Research PreProposal

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1. Title

Development of WCE to increase its uses through clinical engineering

Introduction

Currently, traditional endoscopy involves passing a long, flexible tube equipped with a video camera down the throat of the patient or through the rectum. Wireless capsule endoscopy (WCE) is the most advanced technology for non-invasive visualization of the gastrointestinal (GI) tract. WCE uses a tiny wireless camera that takes pictures of the digestive tract. The camera sits inside a vitamin-size capsule administered orally. As the capsule travels through the digestive tract, the camera takes thousands of pictures that are transmitted to a recorder fitted in a waist belt on the patient. That helps doctors see inside the small intestine - an area that isn't easily reached with more-traditional endoscopy procedures. After completing the scanning, the capsule will be flushed out from the patient. The capsule endoscopy has also been approved for the screening of the colon for colon polyps where the conventional colonoscopy cannot be done. Major advantage of the WCE over the traditional endoscopy is that the patient will not be sedated, and the procedure can be done as an out-patient, without admitting in the hospital ward. However, there are some technical problems that reduce its use in diagnosis and treatment such as battery life time, image resolution, capsule size, real time view, movement of the capsule inside the body and biocompatibility. We will be resolved one or more of these problems by modified design and install new component and tools.

2. Research Question

How Solve the WCE problems to increase the uses of WCE?

4. Previous Research (Literature Review)

Capsule endoscopy entered the domain of clinical gastroenterology in the year 2001 with the clearance by the Food and Drug Administration (FDA) and obtaining CE Mark certification. The journey from conception to implementation

started 20 years earlier. In 1981, Gavriel Iddan had taken an interest in medical imaging and spent his leave to study X-ray and ultrasound imaging for Elscint (a company dedicated to medical imaging) in Boston. His neighbor, Eitan Scapa, gastroenterologist

spent his sabbatical in a medical institution in Boston as well. The two befriended each other and Iddan learned about the use of fiber optics in the gastrointestinal tract. Scapa explained to Iddan that the technology of fiber optics left the small bowel out of reach for medical inspection. That is when Iddan became aware of the medical challenge and started thinking about solutions. In the meanwhile, small charged coupled device (CCD) imaging chips reached the market. Ten years later, on a second sabbatical, Iddan considered using the CCD miniature camera connected to an electrical umbilical cord. The length of the small bowel precluded this option. That is when he suggested cutting the umbilical cord, in its stead attaching a mini transmitter to the CCD camera and letting the device travel on its own. However, the CCD elements consume a lot of energy and miniature batteries would permit at best 10 min transmission time. More problems accumulated. How would the capsule guarantee adequate visibility, debris could obscure the surface of the camera? A capsule study of the small intestine is likely to take many hours and occupy patient and physician at the screen for a large amount of time. How would it be possible to free patient and physician from a lengthy exam and limit the time necessary at the screen? In 1993, Iddan came up with the brilliant idea to split the system into three parts. Part one: the camera and its transmitter. Part two: a recorder attached to a sensor array placed on the surface of the patient's abdomen. Part three: a software package that processes the stored information on the recorder to generate a study that can be reviewed by the physician at his leisure in a reasonable amount of time. The problem of the energy guzzling CCD camera was solved nearly by coincidence. While reading a journal on optical engineering , Iddan came across an article by Eric Fossum. He described the use of a Silicon chip (CMOS—complementary metal oxide semiconductor) and in near clairvoyance predicted that CMOS would replace CCD. This would happen for multiple reasons not the least that they consume just one percent the amount of energy of CCDs. Fossum would later assist the Given Imaging team of engineers . Now the pieces were beginning to fall into place. Further miniaturization of the components helped along.

5. Research Method (Research Design)

The main objective is design, improve and develop a wireless capsule endoscopy useful for the diagnosis of gastrointestinal diseases which increase the uses

6. Project Plan

- introduction
- research methodology
- implementation of solution
- testing the solution
- result
- conclusion
- contribute