Project summary

To fight soaring health care costs and simultaneously increase the quality of health care, many researchers are turning to the technologies of robotics and intelligent systems to find solutions. Over the last decade, there has been an explosion of robotic applications in health services. Given the increasing adoption of robotics technology in health care, is there reason for concern? There are in fact two reasons. The first involves the safety associated with autonomous robots. Future systems, will yield more autonomous control to the robotic system. Starting with routine tasks such as suturing, future systems may be capable of completeing full procedures [ref]. The concern is that when robots are required to perform autonomous actions in close proximity to humans, serious issues of operator and patient safety arise. The second reason for concern is that all systems are subject to failure. Current systems notify the operator when a component nears the end of it reliable lifetime. However, there are no methods employed in practice which address issues of patient or operator safety if a component was to fail *during* use.

The objective of this research is to address these concerns through several technical and experimental specific aims. To make robots safer during autonomous operation, we propose to develop an inherently safe, real-time control and planning algorithm based on novel velocity field control algorithms which will avoid collisions with people in the workspace of the robot. We understand that no safeguarding system can ever be perfect, that is, risk free. Therefore we will also apply qualitative and quantitative methods from safety engineering to fully characterize the relative safety of the control and planning algorithms we develop. To make robots more robust to component failure during operation, we are proposing the development of novel fault models and nonlinear estimation methods to detect and quantify/identify unexpected behaviors from the human and robotic system. Finally we will experimentally assess all developed algorithms on a novel, roboticly actuated X-Ray imaging platform being developed in parallel at the University of Florida.