Feasibility Assessment of Bluetooth Based Location System for Workflow Analysis of Nursing Staff

Kikue Sato, Tomohiro Kuroda, Member, IEEE, Tadamasa Takemura, Akitoshi Seiyama

Abstract—Once Hospital information system provides places of Locations of the nursing care is. We examined the staff’s trajectory analysis based on the location system data using Bluetooth for the assessment of the workflow in the ward. To assess the feasibility of this location data, we confirmed the identification accuracy of staff’s location. These results showed potential for supporting workload evaluation by quantifying staff’s trajectory.

I. INTRODUCTION

Quantitative investigation of the nursing care is indispensable for studies on evaluation and standardization of nursing care. Previous studies utilized the standard methods such as time-and-motion study or work sampling. However, these methods require too much human resources to conduct measurements, and, consequently, they can collect limited samples of, limited period.

Hospital information system (HIS) with point of care system (POCS) enables us to measure time and tasks of nursing care for unlimited period automatically. Once HIS provide location of nursing care, we can conduct detailed analysis of nursing staff’s activities.

Kyoto University Hospital (KUHP) has introduced Real-Time Location System (RTLS).

We assessed the location data obtained by RTLS to evaluate feasibility for quantitative analysis of nursing care.

II. MATERIALS AND METHODS

The RTLS consists of proximity sensors utilizing inquiry process of Bluetooth named BTID [1]. KUHP placed BTID beacons (fig. 1 left) on each bedside and provided barcode readers (fig. 1 right) connecting to BTID as POCS terminal for nurses [2]. Therefore, when nurses ordering check at the bedside using the barcode, HIS collect task, time and location of each action.

After excluding mere errors, such as a single terminal located at multiple places, and summarized as several graphs for detailed analysis.

Additionally, the obtained location data is compared with data obtained by other methods.

*This research is partly supported by Tateishi Foundation, and Grant-in-Aid for Scientific Research 25280106 of Japan Society for the Promotion of Science.
K Sato and A Seiyama are with Graduate School of Medicine, Kyoto University, Kyoto, Japan (e-mail: kikue@gifu-u.ac.jp).
T Kuroda, is with Kyoto University Hospital, Kyoto, Japan.
T Takemura is with Graduate School of Applied Informatics, University of Hyogo, Kobe, Japan.

Figure 1. Devices of introduced RTLS

We conducted time-and-motion study of nurses in daytime shift of a ward during the following period.
1) June 4 - 8, 2012
Additionally, we conducted system tuning of RTLS by replacing the beacons for better performance and compared the obtained location data with logs of HIS; whether a nurse performs order checking of a certain patient is detected at the bedside of the patient. This comparison is performed in the following period.

III. RESULTS AND DISCUSSIONS

The probability to locate a certain staff to wrong room was 5.9%, 8.8%, and 3.3% for period 1), 2), and 3), respectively.

The summarized data tells nursing staff visit patient frequently around 9 and 14, and nurses stays much longer period at bedsides of patients requires intensive care. The findings fit quite well with common knowledge about nursing care.

IV. CONCLUSION

This study confirms the feasibility of the RTLS based on BTID for nursing care analysis. The utilization of location data may provide quantitative measure to assess process workflow. Further studies are needed to find proper visualization method to contribute workflow analysis of nursing staff.

REFERENCES