A

Seminar-I Report

on

PILL CAMERA

Submitted in Partial Fulfillment of
the Requirements for the Degree Third Year
of

Bachelor of Engineering

in

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Submitted by

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SSBT's COLLEGE OF ENGINEERING AND TECHNOLOGY, BAMBHORI, JALGAON - 425 001 (MS)

DEPARTMENT OF COMPUTER ENGINEERING

CERTIFICATE

This is to certify that the Seminar-I entitled *PILL CAMERA*, submitted by

Vrushali S. Patil

in partial fulfillment of the degree of *Bachelor of Engineering* in *Computer Engineering* has been satisfactorily carried out under my guidance as per the requirement of North Maharashtra University, Jalgaon.

Date: 5 April 2016
Place: Jalgaon

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Vrushali S. Patil

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Abstract

The aim of technology is to make products in a large scale for cheaper prices and increased quality. The current technologies have attained a part of it, but the manufacturing technology is at macro level. The future lies in manufacturing product right from the molecular level. Research in this direction started way back in eighties. At that time manufacturing at molecular and atomic level was laughed about. But due to advent of nanotechnology we have realized it to a certain level. One such product manufactured is PILL CAMERA, which is used for the treatment of cancer, ulcer and anemia. It has made revolution in the field of medicine. This tiny capsule can pass through our body, without causing any harm. We have made great progress in manufacturing products. Looking back from where we stand now, we started from flint knives and stone tools and reached the stage where we make such tools with more precision than ever. The leap in technology is great but it is not going to stop here. With our present technology we manufacture products by casting, milling, grinding, chipping and the likes.

Chapter 1

Introduction

Pill-sized camera is the camera that could travel through your body taking pictures.taking images helping diagnosa problam which doctor's previously would have found only through surjary. The pill camera is sized at 26*11 mm and is capable of transmitting 50,000 color images during its traversal through the digestive system of patient.In the manufacture of these products we have been arranging atoms in great thundering statistical herds. All of us know manufactured products are made from atoms. The properties of those products depend on how those atoms are arranged. If we rearrange atoms in dirt, water and air we get grass.

In this chapter,In section 1.1 the conventional method. Description of Pill Camera in section 1.2.

1.1 Conventional method

Currently, standard method of detecting abnormalities in the intestines is through endoscopic examination in which doctors advance a scope down into the small intestine via the mouth. However, these scopes are unable to reach through all of the 20-foot-long small intestine, and thus provide only a partial view of that part of the bowel. With the help of pill camera not only can diagnoses be made for certain conditions routinely missed by other tests, but disorders can be detected at an earlier stage, enabling treatment before complications develop. Following Figure 1.1 shows Conventional method of Pill Camera. The current technologies have attained a part of it, but the manufacturing technology is at macro level. The future lies in manufacturing product right from the molecular level. Research in this direction started way back in eighties. At that time manufacturing at molecular and atomic level was laughed about. But due to advent of nanotechnology we have realized it to a certain level. One such product manufactured is PILL CAMERA, which is used for the treatment of cancer, ulcer and anemia. It has made revolution in the field of medicine. This tiny capsule can pass through our body, without causing any harm.[1]

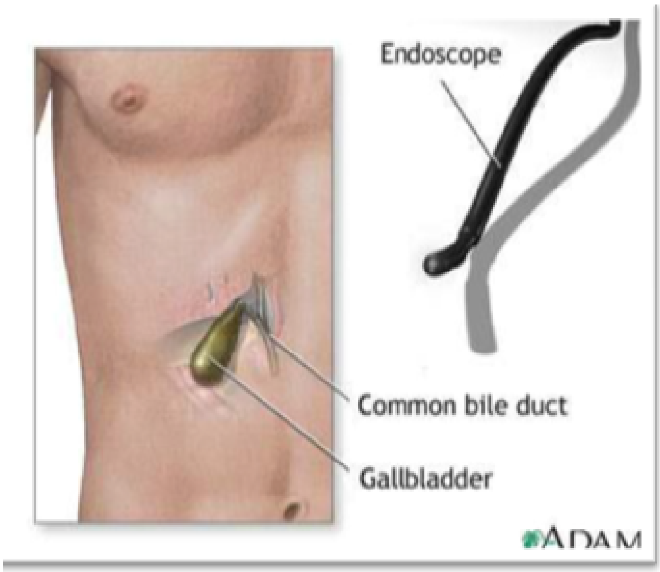

Figure 1.1: Conventional Method

The device, called the given Diagnostic Imaging System, comes in capsule form and contains a camera, lights, transmitter and batteries. The capsule has a clear end that allows the camera to view the lining of the small intestine. Capsule endoscopy consists of a disposable video camera encapsulated into a pill like form that is swallowed with water. The wireless camera takes thousands of high-quality digital images within the body as it passes through the entire length of the small intestine. The latest pill camera is sized at 26*11 mm and is capable of transmitting 50,000 color images during its traversal through the digestive system of patient.

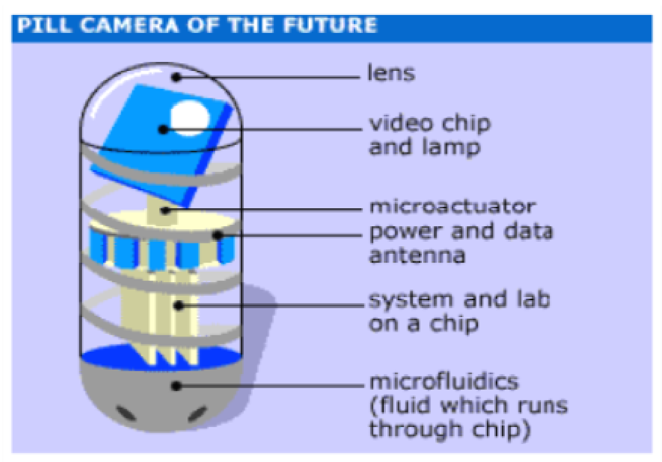

Figure 1.2: Pill Camera of the Future

Figure 1.2: Pill Camera of the Future Video chip consists of the IC CMOS image sensor

which is used to take pictures of intestine. . Above figure 1.2 shows Pill Camera of the future of Pill Camera. The lamp is used for proper illumination in the intestine for taking photos. Micro actuator acts as memory to store the software code that is the instructions. The antenna is used to transmit the images to the receiver. For the detection of reliable and correct information, capsule should be able to design to transmit several biomedical signals, such as pH, temp and pressure. This is achieved with the help of Soc. The advancement of our technology today has led to its effective use an Application to the medical field. One effective and purposeful application of the Advancement of technology is the process of endoscopy, which is used to diagnose and examine the conditions of the gastrointestinal tract of the patents. It has been reported that this process is done by inserting an 8mm tube through the mouth, with a camera at one end, and images are shown on nearby monitor, allowing the medics to carefully guide it down to the gullet or stomach. However, despite the effectiveness of this process to diagnose the patients, research shows that endoscopy is a pain stacking process not only for the patients, but also for the doctors and nurses as well. From this, the evolution of the wireless capsule endoscope has emerged. Reports, that through the marvels of miniaturization, people with symptoms that indicate a possible in the gastrointestinal tract can now swallow a tiny camera that takes snapshots inside the body for a physician to evaluate. The miniature e camera, along with a light, transmitter, and batteries, called Capsule Cam, is housed in a capsule,

The size of a large vitamin pill, and is used in a procedure known as capsule endoscopy, which is a noninvasive and painless way of looking into the esophagus and small intestine.

1.2 Description of Pill Camera

The device, called the given Diagnostic Imaging System, comes in capsule form and contains a camera, lights, transmitter and batteries. The capsule has a clear end that allows the camera to view the lining of the small intestine. Capsule endoscopy consists of a disposable video camera encapsulated into a pill like form that is swallowed with water. The wireless camera takes thousands of high-quality digital images within the body as it passes through the entire length of the small intestine.

The latest pill camera is sized at 26*11 mm and is capable of transmitting 50,000 color images during its traversal through the digestive system of patient. Video chip consists of the IC CMOS image sensor which is used to take pictures of intestine. The lamp is used for proper illumination in the intestine for taking photos. Micro actuator acts as memory to store the software code that is the instructions. The antenna is used to transmit the images to the receiver. For the detection of reliable and correct information, capsule should be able to design to transmit several biomedical signals, such as pH, temp and pressure.[2]

This is achieved with the help of Soc. external reference crystal or clock. The decoder IC receives the serial stream and interprets the serial information as 4 bits of binary data. Each bit is used for channel recognition of the control signal from outside the body. Since the CMOS image sensor module consumes most of the power compared to the other components in the telemetry module, controlling the ON/OFF of the CMOS image sensor is very important. Moreover, since lightning LEDs also use significant amount of power, the individual ON/OFF control of each LED is equally necessary. As such the control system is divided into 4 channels in the current study. A high output current amplifier with a single supply is utilized to drive loads in capsule. In the near future most of the conventional manufacturing processes will be replaced with a cheaper and better manufacturing process "nanotechnology".

1.3 Summary

In this chapter the introduction of pill camera. It described its purpose against conventional method , also Description of Pill Camera. In the next chapter is literature survey will discuss.

Chapter 2

Literature survey

A schematic of the external control circuit unit is illustrated below, where the ON/OFF operation of the switch in the front of the unit is encoded into 4 channels Control signals. These digital signals are then transferred to a synthesizer and modulated into an RF signal using a OOK transmitter with a carrier frequency of 433 MHz.

In this chapter ,discuss about the literature survey and the historyin section 2.1.A schematic of the external control circuit unit is illustrated belowin the section 2.2 in detail.

2.1 History

EUS endoscopes are unique because they offer ultrasound guided needle biopsy, colour Doppler and advanced image. The technology available to doctors has evolved dramatically over the past 40 years, enabling specially trained gastroenterologists to perform tests and procedures that traditionally required surgery or were difficult on the patient.

Figure 2.1: EUS endoscop

"Basic endoscopy was introduced in the late 1960s, and about 20 years later, ultrasound was added, enabling us to look at internal GI structures as never before. Now, with EUS ,we can determine the extent to which tumours in the esophagus, stomach, pancreas, or rectum have spread in a less invasive way. In addition to using an endoscope to stage tumours, gastroenterologists can use the instrument to take tissue samples with fine needle aspiration(FNA).[3] The endoscope, specially equipped with a biopsy needle, is guided to a specific site and extracts a tissue sample.

One technology that has been available for about 30 years, Endoscopic Retrograde Cholangio- pancreatography (ERCP),combines X-rays and endoscopy to diagnose conditions affecting the liver, pancreas, gallbladder, and the associated ducts. An endoscope is guided down the patient's esophagus, stomach, and small intestine, and dye is injected to tiny ducts to enhance their visibility on X-ray. ERCP's role has expanded, and in certain medical centers, such as University Hospital's Therapeutic Endoscopy and GI Mobility Center, it is used to place stents within bile ducts, remove difficult bile duct stones, and obtain biopsy samples Motility is the movement of food from one place to another along the digestive tract. When a person has difficulty in swallow ing food or excreting waste, there could be a motility problem. "Manometry" is a specialised test that gastroenterologists use to record muscle pressure within the esophagus or anorectal area, essential information for the diagnosis of esophageal disorder such as achalasia, the failure of the lower esophageal sphincter muscle to relax, and problem such as fecal incontinence or constipation-related rectal outlet obstruction.

The traditional PH test involves threading a catheter into the patient's nose and down the throat; the catheter is attached to a special monitor, which is worn by the patient for 24 hours. A newer alternative eliminates the catheter completely. I instead, the gastroenterologist, using an endoscope, attaches a small capsule to the wall of the esophagus. The capsule transmits signals to a special receiver afterward, the data is downloaded to a computer at the doctor's office.

2.2 External Control Unit

A schematic of the external control circuit unit is illustrated below, where the ON/OFF operation of the switch in the front of the unit is encoded into 4 channels Control signals. These digital signals are then transferred to a synthesizer and modulated into an RF signal using a OOK transmitter with a carrier frequency of 433 MHz.

To verify the operation of the external control unit and telemetry capsule, CH1 was used to control ON/OFF of CMOS image sensor and CHs 2-4 to control led lighting. The four signals in front of the control panel were able to make 16different control[5] signals.The bi-directional operation of telemetry module is verified by transmitting video signal from CMOS image sensor image data was then displayed proposed.

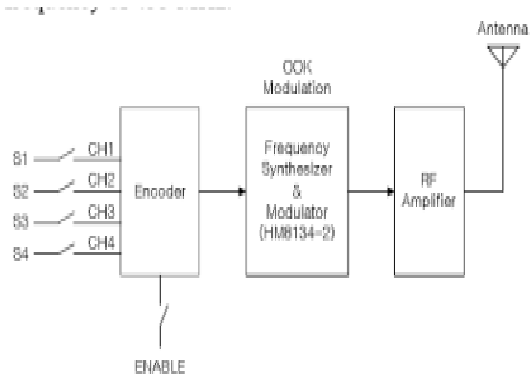

Figure 2.2: External Control unit

telemetry capsule can simultaneously transmit a video signal and receive a control determining the behavior of the capsule. As a result, the total power consumption of the telemetry capsule can be reduced by turning off the camera power during dead time and separately controlling the LEDs for proper illumination in the intestine. Accordingly, proposed telemetry module for bidirectional and multi-channel

2.3 Other field in nanotechnology

1. Nanotechnology may have its biggest impact on the medical industry. Patients will drink fluids containing nanorobots programmed to attack and reconstruct the molecular structure of cancer cells and viruses to make them harmless.

2. Nanorobots could also be programmed to perform delicate surgeries –such nanosurgeons could work at a level a thousand times more precise than the sharpest scalpel. By working on such a small scale, a nanorobot could operate without leaving scars that conventional surgery does.

3. Additionally, nanorobots could change your physical appearance. They could be programmed to perform cosmetic surgery, rearranging your atoms to change your ears, nose, eye color or any other physical feature you wish to alter.

4. There's even speculation that nanorobots could slow or reverse the aging process, and life expectancy could increase significantly.

5. In the computer industry, the ability to shrink the size of transistors on silicon microprocessors will soon reach its limits. Nanotechnology will be needed to create a

new generation of computer components. Molecular computers could contain storage devices capable of storing trillions of bytes of information in a structure the size of a sugar cube.

6. Nanotechnology has the potential to have a positive effect on the environment. For instance, airborne nanorobots could be programmed to rebuild the thinning ozone layer.Nanotechnology may have its biggest impact on the medical industry. Patients will drink fluids containing nanorobots programmed to attack and reconstruct the molecular structure of cancer cells and viruses to make them harmless.[6]

2.4 Summary

In this chapter the history and related work about the pill camera is related a where is developed external control unit of pill camera and development in other field of nanotechnology. The next section contains the methodology of the system.

Chapter 3

Methodology

In this chapter, It consist of Workings of pill camera. In section 3.1 the architecture of the pill camera are discussed. the working of the pill camera are discussed in section 3.2.

3.1 Architecture

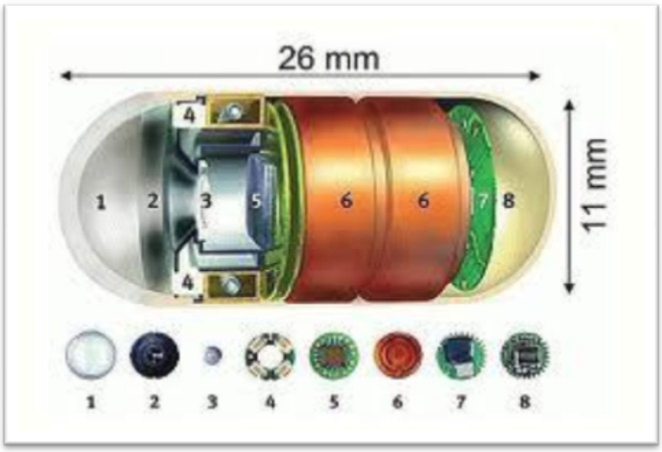

Figure 3.1: View of the Pill Camera

The figure shows the view of pill camera. It has 8 parts:

1. Optical Dome
2. Lens Holder
3. Lens
4. Illuminating LEDs
5. CEMOS image sensor
6. Battery

7. ASIC Transmitter
8. Antenna

Optical Dome : It is the front part of the capsule and it is bullet shaped. Optical dome is the light receiving window of the capsule and it is a non-conductor material it prevent the filtration of digestive fluids inside the capsule

Lens Holder This accommodates the lens. Lenses are tightly fixed in the capsule to avoid dislocation of lens.

Lens : It is the integral component of pill camera. This lens is placed behind the Optical Dome. The light through window falls on the lens.

Illuminating LEDs : Illuminating LEDs illuminate an object. Non reflection coating id placed on the light receiving window to prevent the reflection. Light irradiated from the LEDs pass through the receiving window

CEMOS image sensor It has 140 degree field of view and detect object as small as 0.1mm. It have high precise.

Battery Battery used in the pill camera is bullet shaped and two number and silver oxide primary batteries are used. It is disposable and harmless material

ASIC transmitter : It is application specific integrated circuit and is placed behind the batteries. Two transmitting electrodes are connected to this transmitter and these electrodes are electrically.

Antenna Parylene coated on to polyethylene or polypropylene antennas are used. Antenna received data from transmitter and then sends to data recorder. [7]

3.1.1 Capsule Endoscopy

Capsule endoscopy is a procedure that uses a tiny wireless camera to take pictures of your digestive tract. The camera sits inside a vitamin-sized capsule that you swallow. As the capsule travels through your digestive tract, the camera takes thousands of pictures that are transmitted to a recorder you wear on a belt around your waist or over your shoulder. Capsule endoscopy helps doctors see inside your small intestine an area that isn't easily reached with conventional endoscopy. Capsule endoscopy can be used by adults and by children who can swallow the capsule. The procedure is usually started in a doctor's office. Capsule endoscopy helps your doctor see inside your small intestine. Your small intestine, located between your stomach and your colon, can be difficult to reach with conventional endoscopy and imaging tests. Capsule endoscopy can also provide better imaging of the lining of the small intestine than can other tests.[8]

To prepare for capsule endoscopy, your doctor may ask that you:

1. Restrict your diet you probably will be asked to have only clear liquids for 24 hours before the procedure and nothing by mouth the morning of the procedure, to help ensure that the camera captures clear images of your digestive tract.

2. Stop or delay taking certain medications, to prevent them from interfering with the camera.

3. Avoid strenuous exercise or heavy lifting after the procedure. You'll be able to do most normal activities after swallowing the capsule that contains the camera. But if you have an active job, ask your doctor whether you can go back to work on the day of your capsule endoscopy.

Some capsule endoscopy devices require adhesive patches that are attached to your abdomen. Each patch contains an antenna with wires that connect to a recorder. The recorder collects and stores the pictures taken by the camera as it passes through your digestive tract. You wear the recorder on a special belt around your waist or in a bag over your shoulder. Once the recorder is connected, you will be asked to swallow the camera capsule. It's about the size of a large vitamin pill. A slippery coating makes the capsule easier to swallow.

You can generally go about your normal activities while the camera pill passes through your digestive tract. You may be asked to avoid repetitive movements that could disrupt the recorder. Capsule endoscopy can be done with a camera that takes pictures for eight hours or 12 hours. Your doctor will tell you which type of capsule endoscopy you are having, and when you can resume eating and drinking. The procedure is complete after eight or 12 hours or when you see the camera capsule in the toilet after a bowel Movment.

There have been few side effects reported with capsule endoscopy. You should contact your gastroenterologist immediately if you:

- Develop a fever after swallowing the capsule.

- Have trouble swallowing.

- Begin to vomit.

- Experience increasing chest or abdominal pain.

Cramping and abdominal discomfort have not yet been reported during the capsule endoscopy procedure. Very rarely, the capsule can become stuck in the digestive tract due to a blockage or narrowing of the intestines. In this case, surgery may be required to remove the capsule. You are at a higher risk of blockage if you have a history of bowel obstruction or previous gastrointestinal surgery is sure to discuss the risks with your doctor before the procedure. If you cannot positively confirm that the capsule has been excreted from your body within a week, contact your gastroenterologist for an evaluation and possible abdominal X-ray to establish the location of the capsule. You should not undergo a Magnetic Resonance Imaging (MRI) examination or be near any powerful magnetic fields (such as amateur or ham radio) until after the capsule is excreted. Doing so could result in serious damage to your intestinal tract and abdominal cavity.[9]

3.1.2 Data Recorder

Data recorder is a small portable recording device placed in the recorder pouch, attached to the sensor belt. It has light weight (470 gm). Data recorder receives and records signals transmitted by the camera to an array of sensors placed on the patients body. It is of the size of walkman and it receives and stores 5000 to 6000 JPEG images on a 9 GB hard drive. Images take several hours to download through several connections. The Date Recorder stores the images of your examination. Handle the Date Recorder, Recorder Belt, Sensor Array and Battery Pack carefully. Do not expose them to shock, vibration or direct sunlight, which may result in loss of information. Return all of the equipment as soon as possible.

Figure 3.2: Data Recorder

3.2 Working

3.2.1 Down the Hatch

the patient gulps down the capsule, and the digestive process begins. Over the next eight hours, the pill travels passively down the esophagus and through roughly 20 to 25 feet of intestines, where it will capture up to 870,000 images. The patient feels nothing.

3.2.2 Power Up

The Sayaka doesnt need a motor to move through your gut, but it does require 50 milliwatts to run its camera, lights and computer. Batteries would be too bulky, so the cam draws its power through induction charging. A vest worn by the patient contains a coil that continuously transmits power.

3.2.3 Start snapping

When it reaches the intestines, the Sayaka cam begins capturing 30 two-megapixel images per second (twice the resolution of other pill cams). Fluorescent and white LEDs in the pill illuminate the tissue walls.

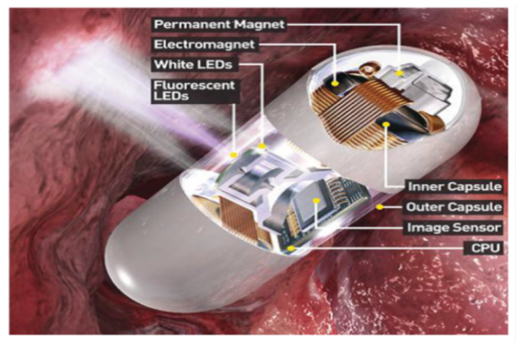

Figure 3.3: Pill Camera

3.2.4 Spin for Close-Ups

Previous pill cameras place the camera at one end, facing forward, so the tissue walls are visible only in the periphery of their photos. Sayaka is the first that gets a clearer picture by mounting the camera facing the side and spinning 360 degrees so that it shoots directly at the tissue walls. As the outer capsule travels through the gut, an electromagnet inside the pill reverses its polarity. This causes a permanent magnet to turn the inner capsule and the image sensor 60 degrees every two seconds. It completes a full swing every 12 secondsplenty of time for repeated close-ups, since the capsule takes about two minutes to travel one inch.

3.2.5 Offload Data

Instead of storing each two-megapixel image internally, Sayaka continually transmits shots wirelessly to an antenna in the vest, where they are saved to a standard SD memory card.

3.2.6 Deliver Video

Doctors pop the SD card into a PC, and software compiles thousands of overlapping images into a flat map of the intestines that can be as large as 1,175 mega pixels. Doctors can replay the ride as video and magnify a problem area up to 75-fold to study details.[10]

3.2.7 Leave the Body

At around 100Doller, the cam is disposable, so patients can simply flush it away. The below is the block diagram of receiver that receives the pictures snapped by the camera inside the stomach.

3.2.8 Circuit Block Diagram of Transmitter and Receiver

In the first block diagram, one SMD type transistor amplifies the video signal for efficient modulation using a 3 biasing resistor and 1 inductor. In the bottom block, a tiny SAW resonator oscillates at 315 MHZ for modulation of the video signal. This modulated signal is then radiated from inside the body to outside the body. For Receiver block diagram a commercialized ASKS/ OOK (ON/OFF Keyed) super heterodyne receiver with an 8-pin SMD was used. Following figure shows a to video signal transmitter of capsule .

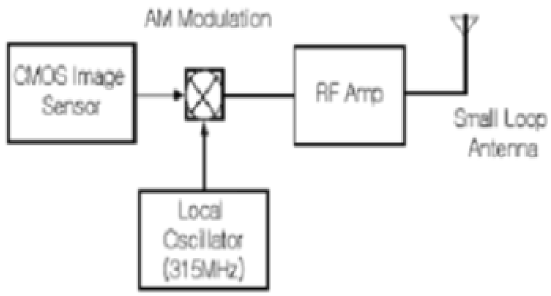

Figure 3.4: To Video Signal Transmitter of Capsule Inside

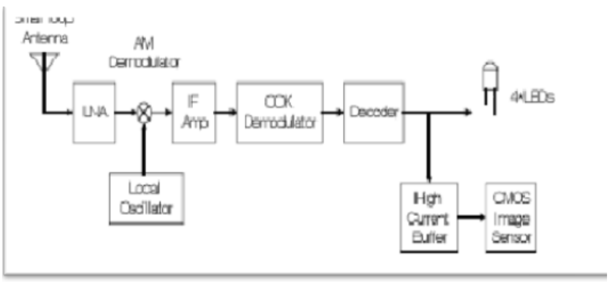

Figure 3.5: Receiver Circuit inside Circuit

Above figure 3.5 shows a receiver circuit inside circuit. This single chip receiver for remote wireless communications, which includes an internal local oscillator fixed at a single frequency, is based on an external reference crystal or clock. The decoder IC receives the serial stream and interprets the serial information as 4 bits of binary data. Each bit is used for channel recognition of the control signal from outside the body. Since the CMOS image sensor module consumes most of the power compared to the other components in the telemetry module, controlling the ON/OFF of the CMOS image sensor is very important. Moreover, since lightning LEDs also use significant amount of power, the individual ON/OFF control of each LED is equally necessary. As such the control system is divided into 4 channels in the current study. A high output current amplifier with a single supply is utilized to drive loads in capsule.

3.3 Summary

In above chapter, see the architecture and working of Capsule endoscopy. see the overall architecture of capsule endoscopy and data recorder in deta.The next chapter, discuss about advantages, disadvantages and application .

Chapter 4

Discussion

In this chapter, in section 4.1 the Application of the pill camera are discussed. The advantages of the pill camera are discussed in section 4.2. In section 4.3 the disadvantages of the pill camera are discussed.The drawback of the pill camera are discuss in section 4.4.

4.1 Application

Biggest impact in the medical industry. Nano robots perform delicate surgeries. Pill cam ESO can detect esophageal diseases, gastrointestinal reflex diseases, barreffs esophagus. Pill cam SB can detect Crohns disease, small bowel tumours, small bowel injury, celiac disease, ulcerative colitis etc.[12]

4.2 Advantages

- Painless, no side effects.
- Minature size.
- Accurate, precise (view of 150 degree) .
- High quality images.
- Harmless material.
- Simple procedure.
- High sensitivity and specificity .
- Avoids risk in sedation.
- Efficient than X-ray CT-scan, normal endoscopy.

This section discuss about Advantages pill camera.The next section 8.2 discuss about Disadvantages and application.

4.3 Disadvantages

Gastrointestinal obstructions prevent the free flow of capsule. Patients with pacemakers, pregnant women face difficulties. It is very expensive and not reusable. Capsule endoscopy does not replace standard diagnostic endoscopy. It is not a replacement for any existing GI imaging technique, generally performed after a standard endoscopy and colocoscopy. It cannot be controlled once it has been ingested, cannot be stopped or steered to collect close-up details. It cannot be used to take biopsies, apply therapy or mark abnormalities for surgery.

4.4 Summary

In this chapter we discussed the advantages and disadvantages of pill camera and the application of the pill camera and the drawback of the pill camera . In the next chapter is conclusion.

Conclusion

Wireless capsule endoscopy represents a significant technical breakthrough for the investigation of the small bowel, especially in light of the shortcomings of other available techniques to image this region. Capsule endoscopy has the potential for use in a wide range of patients with a variety of illnesses. At present, capsule endoscopy seems best suited to patients with gastrointestinal bleeding of unclear etiology who have had non-diagnostic traditional testing and whom the distal small bowel(beyond reach of a push enetroscope) needs to be visualised. The ability of the capsule to detect small lesions that could cause recurrent bleeding(eg. tumours, ulcers) seems ideally suited for this particular role. Although a wide variety of indications for capsule endoscopy are being investigated, other uses for the device should be considered experimental at this time and should be performed in the context of clinical trials. Care must be taken in patient selection, and the images obtained must be interpreted approximately and not over read that is, not all abnormal findings encountered are the source of patients problem. Still, in the proper context, capsule endoscopy can provide valuable information and assist in the management of patients with difficult to- diagnose small bowel disease.

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