Deployment of a tag-based system to ensure traceability management of parenteral nutrient mixtures

Dr. Javier Sanz-Valero - University Miguel Hernández, Elche, Spain (jsanz@umh.es) / University of Alicante, Alicante, Spain(javier.sanz@ua.es)
Luis M. Álvarez Sabucedo - University of Vigo, Vigo, Spain
Dra. Carmina Wanden-Berghe - University General Hospital, Alicante, Spain
Victor M. Alonso Roris - University of Vigo, Vigo, Spain
Juan M. Santos Gago - University of Vigo, Vigo, Spain

Rationale

• Management control and traceability of medications improves patient care, ensuring treatment adherence.

• To develop a mobile technology platform that efficiently and in a non-intrusive way allows the implementation of control procedures and traceability in the domain of parenteral nutrient (PN) mixtures.

Results

• A mobile application for the Android operating system was developed to support this task.

• The above mentioned application can read the different types of tags and is able to interact with the local server according to a defined schema.

• Additionally, by means of a internal cache support, it is ensured the availability of the system even in the event of occasional problems with the network connection.

• 1040 test traces were generated in the frame of the above mentioned control environments. Among all the test traces, 102 traces (9.81%) reflected unfavourable situations. Nevertheless, this paper presents solutions to cope with these detected situations.

• In no event, traceability failure was detected. All captured traces were stored in the records of the system.

Material and Methods

• A comprehensive approach that combines techniques of software engineering and knowledge engineering was used for characterization of the framework. Tags used were: QR, DataMatrix and NFC.

• Experiments on controlled environments for evaluation were conducted within various application areas, carrying out a test/retest study to detect possible errors or conflicts in different contexts and control processes throughout the entire cycle of PN. From that data, the absolute and relative frequencies (percentages) were calculated.

Conclusions

• It was generated and tested a system based on mobile technology that allows enhanced control and quality management of parenteral nutrient mixtures. The model is easy to incorporate into regular praxis of healthcare processes.

Table 1: frequency and percentage of errors (desfavourable situations) identified in the assessment of the management and traceability platform and provided solutions.

Desfavourable situation	f_0	%	Solution
The QR tag was stain and was not readable	9	0,87	Laminating labels
QR tag was attached to a surfaces with a large curvature and it was not readable (the camera was not able to capture a defined image of the whole QR code)	11	1,06	Reducing the size of the label to minimize the curvature radius or change of location to a nearby flat surface
In poorly lit places, the camera was not able to read the QR tag	5	0,48	While reading, the application triggers a flash to illuminate the corresponding surface
The NFC tag could not be read as it was attached to a metallic surfaces	9	0,87	Replacing basic NFC tags for special NFC tags designed to be used on metallic surfaces or placing them on another spot
The NFC tag was located behind a plastic sign on the door and could not be read	14	1,35	Remove any surface between the mobile and NFC tag
Unable to log on to the application when offline the first time the application was used on that mobile device (no pre-existing cache contents)	6	0,58	The system requests the user to log in, at least the first time, in an online context.
The user, trying to read the tag, notes that battery is empty	2	0,19	User training (no solution in the application)
The user typed a decimal value by entering a comma instead of a period. As result, data is misinterpreted	21	2,02	Using the period button was blocked in the application
The system notified that it was impossible to invoke the service when the form was including incorrect values. No hints on the wrong values were provided.	6	0,58	The application was updated to show a warning message when wrong data is detected. Also, information about accurate expected values is presented.
In the input form, when trying to send multiple documents (eg photographs) with the same name, the server could only recover the last one.	4	0,38	A mechanism is implemented in the application to avoid conflict in file names
Possibility to leave mistakenly the input form, resulting in losing all data entered so far.	1	0,10	The application was modified so that when trying to leave the input form, it is reported that the data filled would be lost and an explicit confirmation is requested
The implementation required to have the GPS service active to inform the server about the location of the operator in each of the traces generated. This circumstance caused a high battery consumption.	14	1,35	The initial mechanism to recover coordinates based on continuous queries was replaced by an intelligent mechanism that checks the GPS service according to the mobility over time shown by the user.
Total	**102**	**9,81**	