The Intelligent Medical Stapler: Ending the Emergency Room Crisis

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Emergency rooms are overcrowded with patients who need treatment for lacerations, the most common injury after a broken bone. Such injuries require a simple treatment, sutures or staples; yet, a doctor must complete the procedure. As a result, doctors waste their valuable education on simple stitching for sometimes half their day. The goal of this project is to design a prototype robot which can perform medical staple autonomously, taking the burden of treating lacerations off of doctors' shoulders. Overtime, the design of a delta robot with six axes of rotation and camera tracking were selected to complete the task. The base is a rotary delta system. This robot uses three motor powered arms, with three joints per arm, which connect to a parallel end effector. This end effector is host to a rotational plate; this component allows the robot to follow curved lacerations. A tilting platform is offset from the rotational plate to perform staples along the side of a patient. A majority of the components are 3D printed parts, with some metal and wooden supports. The tilting plate is the final end effector and can move along six different axes. A USB camera and a medical stapler are attached to the final end effector. During testing, the robot held up to significant stress testing, and the motors were able to achieve a twenty percent margin over the desired range of motion. The computer vision software identified a majority of skin and lacerations effectively, and the kinematics of the delta robot translated effectively into Cartesian motion. In the future, through further development to increase precision, the Intelligent Medical Stapler can transform overcrowded, overworked Emergency Rooms into hubs of medical innovation.

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