THE KOREAN SOCIETY OF NEPHROLOGY
APCN & KSN 2024
June 13(Thu) - 16(Sun), 2024 Coex, Seoul, Korea
APSN
Promoting Sustainable Kidney Health: The Asia-Pacific and Beyond

Abstract Submission No.: A-0524

Robot-Assisted Kidney Imaging: Transforming Kidney Ultrasound Practices

Muhammad Umair Ahmad Khan, Farhan Ali, Nazli Khuram, Menahil Khalid
Department of Biomedical Engineering, University of Engineering and Technology Narowal Campus, Pakistan

Objectives : Ultrasound imaging is a critical tool in medical diagnostics, extensively used for kidney examinations among other applications. However, the manual operation of ultrasound probes often leads to musculoskeletal disorders in sonographers due to prolonged and repetitive use. The advent of COVID-19 has further complicated the scenario by adding the risk of infection during close patient interactions. To address these challenges, we propose robotic system, designed to operate on master-slave principle, thereby reducing physical strain on sonographers and minimizing infection risks.
Methods : Our design integrates a robotic arm capable of holding and manipulating an ultrasound probe with precision. The system operates on a master-slave principle, where the movements of a master controller are replicated by the slave robotic arm. This setup is enhanced with ultrasonic sensors and force-sensitive resistorsto ensure collision avoidance and provide haptic feedback, respectively. The device's effectiveness and safety were evaluated through a series of controlled tests, simulating kidney examinations in a clinical environment. Parameters assessed included accuracy of probe positioning, user ease, and safety in terms of collision avoidance.
Results : The robotic system for kideny ultrasound demonstrated high accuracy in probe manipulation, closely replicating the movements directed by the master controller. The collision avoidance system effectively prevented any unintended contact, ensuring patient safety. User feedback indicated significant ease of operation and reduced physical strain. Importantly, the device enabled remote operation, markedly reducing the risk of COVID-19 transmission between healthcare providers and patients.
Conclusions : The robotic system for kideny ultrasound shows promise in revolutionizing kidney examinations by enhancing sonographer safety, reducing the physical toll of ultrasound procedures, and minimizing infection risks in pandemic situations. Its precision, safety features, and remote operability present a significant advancement in ultrasound imaging technology. Further studies are recommended to explore its application in other areas of ultrasonography and to assess long-term impacts on clinical practice.