

## 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 biopsies, future systems may be capable of completing full procedures. 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. However, new algorithms for collision avoidance or real-time control are published with no characterization of the improvement in failure probability or some associated measure. Beyond safety concerns, new generations of robotic systems are being developed for rehabilitation and diagnostic tasks. Unlike surgical robots, these platforms must interact with awake and alert humans to perform their task. To date, little work has been done to quantify the effects autonomously operating machines or robots have on awake and alert patients. We need to understand if the measurement system (robotic system) has an impact on the system it is attempting to measure (patient).

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 quantitative methods from safety engineering to fully characterize the relative safety of the control and planning algorithms we develop. Finally we will experimentally assess all developed algorithms on a novel, robotically actuated X-Ray imaging platform being developed in parallel at the University of Florida.