

Comparison of Software Methodologies used in existing Instrument Tracking and Maintenance Systems

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Abstract— Most hospitals perform numerous surgeries per day. All of which require an intensive instrument inspection, contamination, and sterilization. All surgical instruments used in a hospital are being handled by the Central Sterilized Supply Division (CSSD). These instruments after being sterilized, are supplied to different wards in the institution. Also, all these instruments need to be maintained. They often get damaged or degraded, thus it is necessary to get repaired before using again. In this manner, once they are sent to different parts of the building, they cannot be traced and may get lost. University Hospital KDU has no such system to track down surgical instruments. In this research project, I will be aiming to develop a Web-based system tracking down the instruments during the sterilization process. Here I will discuss which methodologies I would use to develop the system that covers most of the required functionalities. The system would comprise QR codes attached to each instrument kit. The system at CSSD would scan the QR code of the instruments which come and go out of the facility. Also, record to which unit they are transported to, and the number of the instruments sent. On the other hand, record how many instruments returned to the CSSD, and if any discrepancy, identify the cause. The system located at the CSSD must be electronically linked to other computers stationed in different units of the hospital and be capable of accessing the data associated with the instrument kits.

Keywords— Central Sterilized Supply Division, Health Data Management, Health informatics

I. INTRODUCTION

Many hospitals are considering new ways to increase their patient population. For many

facilities, the challenge becomes how to attract more patients while remaining efficient and cost-effective. One-way hospitals make money is through the multiple services they offer such as surgery. An increase in surgeries means an increased demand for sterile processing [1], which may result in higher volumes. Generally, the sterilization process of a hospital is handled by the Central Sterilized Supply Division (CSSD). All types of instrument kits are stored at the CSSD. They decontaminate, inspect, repair, recycle, and sterilize used instruments thereafter providing rapid, efficient, and low-cost maintenance and repacking

used instruments for reuse at the hospital. Systems that perform monitoring/tracking of surgical instruments in hospitals are presented in this review. [2] The surgical instrument tracking systems are in the prototype stage, whether in the literature or the industrial sense. The result of these studies has shown that there are three main points needed to make this system successful: a user-friendly interface (easy to use), efficient (quick and can save time), and dynamic surgical instrument tracking system (can provide depth with depth awareness). According to an article by The Washington Post, the shortage of surgical instruments is a global problem, especially in developing countries. Thanks to these kinds of systems hospitals can track the whereabouts of surgical instruments and identify missing items more quickly. The instrument tracking and maintenance system combine just-in-time inventory control methods and ideas with computerized data input and tracking systems and reusable surgical instruments designed for speedy disassembly and repair [3]. The facility for sterilization and maintenance of surgical instruments is remotely located so that it can serve any number of units located at different parts of the medical center. Also located at the sterilization and maintenance site is a host computer that manages and tracks down the flow of information about instrument kits within the system, including data on shipping and receiving units. Attached to each of these data terminals are bar code readers which can identify and track instruments automatically entered into the system. Accordingly selecting the appropriate instrument kit for a procedure is made through the system. It is then identified using the code label and arranged for shipping. Once the kit is received by the appropriate terminal, an acknowledgment is sent.

Another objective of the system is to maintain the instruments. Certain instruments after surgical procedures must be recycled or repaired for reuse. Thus minimize the expense which a hospital is dedicated to maintaining reusable surgical instruments and related equipment.

Table 1. Summary of Literature

Reference	Title	Techniques and Novelty
[4]	Surgical Instrument inventory	This invention pertains to techniques and devices for tracking products in general,

	database management system	and more specifically to a system in which surgical instruments are tagged with computer-readable symbology that is utilized to insert number pointers into an automated inventory management system.
[5]	Process and device for the monitoring and control of the flow of material in a hospital	This invention's object is to record, monitor, and control the material flow of units circulating in a hospital each having its identification. The identification number is advantageous to identify that type of instrument or device it is and makes monitoring the holding time in transit stations, frequency of repairs, etc.
[6]	Method for marking, tracking, and managing hospital instruments	This invention uses an optically scannable unique serial number for each instrument to perform one or more hospital procedures and enters information into the database that identifies each hospital procedure in which each instrument has been used. The present invention may also be utilized to track the sterilization and maintenance of each hospital instrument, determine whether or not an instrument needs to be replaced, provide training, and track the number of uses, repairs, and complaints connected with each instrument.
[7]	Security infusion pump with a bar code reader	The present invention provides an infusion pump with a bar code scanner and a display for infusion data scanned from a barcode label on a medicinal fluid container to overcome certain inadequacies and decrease certain complications of earlier bar code scanner infusion devices and systems. Pump control software displays the name of the medicine recognized by the bar code label after reading information from the label of the container of medicinal fluid. If not computed, the

		program also records the concentration, concentration volume, volume to be delivered, and infusion rate.
[8]	Electronic system for tracking and monitoring articles to be sterilized and associated method	The technology employs a sterilization indication that electronically links sterilization data to the objects that have been sterilized. The indication provides for the monitoring of a sterilization cycle without requiring a user to subjectively discern between color, quality, or intensity of display patterns.
[9]	Safety surgical sterilization tool and system	An individual coding machine is included in the system, which codes each surgical tool and assigns it a unique identification number that can be scanned. The primary procedure comprises a database that is linked to individual checkpoints and will sound an alarm if each procedure is not followed.
[10]	System for recycling of medical instruments in a central sterilization unit	System for reprocessing medical instruments in a central sterilization department, in which the instruments are given an identifying code that is utilized in the sterilization department's packing section for packing and screening, as well as to update a central database.

II.METHODOLOGY

The methodology of tracking surgical instruments in hospitals comprise the steps of:

- a. transmitting data identifying surgical operations planned to be conducted at said hospital during a scheduling period from a data terminal at the said hospital to a host computer;
- b. assembling a group of said cleaned and sterilized instruments into instrument kits at an instrument maintenance facility separate from the said hospital, each of said kits matching to one of the said surgical procedures;
- c. moving tool kits conforming to said planned surgical procedure data sent from said

hospital to said host computer via carrier from said maintenance facility to said hospital;
d. following usage at said hospital, delivering said instrument kits by the carrier to said repair facility; and
e. At said maintenance facility, said equipment from said instrument kits are cleaned and sterilized.

In the comprehensive literature review, I have conducted comprehensive research through a wide range of literature sources to find out the available software development methodologies and compare their advantages and disadvantages. Most of the software developed followed methodologies like the Waterfall model, Spiral model, and Agile model.

III. RESULTS AND DISCUSSION

According to my findings, Surgical instrument tracking systems are in the prototype stage, either in the literature or in the real world. Especially in developing countries preventing the loss of these highly expensive instruments is much required. It is the first time introducing an Instrument tracking and maintenance system to University Hospital KDU. Aiming to prevent loss of surgical instruments and determine any missing surgical equipment more quickly and effectively.

I performed an in-depth survey of the existing methodologies and noticed some patterns, like flaws. I evaluated each scenario and presented all the possible solutions and their advantages and disadvantages in comparison with each other. Finally, identify which methodology suits the project best.

IV. CONCLUSIONS

After researching the methodologies, I have concluded that Agile is the best methodology to carry on my research since it has core benefits such as satisfied customers, improved quality, adaptability, predictability, reduced risk, and better communication.

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