ORCAV:
Medical Imaging Service for Rural Areas in Indonesia

Elbo S. Pangestu, Hari Setiaji, Irving V. Paputungan, dr. Muhammad N. Imansyah

Research, Innovation & Creativity Exhibition

Background

Several medical misdiagnosis or malpractices often occurred in some rural areas in Indonesia. One of the reasons is because the patient medical image (e.g., X-Ray) is normally sent to the doctors by the clinicians via messaging application. The quality of the image is greatly reduced in such practice. It makes the image analysis becomes weak as well. Such situation regularly happens during weekend when the doctors are not fully in the hospital. Almost all of healthcare provider in rural areas in Indonesia has no Picture Archiving and Communication System (PACS) at the moment. They only share any images taken from any modalities by messaging application.

Objective

Develop affordable support systems that works as PACS for mid-level hospital or clinics in Indonesia.

Method

Employ the common Software Development Life Cycle (SDLC) methodology called Waterfall because of its simplicity.

Requirement

The development of Orcav, a Picture Archiving and Communication System (PACS) software, originated in 2018 when dr. Imansyah, a medical student at that time, identified a pressing need. dr. Imansyah recognized the challenges faced by healthcare professionals in accessing and managing medical images efficiently. He began by conducting extensive research and speaking with colleagues to understand their pain points. Through surveys and discussions, he gathered a comprehensive list of features and requirements specific to a PACS solution for rural healthcare settings.

System Design

With a clear understanding of the unique needs of rural healthcare providers, the Orcav team moved on to the design phase. They outlined the software's architecture, emphasizing scalability and security, and tailored it to the limited resources available in rural areas. dr. Imansyah collaborated closely with software designers to create an intuitive user interface, ensuring Orcav would be user-friendly for healthcare professionals in his region.

Coding and Implementation

Development commenced with a small, dedicated team of programmers who shared dr. Imansyah's vision. They started by building the core functionality of Orcav, focusing on image storage, retrieval, and secure transmission. As they progressed, they iteratively added features such as remote diagnostics, patient record integration, and multilingual support. The team adhered to international standards for medical software development.

Testing

Orcav's testing phase was meticulous, considering the critical nature of healthcare data. Testers, including medical professionals, rigorously examined the software, using a combination of automated and manual testing methods. They simulated various clinical scenarios, identified and rectified bugs, and ensured the software performed flawlessly and securely. The iterative development process allowed for continuous testing and refinement.

Deployment

After months of development and rigorous testing, Orcav was ready for deployment. The team worked closely with the hospital to set up secure servers and an infrastructure tailored to the region's connectivity challenges. Orcav's launch was a significant event for the hospital, streamlining image management and diagnostics. dr. Imansyah provided training to the hospital staff, ensuring they could maximize the benefits of the software in their daily workflows.

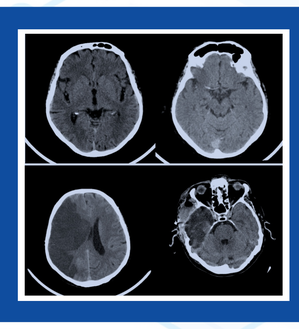
Maintenance and Support

Following the successful deployment of Orcav, the hospital in rural Indonesia saw remarkable improvements in healthcare delivery. dr. Imansyah, now a medical doctor, along with a dedicated support and maintenance team, diligently addressed user inquiries, resolved issues promptly, and released regular updates to enhance the software's capabilities. Orcav became an essential tool for healthcare professionals, enabling them to provide better patient care in a region where access to advanced medical technology was previously limited.

Case Study

Cerebral Hemorrhage

New patient with Cerebral Hemorrhage suspect was coming to the ER after office hour and performed CT Scan. Since the doctor was not available, the result reading was conducted in the next day. That was very late decision in the Golden Hours point of view.



Source image: https://radiopaedia.org/cases/ischemic-stroke-1

Otorhinolaryngology

There was once a young child who had to undergo neck surgery because they were diagnosed with swallowing a paperclip (turned-out to be a cable based on X-ray picture). Before any action was taken, X-ray data was needed for the child. Due to the X-ray quality, nothing was seen in the picture in the first place.

Source image: Tim B. Hunter and Mihra S. Taljanovic, radiologykey.com

Bone Fracture History

Traditional communities still keep X-ray images haphazardly, making them easily lost or damaged. Consequently, if one needs to check the condition of a broken bone after some time, it becomes relatively difficult, and retaking the X-ray may be necessary.

Source image: researchgate.net/publication/257302417_Digital_Radiology_to_Improve_the_Quality_of_Care_in_Countries_with_Limited_Resources_A_Feasibility_Study_from_Angola

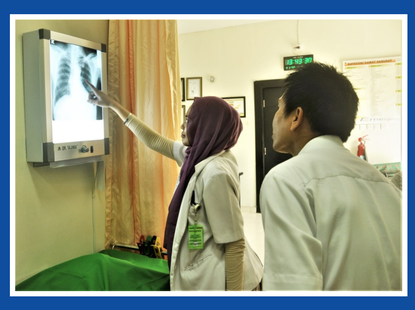
Hairline Crack

The occurrence of a hairline crack in a 9-year-old child's bone initially diagnosed as 'nothing happened' due to the quality of picture read by clinician.

Source image: Gerry Gardner, Radiopaedia.org, rID: 13908

Medical Image Sharing

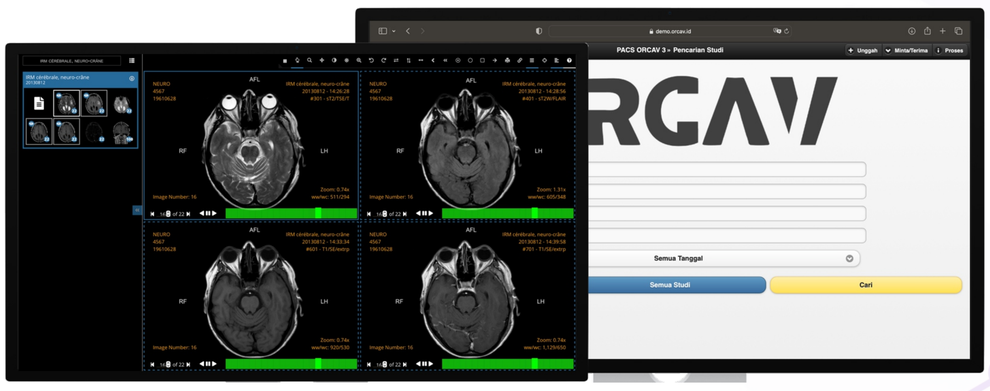
Communication between nurses and doctors in the hospital often involves sharing X-ray or medical imaging results through messenger applications, resulting in the easy dissemination of data with subpar quality. Furthermore, when it comes to sharing data with researchers, the hospital's stored image records are not well-documented, making them difficult to distribute.



Source image: bhaktirahayu.com

Result

ORCAV as a prototype of PACS has been developed to support medical image archiving and sharing among medical practitioners.



Conclusion

ORCAV is able to collect medical image data from connected modalities and communicate them to the doctors. Testimonial from some doctors say that ORCAV (the prototype) is able to perfectly support their work from home or when they are not in the hospital.