

Project Summary

Major advances are taking place in the fields of medicine and technology. The challenge is to bring the emerging technologies to improve the quality of healthcare. The use of pervasive devices and communication enables “anytime, anywhere” access to patient data. The proposed research contributes towards this objective through enhancing timely data exchange among patients, physicians, nurses, and other professionals involved in healthcare delivery. We propose a framework that enables distributed and pervasive data access in healthcare, focusing on key aspects including integration, privacy, and usability. Our research team brings together expertise in mobile and wireless computing and communications, middleware, context modeling, security and privacy, usability, as well as healthcare.

Intellectual Merit

Integrated middleware: Models for context inference and validation will be developed considering subjective dimensions such as social and personal situations. Schemes for context-aware data protection and workflow-level data access management will be developed. A middleware system prototype will be tested in a laboratory and then deployed and evaluated in a real hospital setting.

Privacy and access control: The implications of providing data access via pervasive devices in terms of privacy and trust will be investigated. The vulnerabilities in pervasive data access and potential attacks will be identified and mechanisms to enable fine-grained access control and to provide usable interfaces for enforcing trust and privacy will be developed. These mechanisms will be implemented in the middleware and evaluated in terms of completeness of enforcement in various contexts.

Usability of pervasive devices and technologies: This research will contribute to the evaluation and development of better user interfaces of pervasive devices for diversified populations, including patients and medical professionals. The control mechanisms of data access in the hands of patients will be studied in order to increase usability as well as privacy protection.

Deployment and evaluation in hospitals and clinics: The established partnership between the research team and medical institutions provides a unique opportunity to evaluate pervasive technologies by medical professionals in real medical facilities. Experience, benchmarks, and metrics will be obtained through experiments and measurements in compliance with HIPAA regulations and other American Medical Association guidelines.

Broader Impact

Our proposed research will contribute to the improvement of healthcare using pervasive technologies. The pervasive access of information will lead to higher robustness of medical care and cost-effectiveness. Timely data exchange will result in better preparedness and immediate medical aid during disasters and terrorist attacks. The usability study will allow the deployment of new devices in the hands of general populations which will empower them with control over data about themselves.

We will provide middleware and software tools to hospitals and clinics and work closely with medical professionals in order to achieve technology transfer for use in a larger setting. This will help increasing the awareness and interest of the healthcare community in adopting advances in computer science. Undergraduate and graduate courses in computer science, nursing, and psychology will be enhanced to reflect the latest advances in pervasive computing, privacy, and usability.

We will contribute to the outreach programs, through the well established activities at the Center for Education and Research in Information Assurance and Security (CERIAS) at Purdue University. Five women (two of them minority) graduate students will participate in this research effort. The PIs will involve undergraduate minority and women students in the project through the EPICS Program (Engineering Projects in Community Service).