds comprehensive information of each worker’s capacity including the level of skills and safety records.

The screenshot shows a web browser window titled "GS TPMS Personal Records - Microsoft Internet Explorer". The page content includes a search bar with "From" and "To" date pickers, a "Search Category" dropdown, and a "Key word" input field. Below the search bar, there are navigation buttons: "Safety", "Print Pass.", "Ind. Work Data", "Print", "Add", "Edit", and "Delete". The main area displays a table of personnel records with the following columns: Subcontractor, Discipline, Occupation Category, Name, First Work Date, ID No., Appropriate, and Check-up Results. The table contains 10 rows of data, with the first row selected. At the bottom of the table, there is a pagination control showing "1 2 3 4 5 6 7 8 9 10" and a "Page" button.

| <input type="checkbox"/> | Subcontractor | Discipline | Occupation Category | Name | First Work Date | ID No. | Appropriate | Check-up Results |
|-------------------------------------|---------------------|------------|---------------------|-------------|-----------------|-------------|-------------|------------------|
| <input checked="" type="checkbox"/> | DAEMYUNG GS | 플랜트 | 계장공 | 김경서 | | 641220***** | Y | |
| <input type="checkbox"/> | Italian Thai for GS | 플랜트 | Common Labor | JARIN Y. | 05-04-2007 | IG0937***** | | |
| <input type="checkbox"/> | Italian Thai for GS | 플랜트 | Common Labor | MONTAKAN T. | 05-04-2007 | IG0938***** | | |
| <input type="checkbox"/> | VPE | 플랜트 | Pipe Fitter | NIWAT K. | 05-04-2007 | VP1701***** | | |
| <input type="checkbox"/> | Italian Thai for GS | 플랜트 | Common Labor | NOANGYAO B. | 05-04-2007 | IG0935***** | | |
| <input type="checkbox"/> | Italian Thai for GS | 플랜트 | Common Labor | NOOPIS K. | 05-04-2007 | IG0934***** | | |
| <input type="checkbox"/> | Italian Thai for GS | 플랜트 | Helper | PAISARN B. | 05-04-2007 | IG0940***** | | |
| <input type="checkbox"/> | VPE | 플랜트 | Pipe Fitter | SOMPON T. | 05-04-2007 | VP1702***** | | |
| <input type="checkbox"/> | VPE | 플랜트 | QC Inspector | SONGKRAN N. | 05-04-2007 | VP1704***** | | |
| <input type="checkbox"/> | Italian Thai for GS | 플랜트 | Carpenters | SONTAYA L. | 05-04-2007 | IG0936***** | | |

Figure 2. Personal Records

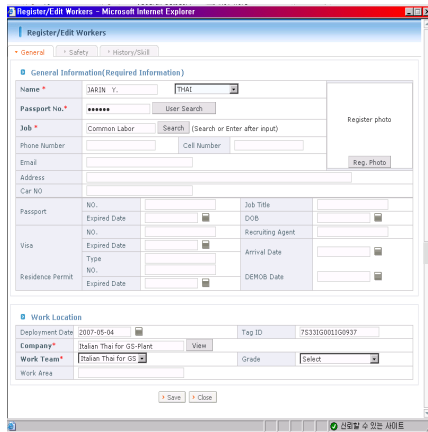


Figure 3. Personal Records Card

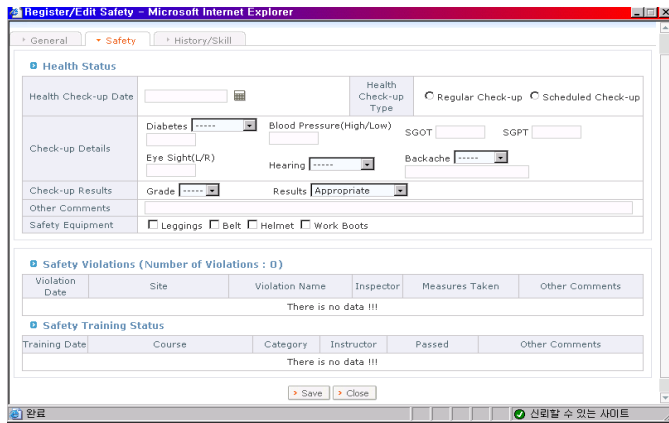


Figure 4. Safety records window

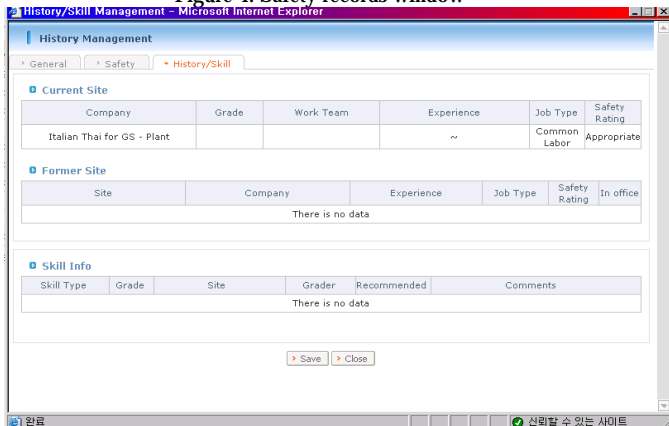


Figure 5. History/Skill window

The workforce database system allows the user to consider workforce capacity in production planning. As shown in Figure 6, for example, the user made

comments to enforce safety field supervision taking into accounts the safety records. However, there is no guarantee that employees assigned to the task will show up.

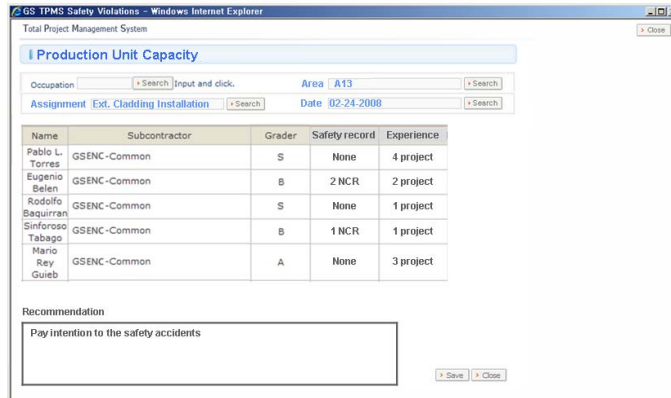


Figure 6. Example of Production Unit Capacity Screen for Production Planning

The system uses RFID technology to trace workforce information. When any labor gets into site, he or she must scan his/her ID on the RFID reader, and this information is sent to MMS (Figure 7). Then, site managers, field managers, and subcontractors can exactly know how many people come in the site, and when they arrived on the site. Besides, frontline managers also can check his/her general

information, safety records, and history and skills on site through their PDA. In case where PU (production unit) members assigned to the task in the planning are different from employees who show up on sites, a frontline manger can react times and effectively.



Figure 7. Issuing ID and scanning RFID reader



Figure 8. PDA window

SUMMARY AND MOVING FORWARD

This paper describes workforce database system which focuses on tracking workforce capacity on daily production on sites. The system also uses RFID technology to trace and

ensure that employees assigned to the task in a production planning are identical as well as to headcount workforce daily. Information on workforce capacity includes work history, skills, training records as well as personal records. The next phase of the study is on how such information

on workforce capacity is utilized in production planning to match with loads of the tasks. Other researchers working in this area are encouraged to contact the authors to share ideas and coordinate future research.

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