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PILL CAMERA

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Abstract: Technology's goal is to mass-produce items at lower costs and higher quality. Current technologies have achieved a portion of it, but manufacturing technology is on a far larger scale. Manufacturing products at a molecular level is the way of the future. In the 1980s, researchers began investigating this topic. Manufacturing at the atomic and molecular level was ridiculed at the time. However, thanks to the development of nanotechnology, we have come close to realising it. PILL CAMERA, for example, is a cancer, ulcer, and anaemia treatment product. In the sphere of medicine, it has caused a revolution. Manufacturing at the atomic and molecular level was ridiculed at the time. However, thanks to the development of nanotechnology, we have come close to realising it. PILL CAMERA, for example, is a cancer, ulcer, and anaemia treatment product. In the sphere of medicine, it has caused a revolution.

This little capsule is safe to pass through our bodies. It captures photos of our intestines and sends them to a computer for analysis. This method can aid in the detection of any digestive system ailment. We've also talked about the disadvantages of the PILL CAMERA and how they can be mitigated by employing a grain-sized motor and a bi-directional wireless telemetry capsule. Apart from that, we looked at how nanotechnology is used to make items.

Index Terms - Pill Camera, Nanotechnology

I. INTRODUCTION

Technology is like to the universe expanding. Humans are still thinking more complexly about novel ideas, despite enormous advancements in product manufacture. Casting, milling, grinding, chipping, and integrated fabrication are all methods used to make items with our current technology.

We've manufactured more items at cheaper costs and with greater precision than ever before thanks to these technologies. We arranged atoms in enormous thundering statistical herds throughout the manufacturing of these items. Atoms are the foundation of all produced goods. Manufacturing products at a molecular level is the next step in manufacturing technology. "NANOTECHNOLOGY" is the term for the technology utilised to achieve molecular manufacturing. Nanotechnology is the manipulation of microscopic matter to create useful materials, devices, and systems (nanometre). Nanotechnology is the study of items having nanometre-sized dimensions. Nanometres are billionths of a metre, millionths of a millimetre, or 1/80000 of a human hair width. Intestinal cancer and oesophageal disorders including Crohn's disease are detected via pill camera endoscopy.

Its primary function is to take live colour footage of the small intestine and to detect any digestive system disease at an early stage.

II. LITERATURE SURVEY

Historical Overview

The manipulation of atoms was initially discussed by Nobel winner Dr. Richard Feyngman in 1959 at the annual meeting of the American Physical Society at The California Institute of Technology -Caltech, and it was laughed at the time. Nothing was done in it until the 1980s.

In the year 2000, a group of English doctors reported the development and use of a new instrument for identifying internal bleeding in the digestive system's small intestine. They employed a 1-1/8-inch-long, 3/8-inch-wide capsule endoscope. It had an 8-hour battery, a light source, a camera, and a small transmitter, and it was the size of a huge pill. The capsule takes 2 photographs every second after ingestion, totaling 55,000 images. The capsule delivers the photos to an external computer monitor after 8 hours, where they are saved and processed for further analysis, and the pill is discarded.

Because of its enhanced safety and accuracy, PillCam has had significant success since its initial release in 2001. It is less harmful than X-rays and radioactive tracing of stomach cancers. Currently, more than 5,000 medical facilities in more than 75 countries have employed the PillCam video capsule about 1.5 million times. The innovative wireless capsule endoscopy has become the global standard for digestive diagnosis. Given Imaging, the PillCam company, has sold 221,300 capsules and has a $157.8 million yearly revenue.

Development Barriers

The difficulty in gaining regulatory clearance or approval to market the products was one of the development barriers. Additionally, changes in the regulatory environment made obtaining FDA approval challenging. Furthermore, the introduction of new products may render the Given Imaging items outdated. During the first testing of the system, the lack of proper bowel preparation materials to be employed with PillCam proved to be a development challenge. Given that the protection and validity of patents and other intellectual property rights hampered imaging, Following the creation of PillCam, competition from other companies surged substantially. Iddan's team initially had difficulties in gaining reimbursement and financing for their invention from government and commercial sources. Currently, quarterly changes in operating outcomes make determining the pill's success challenging. The PillCam profit is also heavily dependent on the influence of global economic conditions, which is a barrier to development. Finding firms to implement the pill for commercial profit was challenging, but the PillCam's success allowed it to make significant profits. Other impediments include modifications and reforms to applicable healthcare legislation and regulations. Quality concerns with the products, such as capsule retention, aspiration and failure to attach or detach, haemorrhage or perforation, could necessitate a recall by Given Imaging.

PillCam is not suitable for everyone and is not recommended for those suffering from gastrointestinal disorders. Patients who have swallowing problems or gastrointestinal obstructions based on pre-procedure tests and medical history are not eligible for the PillCam procedure. Capsule endoscopy should not be performed on people who have electromedical equipment implanted. The biggest developing challenge is that as the technique is carried out, there is a chance of clogging the pill owing to the very illnesses that the pill is attempting to discover. There is substantial pre-procedure preparation and testing to ensure that the tablet does not become clogged in the intestinal tract or cause internal haemorrhage. PillCam carries a number of hazards, including capsule retention, aspiration, and skin irritation. Patients should avoid being near an electromagnetic field after taking the PillCam capsule. Even persons with allergies cannot do the test due to medication problems and the dangers of allergic reactions. Medical, endoscopic, or surgical intervention may be required. Because capsule endoscopy cannot distinguish between malignant and benign tumours, when it discovers cancers, additional testing is required; otherwise, a seemingly benign tumour could quickly kill a patient. It is impossible to control the capsule's course or to localise diagnosed lesions. The rate of incidental discoveries and incorrect diagnoses in capsule endoscopy is 11%.

III. BASIC STRUCTURE OF PILL CAMERA

Optical Dome

This form allows the capsule axis to be readily oriented along the central axis of the small intestine, allowing the capsule to move forward more easily. The Light Receiving Windows are located in the optical dome.

Lens Holder

The Lens Holder is the section of the capsule that houses the lens. The lens is securely fastened so that it does not move at all.

Lens

The lens is a necessary part of the capsule. It is set up behind the light-catching windows. Four LED'S surround the lens and CMOS Image Sensor.

Illuminating LED'S

These numerous lighting devices are grouped in the form of a donut.

CMOS Image Sensor

It is the most vital component of the capsule. It is incredibly sensitive and creates photos of exceptional quality.

Battery

The capsule's battery is button shaped and has two of them.The batteries are positioned in a row behind the CMOS image sensor. The primary batteries are silver oxide.

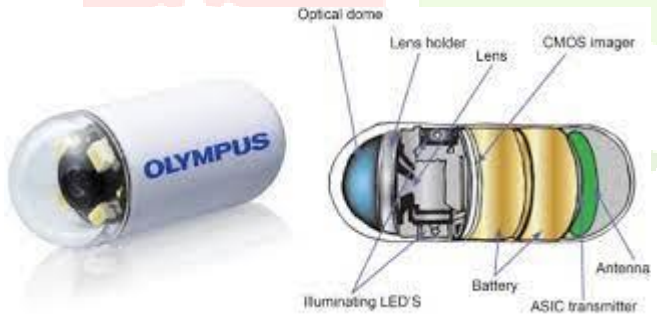
ASIC Transmitter

Behind the batteries is where the ASIC Transmitter is located. Two Transmitting Electrodes are attached to the ASIC Transmitter's outlines.

Antennae:
The antennae are located at the capsule's end. It's contained within a dome-shaped chamber.

IV.WORKING OF PROPOSED METHOD

It's a little bigger than a standard capsule. When the patient takes the capsule, the natural muscle waves of the digestive tract move it forward through the stomach, small intestine, large intestine, and out in the faeces. It snaps twice a second as it moves through the digestive tract. The capsule sends photos to a data recorder, which is worn on a belt around the patient's waist while he or she goes about his or her daily activities. The data is subsequently sent to a computer by the physician for processing and analysis. The entire traverse takes around eight hours, and once done, it exits the body as excreta.
The camera pill was found to be safe, with no adverse effects, and capable of detecting abnormalities in the small intestine, including places that the endoscope cannot reach. The smallest endoscope yet takes 30 two-megapixel photos per second and wirelessly transmits them. In an animation, see how it works inside the body. After taking this pill, doctors will be able to check a high-resolution video of your intestines for tumours and other issues, owing to a new spinning camera that takes images in 360 degrees. The Sayaka endoscope capsule, developed by Japan's RF System Lab, will begin clinical trials in the United States this month. The patient swallows the pill, and the digestive process begins. Over the next eight hours, the pill travels passively down the oesophagus and through around 20 to 25 feet of intestines, capturing up to 870,000 photos. The patient has no sensations. Pop this pill, and doctors will be able to check a high-resolution video of your intestines for tumours and other issues eight hours later, thanks to a new spinning camera that captures images in 360 degrees. The Sayaka endoscope capsule, developed by Japan's RF System Lab, will begin clinical trials in the United States this month.



Down the Hatch

The patient swallows the pill, and the digestive process begins. Over the next eight hours, the tablet travels passively down the oesophagus and through 20 to 25 feet of intestines, capturing up to 870,000 photographs. The patient has no sensations.

Power up

The pill camera does not require a motor to go through your stomach, but it does require 50 milliwatts to power its camera, lights, and computer. Because batteries would be excessively heavy, the cam is powered by induction charging. A coil in the patient's vest transmits power continually.

Start Snapping

When the pill cam reaches the intestines, it begins recording 30 two-megapixel photographs per second (twice the resolution of other pill cams). The fluorescent and white LEDs in the pill illuminate the tissue barriers.

Signup for Closeup

This features a permanent magnet that rotates the interior capsule and image sensor 60 degrees every two seconds. It makes a full swing every 12 seconds, giving you plenty of opportunity for close-ups. It takes around two minutes to move one inch.

Offload Data

Transmits the images by a wirelessly connected antenna. Those images are saved into a SD card

Deliver Video

Doctors insert the SD card into a computer, where software merges thousands of overlapping photos into a flat map of the intestines with a resolution of up to 1,175 megapixels. Doctors can watch the ride again as a film and magnify a problem location up to 75 times to see the specifics.

Leave the Body

The patients can simply flush it away

V.APPLICATIONS

Crohn's disease

Crohn's characterized by inflammation disorder that can affect any portion of the digestive tract, but it most commonly affects both small and large intestine. Abdominal pain and diarrhoea are two of the major symptoms. Extraintestinal symptoms, such as arthritis, uveitis, and skin lesions, are possible in patients with this illness. The PillCamTMSB capsule is just an ingestible video camera that sends high-resolution photos of the small intestine mucosa. This makes it easier for doctors to look for tiny bowel illnesses like Crohn's disease. Capsule endoscopy has been shown to accurately diagnose Crohn's disease in four meta-analyses. It should be highlighted that even though it is the best noninvasive method for determining mucosal status, it is not superior to ileocolonoscopy. Only an endoscopic operation, such as capsule surgery, can show mucosal repair along the small intestine. Lengthy mucosal healing was already linked to a decrease in the number of recurrent infections. In people with Crohn's disease, there is less need for hospitalisation and less corticosteroid treatment. The Capsule Endoscopy Crohn's Disease Activity Index has recently been created and validated. Crohn’s illness of the small intestines (also known as Niv score)

Mediation in the case of a small bowl injury

Since the introduction of pill endoscopy (CE) in 2001, gastroenterologists have been able to study its small bowel in a non-invasive manner. CE is most typically used to diagnose or monitor Crohn's disease, suspect a small intestine tumour, diagnose and monitor hereditary polyposis syndromes, Nonsteroidal, anti - inflammatory drug-induced small bowel lesions, and celiac disease. The small intestinal capsule has been available for nearly fifteen years. The goal of this review is to provide a concise but comprehensive summary of small intestinal CE anno 2014, encompassing technical and procedural issues, potential complications, and the most relevant indications.

Ulcerative Colitis

Treatment for ulcerative colitis should be adjusted towards the extent of colonic inflammation, which was previously determined mostly by clinical and biochemical indicators. Mucosal healing has recently been presented as a benchmark for guiding therapy. The goal of this multicenter trial was to see if mucosal appearance as determined by intestinal capsule endoscopy (CCE) could be utilised to distinguish between active and inactive ulcerative colitis.

This prospective study included patients aged from Hong Kong, Singapore, and Taiwan who were reported or known to be have ulcerative colitis. Following usual bowel preparation, these individuals were offered CCE and traditional visual colonoscopy on the same day. CCE's accuracy in measuring intestinal inflammation (described as the existence of ulcers, erythema, erosions, edoema, and exudates in the mucosa) was the primary endpoint, with optical colonoscopy serving as the gold standard.

Diagnosis of Cancer

Surgeries can be a painful treatment for individuals who are already worried about what results might reveal. A tiny optical fibre camera, known as an endoscope, is implanted in a 4feet in length, flexible tube and used to probe the big intestine.
Colonoscopies can identify and diagnose a variety of disorders, including irritable bowel syndrome (IBS) and Crohn's disease, in addition to colon cancer.
The technique is not only unpleasant and expensive, but it might also fail to detect tiny tumours, leading to misdiagnosis. Each year, approximately 750,000 incomplete colonoscopies occur in the United States alone, requiring patients to have an extra procedure, such as an X-ray or CT scan, to complete the intestinal inspection-incurring extra costs and risks in the process.

VI.ADVANTAGES

The fundamental benefit of a pill camera is that it is a non-invasive, all-encompassing diagnostic tool. The disposable capsule, which is about the size of a vitamin pill, has a tiny camera that has its own lens and light source. The pill takes pictures as it goes through your gastrointestinal system and sends them as pictures to a data acquisition system worn around your waist. These scans provide us with more information about your gastrointestinal system from the inside than any other technology. There is also no pain or discomfort with capsule endoscopy. There is no need for sedation, operation, or a stay in the hospital, and the preparatory time is short. We get a complete "image" of your digestive tract, with an emphasis on the small bowel. You will back once your test is over, and we will transfer the photographs from the data acquisition system to a laptop and show you a colour movie of the images obtained by the capsule. There are no negative effects and it is painless. Anesthesia is avoided. It is much more effective than an X-ray CT scan or a standard endoscopy.

1)There is no scarring because a basic bodily hole was used.

2)Recovery period is limited.

3)A shorter hospitalisation.

4)The surgery is usually performed inside the doctor's office, so there is no need to stay in the hospital.
Early diagnosis of recurrence after surgery (finding early)

5)Your doctor will ask you regarding your medical history, including allergies and current medications, before the endoscopy. These variables may influence the operation.

VII.DISADVANTAGE

If polyps are found, the PillCam COLON capsule will not be able to remove them. After a PillCam COLON procedure, a colonoscopy may be suggested to remove and treat the findings. The majority of people will not require a follow-up colonoscopy, but if your physician recommends one, you will need to undergo a second another round bowel preparation**.**

1. "Unfortunately, because of the danger of obstruction, people with gastrointestinal structures or constriction are not good candidates for this surgery." It's also possible that the pill camera won't be able to freely move inside the digestive system, resulting in ambiguous results.

2. If there is a partial restriction in the small bowel, the pill may become lodged there, and a patient who came in for medical diagnostics may end up in emergency with an intestinal obstruction.

3. The capsule camera can send images from inside the body to the outside. As a result, controlling the camera's behaviour, including on/off power operations and appropriate illuminations inside the gut, becomes impossible.
It cannot be considered to take biopsies, administer therapy, or identify abnormalities for surgical correction.

   Pill endoscopic complications include:

   (ii)Organ perforation
   (iii)Excessive bleeding
   (iv)Infection
   (v)Allergic response to the anaesthetic.
   (vi) Pancreatic inflammation
   (vii) The pill may become stuck inside the small intestine and require surgical removal.
   (viii)Due to the metallic components of the capsule camera, no MRI scans can be performed while it is inside the body. Because it is more expensive than a standard endoscopy, reputed medical funds do not cover the treatment.

VIII. CONCLUSION

The provided endoscopic capsule is a cutting-edge medical technology concept for the 21st century. The endoscopic system is the first in the type to be able to image the whole small bowel without invasive procedures. It has completely transformed the area of diagnostic imaging and has shown to be highly beneficial to clinicians all over the world. Most conventional manufacturing processes will be replaced in the near future by "nanotechnology," a cheaper and better manufacturing process.
As per scientists, nanotechnology is not able to produce all of these things. They also predict that in the upcoming decades, nanotechnology will enable the creation of hearts, lungs, livers, and kidneys using only coal, water, and a few impurities, as well as the prevention of ageing. Nanotechnology has the potential to change the industrial sector, yet it will almost definitely raise unemployment in the next generation. This pill camera technology has elevated biomedical engineering and made it easier for physicians to diagnose such a difficult intestinal tract. In the decades ahead, widespread use of Pill cameras will decrease the number of unnecessary deaths.

IX.FUTURE SCOPE

In the future, this pill camera technology could be used to determine temperature, pressure, and a variety of ailments by identifying the presence of a virus in the body. It can also be built as a programmable device that can regenerate blood cells (WBCs and RBCs). This may help patients avoid having to undergo surgery.

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