Enhancing an example of human-system interaction with usage logs: an Azurion case study

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Where innovation starts

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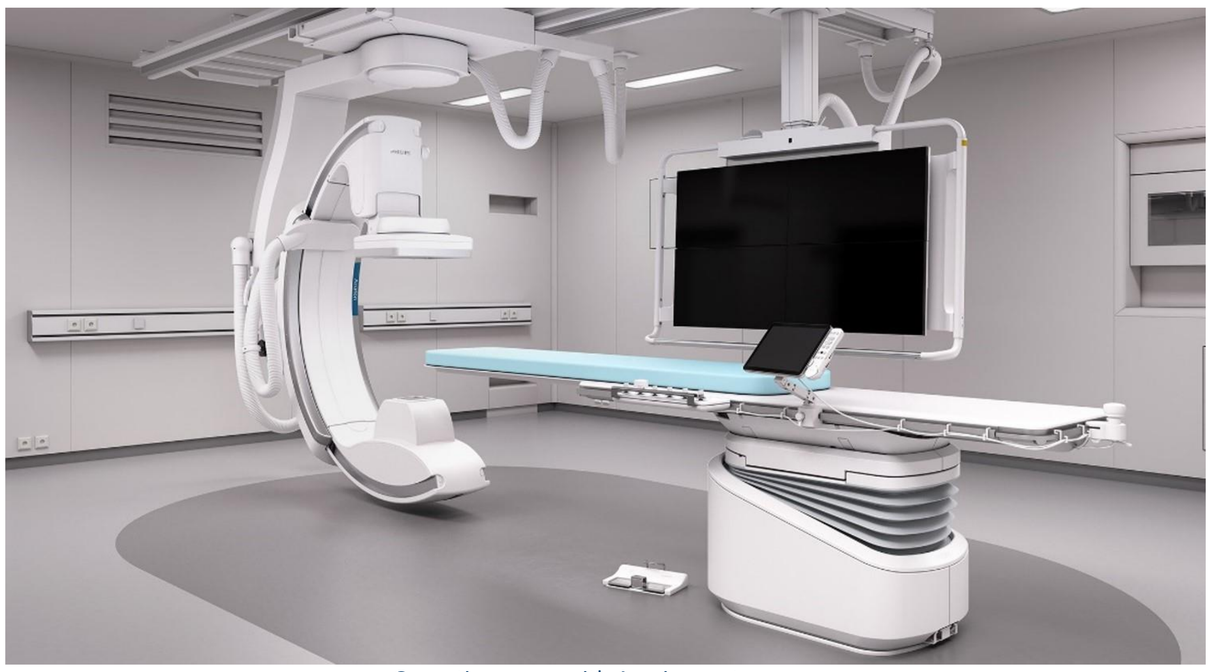
Introduction

The Philips Azurion system: It is an **interventional X-ray machine**. It is an **image-guided therapy** platform that allows users to efficiently perform interventional procedures, optimize lab performance and provide superior care.



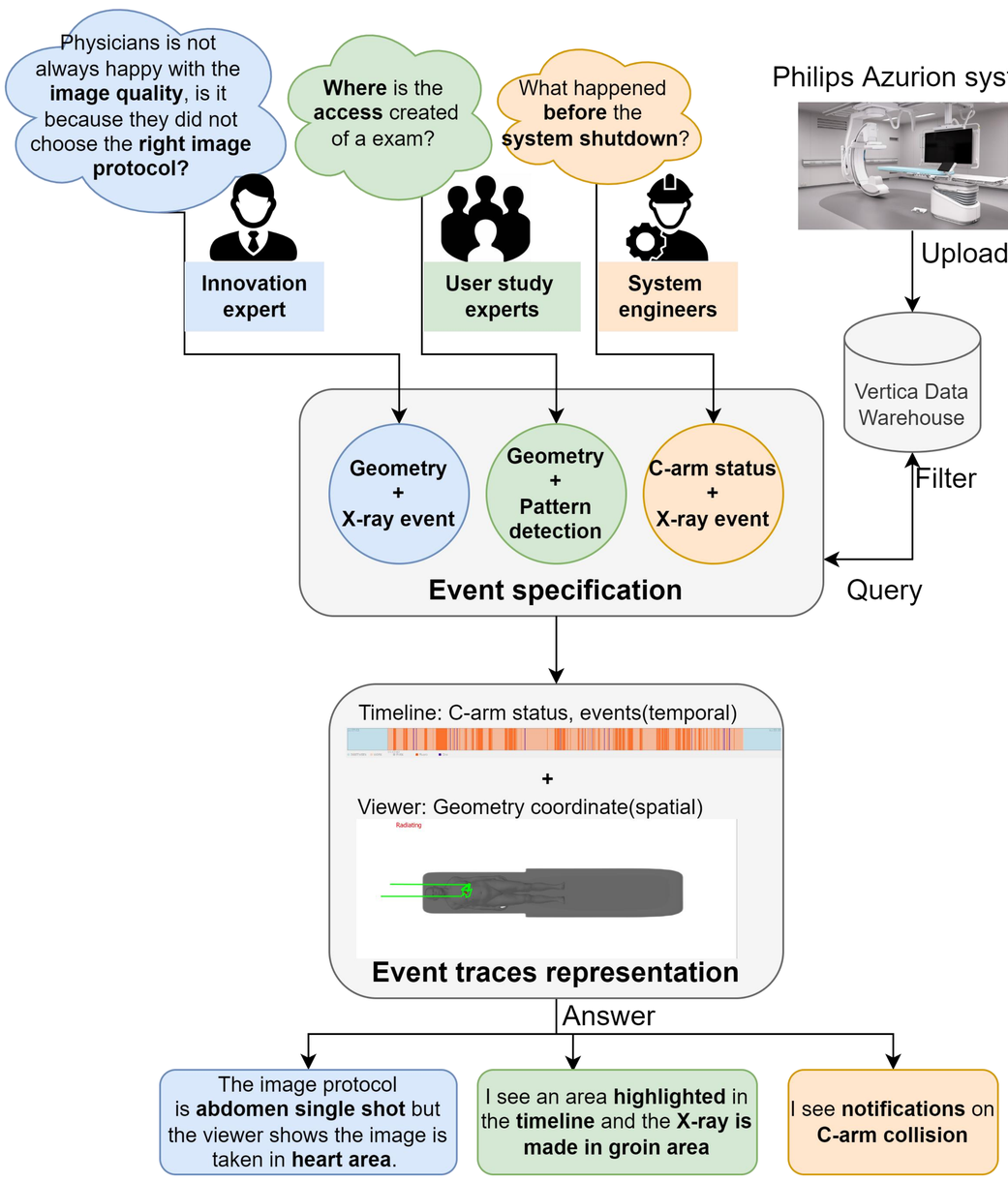
Operation room with Azurion system

Currently, Philips experts want to **study user behavior** to find possible enhancements in the workflow of human-computer interaction systems, specifically, the Philips Azurion system. Unlike observation or interviewing, which requires active and subjective interpretation, system usage data offers an **objective**, **system-centric** way of recording the use scenario. Thus, this project aims to improve the user behavior study by **presenting** the **user activities** from **usage logs** to reconstruct the **use scenario**.

Analyzing usage logs so that they can be used to reproduce use scenarios is challenging. Firstly, usage logs record all level interactions, requiring sufficient background knowledge of the system design and the ability to clean and process the data. Second, the system log is not user-centric. If the user does not interact with the system, the system will not log this part of the activities. Thus, we need to find a proper way of representation that can **translate usage logs to user-centric contextual information**.

Event-based Visualization Design

Both **spatial** and **temporal** dimensions are crucial for the case study. Thus, we adopt an event-based visualization concept that only allows temporal dimension, and adjust it to suit our case study, making our representation of usage logs **more tailed to users' interests**. A visual representation of our framework is in the following figure.



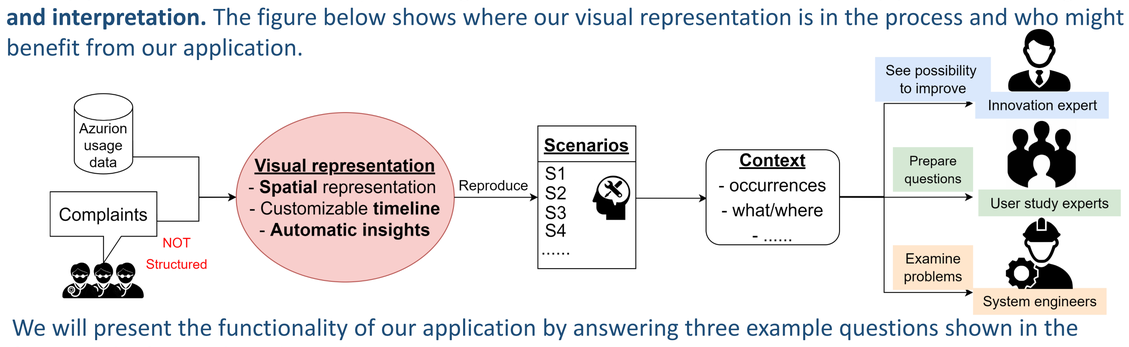
Future Direction

Our application still has limitations, and we have some directions for future development.

- Accurate radiation area: Consider the angulation, rotation, wedges, and shutters to make a visualization of the radiation '**area**' instead of a point.
- Object detection with **dose** usage safety issues: Analyze whether the medical stuff follows the instruction of dose usage by showing the dose safe zone using a physical model of dose and detection of the shield and stuff.
- **AI** algorithm: Show also AI-detected events like the patient on/off the table on our timeline and 2d table viewer. Create labels for the access creation location/radiation body part for AI algorithm training.

Retrospective visual analysis application

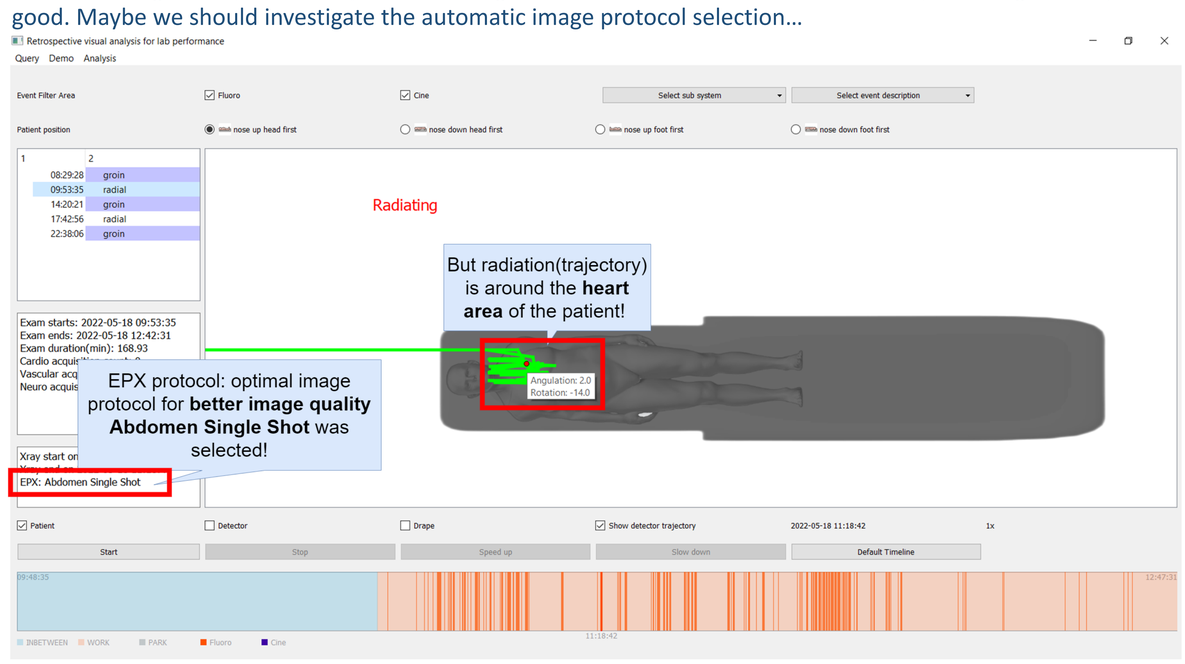
In order to realize the design concept, a retrospective visual analysis application is implemented. We use ground truth from the usage log to reproduce use scenarios, which will give contextual information that meet different people's interests. Three outstanding features of our application are: (1) **A spatial representation of the radiated area**; (2) **A customizable timeline presenting traces and events for users' interests**; (3) **Automatic insights creation and interpretation.** The figure below shows where our visual representation is in the process and who might be benefit from our application.



We will present the functionality of our application by answering three example questions shown in the framework of event-based visualization design.

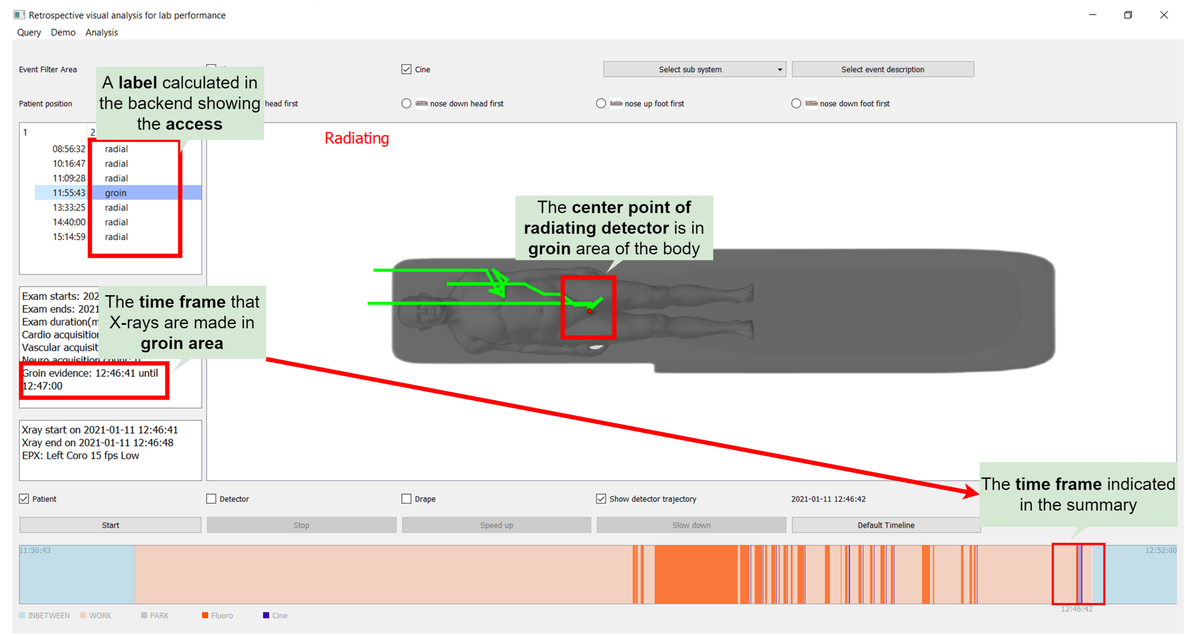
Question 1: An innovation expert receives feedback that physicians are not always happy with the **image quality.** Thus, he/she wants to see whether this is caused by a wrong image protocol selection.

Answer 1: The radiation area in the table viewer is around **heart area** but the image protocol was selected as **Abdomen** Single Shot, which is optimal for images at abdomen area. We understand why the image quality is not good. Maybe we should investigate the automatic image protocol selection…



Question 2: A user study group wants to know more about the **access creation** phase(an access allows catheters to go into the blood vessels) during the exam. Where is the access created during one exam?

Answer 2: A column on the left indicates 'groin.' In the exam summary, a period that all X-ray events are made in the groin area is written, and clicking on the timeline, see the radiation area is in the groin area. (Potential question: Why they move to groin area at the end of the exam?)



Question 3: A system engineer receives a complaint about a sudden system shutdown at a given timestamp. He/she would like to know what happened before this shutdown.

Answer 3: There is a notification about the **C-arm collision** before the shutdown. Let's see whether collision may trigger some faulty issues.