Enhancing Video Capsule Endoscopy: Location and Bleeding Detection

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Video capsule endoscopy (VCE) is a method used to wirelessly scan the gastrointestinal (GI) tract lumen. Despite the effectiveness of VCE in GI endoscopic procedures, VCE is limited because it lacks the capability to exactly locate itself as well as accurately detect bleeding or clotting within the GI tract. The unreliability of localization combined with inaccurate blood detection in VCE ultimately leads to wired endoscopy for additional diagnosis. In this paper, a method to address localization of the VCE device, also known as a pill camera or capsule, in conjunction with an accurate detection of active bleeding and clotting inside the small intestine, is introduced. The Texas Instruments, ZigBee® kit, which uses a 3D trilateration method will be used for accurate location detection and image transmission throughout the VCE procedure. The system will be interfaced with software providing end users with the path and total distance traveled by the pill capsule within the small intestine. The blood detection system is enhanced by using a minilow energy wireless Raman spectrometry to scan for active bleeding or clots along the small intestinal wall. The employed spectrometry method scans for wavelengths based on blood's optical characteristics and records any image fitting the exact spectrum. Blood detection and localization data are coupled together and then transferred to an external receiver. These two improvements together will enhance capsule endoscopy procedures and fill the gap created by the existing capsule endoscopy technologies, therefore, meeting the needs of physicians and patients.

Design of a Compliant Steerable Arthroscopic Punch

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Meniscectomy is a medical procedure where ruptured meniscal tissue is removed within the knee joint. The conventional cutters fail to reach the entire meniscus. Therefore, the focus of this study is to create a steerable joint, which allows sideway steering of the tip to increase the reachability within the knee joint. Additionally, the steerable joint is required to be robust to transmit a cutting force of up to 190 N. The mechanism design is divided into the functions: steering and actuating cutting mechanism. The most promising solution of these functions was combined and resulted in the use of a crossed configuration of a compliant rolling-contact element for the instrument joint. Flexural steering beams actuate the rotation of the joint using the principle of a parallelogram mechanism. The prototype has a range of motion of +25 deg and −22 deg with a steering stiffness at the handle side of 33 N mm/rad. An axial load of 200 N on the tip corresponded with a parasitic deflection of 4 deg. This unique type of steerable instrument shows potential to be functional in meniscectomy due to the great robustness of the joint.

