

# **A NEW APPROACH FOR IMAGE TRANSMISSION FOR ADVANCED WIRELESS COMMUNICATION APPLICATIONS**

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**Abstract—** Endoscopy is an invasive procedure used for the diagnosis and treatment of gastrointestinal tract diseases. It plays a great deal in the medical field as it saves human life. Capsule Pill Camera is a device equipped with a miniature video camera to visualize the small intestine. The proposed System use IoT to access Pill Camera Endoscopy images and stored in the cloud, it helps individuals to perform health check at regular intervals and produce dynamic health reports on the health-related problems that individuals may face. This novel system helps a quick and accurate diagnostic tool to detect gastrointestinal abnormalities. The images imposed to various processing steps like filtering, noise cancellation and enhanced to improve the efficiency, cloud computing technology used to diagnose and identify the diseases. The control of capsule functionality is made with the help of the Internet of Things.

**Keywords –** Keywords: Pill Camera, Endoscopy, Capsule, Internet of Things.

## **I. INTRODUCTION**

The revolution was created after the fiber-optic endoscopy development to observe the entire gastrointestinal tract and treatment of stomach diseases. However, this method has limitations only proximal duodenum and distal ileum can be analyzed with the help of small bowel. With the discovery of capsule pill camera endoscopy in 2000, [1] it is possible to view the entire Gastrointestinal track. By inhaling the pill camera capsule, it is possible to take images of the gastrointestinal tract and send the images using RF Antenna. These technologies enable physiological endoscopy, which helps to increase day by day examination of Colon tumors, colorectal cancer, Find the reason for gastrointestinal bleeding, identify inflammatory bowel diseases, such as Crohn's disease, diagnose celiac disease and Inspect esophagus.

## II. CAPSULE ENDOSCOPY

The pill camera endoscopy technology gives a remote, hands-free, and high precision imaging sensory system for health care doctors. A pill camera consists of a mini camera that captures the illness present in the gastrointestinal tract. The technology was first introduced in 2000 for commercial healthcare services. These pill camera devices are currently helping to examine gastrointestinal problems related to medical cardiac devices.

Patients with Left-Ventricular Assist devices may have common side effects Gastrointestinal bleeding. Angiodysplasia, or vascular ectasias, is closely related to the presence of the complex cardiac healing device is another form of varices in the lower colon. Anticoagulants with LVADs are used in patients for further thought. and with some cardiovascular conditions.

The U.S. Food and Drug Administration (FDA) recognizes the general pill camera endoscopic as a remedy, a one-time-use capsule considered to obtain continuous video images during normal propulsion through the gastral system. Nowadays, with the help of pill camera endoscopy was contraindicated for effect person with cardiac transplants, because of the option of intrusion during in vivo functions of both the cardiac implant and pill Camera.

However, there is sufficient evidence-based research that found that pill camera capsule endoscopy is safe for patients. [1] They initiate PillCam's transmission power reduction avoids malfunction of cardiac devices like pacemakers, cardioverter defibrillators (ICD), or Left-Ventricular Assist Devices. so, it should not cause any damage to pacemakers, transplants cardioverter-defibrillators.

A study was made on many gastric problems affected persons referred to pill camera endoscopy if the bleeding in gastric tract and the unclear result were studied comprised. A heart specialist, assisted by a skillful technician, was studied and realized that no problems were found in the operation of the pacemaker before and after taking pill camera and traveled in the gastral track. They found that no problems were found on cardiac functioning after inhaling pill camera for the endoscopy process. They determined that any one of the devices may have malfunctioned. Additional Mayo Clinic study finds that pill camera procedure does not affect with Implantable Electronic Devices (IEDs) function. [2] They also found that IED functioning not affected by pill camera procedure, including pacemakers, ICDs, or LVADs, and pacemakers and ICDs did not affect the pill camera imaging. However, they found Left Ventricular Assisted Devices might create problems to pill camera operations and require that pill camera primes be located as far away as likely from the IED to assure consistent image collection.

While researchers remain to link the dots between angiodysplasia and cardiac illnesses to establish indications for increased bleeding hazards in patients. Stephanie Mai, M.D., Loma Linda University Medical Center, Calif also made a study on the same topic that was presented at the Digestive Disease Week conference in 2016.[3] The study finds that there is an increased need for blood transfusions in affected persons with both entrenched cardiovascular devices and angiodysplasia.

The study was made on 89 patients, those who had small bowel gastrointestinal angiodysplasia. Out of 89 patients, 48 patients had vascular illnesses, leading to a six-fold increase in the risk of needing blood transfusions.

Mai was also elaborate in additional study find that peripheral vascular disease was significantly associated with non-isolated digestive angiodysplasia.[4]

Excepting pill camera endoscopy system from being used for investigative imaging in Cardiovascular Disease affected person will only obscure the imaging technique. There is a clear evident higher probability of patients with a medical sign with cardiovascular transplants creating issues in the colon. In the absence of enough evidence showing the imaging procedure has any adverse effect on cardiovascular implants, healthcare professionals are not ready to discontinue the use of the practice of pill camera endoscopy.

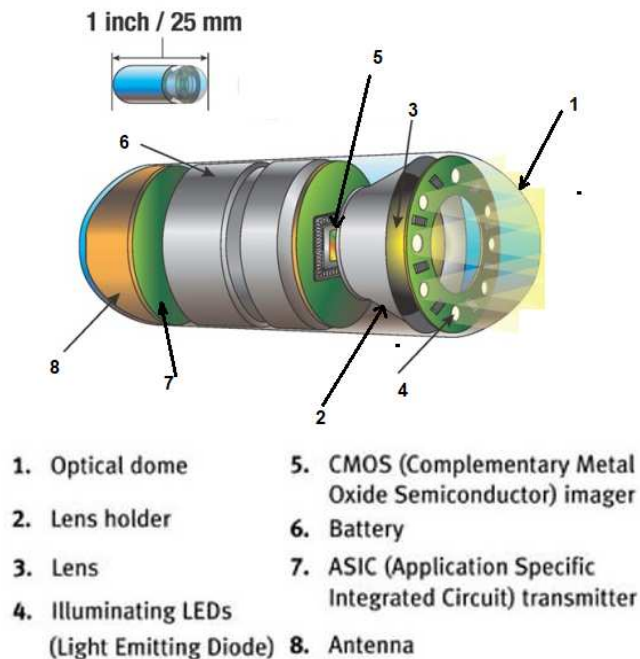
The pill camera endoscopy system is a one-time-use disposable product that does not require surgical actions or the running of anesthesia. There are various products established by the producers in this section, modified to function in the different parts of the gastrointestinal tract. For instance, PillCam is a range of capsule endoscopic devices manufactured by Given Imaging Ltd., including PillCam SB, PillCam Colon, and PillCam ESO.

The FDA accepted PillCam Colon 2 recently for investigative imaging in the presence of suspected lower colon bleeding. The permission will pave way for easy detection of colon polyps in suspected cases.

Pill camera developers of capsule endoscopy systems have made extraordinary growth in terms of advanced hardware and software technologies. Even though some many challenges, the safety standards are successfully maintained. While some beginner products are waiting for clearance from approval authorities, most of them have already saved so many billions of lives and gives very good results among the patient.

### **Components of the Endoscopy capsule**

The Endoscopy disposable capsule consists of an optical ceiling, lens pouch which holds the camera lens, Lens, LED light-emitting diode to act as light sources, CMOS (Complementary Metal Oxide Semiconductor) imager for taking the image, battery, ASIC (Application Specific Integrated Circuit) transmitter, and RF antenna.



### III. INTERNET OF THINGS

The Internet of Things (IoT) is a network of “things” things means any "things" except a computer with an embedded programmed controller with input sensor and output actuator and other technologies like Wi-Fi, Bluetooth, Ethernet, and ZigBee which are used to connect internet and exchange data with other devices and upload to cloud through the internet. Various IoT devices variety from small household things to very complex industrial things. As of now more than 20 billion connected IoT embedded devices today, experts are predicting that it grow to 25 billion by 2025 and 35 billion by 2028.

The growth of IoT technologies in the recent year is drastic and it became a significant trend in recent days. In this technological era, all the things starting from small things like a toothbrush, capsule boxes, home appliances, dolls to bigger devices like cars, industrial machines are monitor and controlled via the internet using an embedded system with sensor and actuator.

By using low-cost cloud computing, the cloud database, big data, data analytics, mobile app, and mobile technologies, IoT devices can sense the parameter to be measured and share the data to other devices and to cloud with fewer human interactions. In this technological internet-connected world, big cloud databases can record, monitor, and give signals to control the connected devices using actuators. This enables the digital world to monitor, control things. The enabler of IoT devices made existence because of several technological growths in this new technological era.

- **Cheaper sensor cost, as the drastic development in Chip technologies VLSI to ULSI and low power chip designs:** Enables cheap and efficient sensors

- **Connectivity:** As recent technological development in wireless network protocols like 3G, 4G and 5G WAN with lesser cost and high speed sensed parameter of “things” are upload data efficiently. Which enables cheaper connectivity and high-speed connectivity.
- **Cloud computing:** Recent development in cloud computing that clouds upload data processing is made easier and cheaper.
- **Machine Learning:** With developments in machine learning and data analytics, giant cloud database handling the sensed data made easier.
- **Artificial intelligence (AI).** The Advances in Artificial intelligence, enable IoT devices to become intelligent and effective decision making made easier with affordable price.

In the recent healthcare system, the Internet of Things (IoT)-devices plays a major role and remote monitoring of the patient is easily possible, the recent technologies with IoT enable a safe and healthy healthcare system. And also empower the doctors and physicians. It has also helped to monitor the patient continuously 24x7 easier and recorded for future analysis of patient health progress day by day, time to time and this enables improved healthcare modern system. As the Patients are monitoring remotely the crowd and patient’s stay in the hospital are reduced. IoT made the healthcare system efficient, low cost, outcomes, and proper timely treatments.

IoT is certainly developing the healthcare system to a height that benefits doctors, physicians, patients, family members by reducing treatment time and low cost.

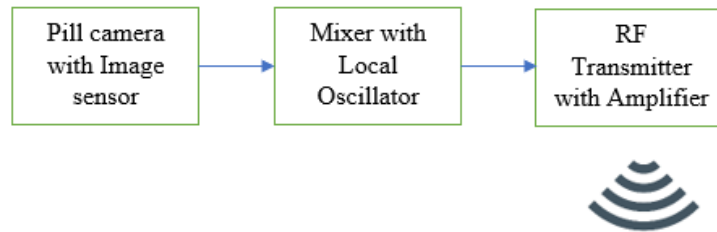
**IoT for Patients** – IoT wearable in the form of watches or hand bands continuous monitoring of Patient Blood Pressure, temperature, heartbeat rate, patient drowsiness, sugar level, etc. enables the doctor-patient continuously connected and personal attention can be provided by the doctor.

IoT also enables the monitor especially elderly patients with an emergency alert system that helps the doctor to get attention when and where the patient is required, which also helps continuous tracking of health conditions of elderly patients. This development enables the long-living of elderly patients with their families.

**IoT for Doctors** – With the help of internet-connected devices like computer, laptop, tablet, and mobile, the doctor can easily monitor the health condition of patients remotely and also provide necessary treatment with the help of actuators in IoT devices, doctor also can keep continuously track the health of the patient’s more effectively and quickly. They can track patients’ in advance and plans the right, timely treatment needs for the patient. IoT enables healthcare specialists to be more alert and connect with the patients. And Continuous collection of health condition data helps the doctor to identify the best treatment required for the patient and save the patient life.

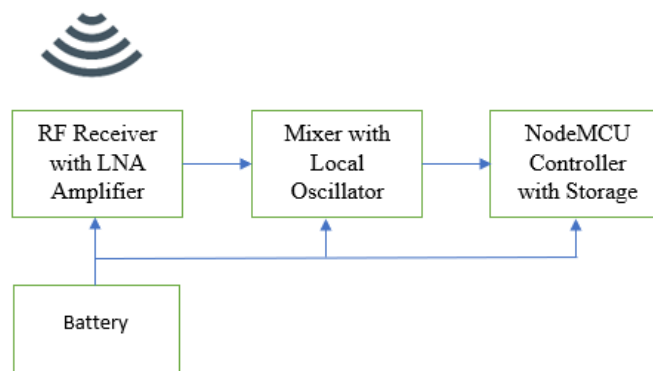
#### IV. PROPOSED METHOD

The Proposed novel Personal Healthcare System with Pill Camera using IoT for Endoscopy is shown in Figure 1.

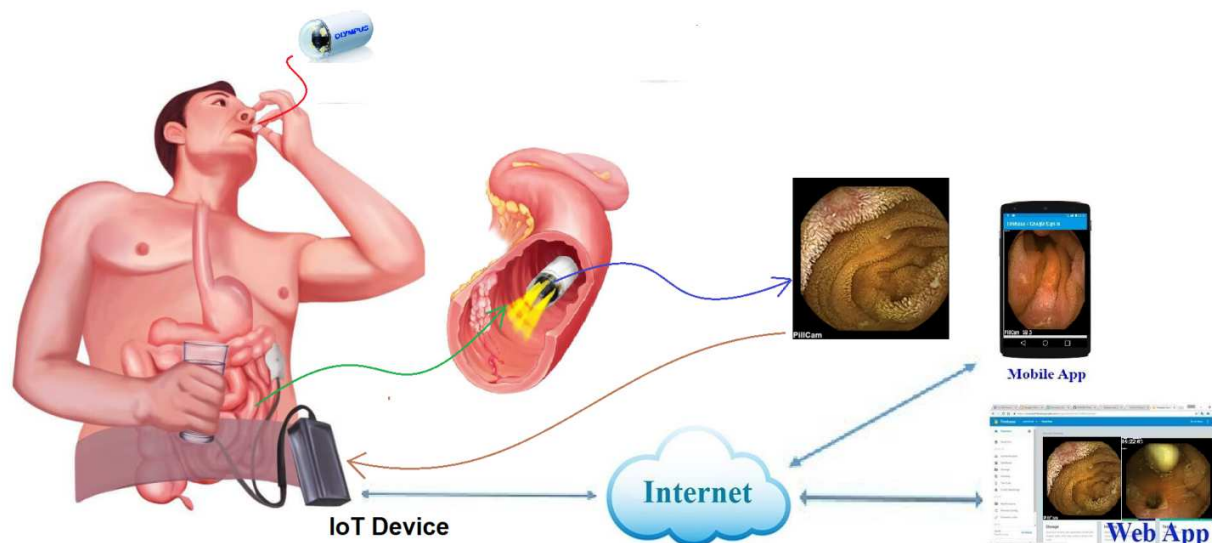


**Figure: 1 Block Diagram of the proposed Healthcare System with Pill Camera transmitter**

The Pill Camera with image Sensor, which is controlled by Android App for capturing Endoscopy photos, and these digital photos are modulated by Amplitude modulation with a mixer & local oscillator for frequency conversion. RF Amplifier amplifies the AM Modulated signal and is transmitted using RF Transmitter.



**Figure: 2 Block Diagram of the proposed Healthcare System with Pill Camera Belt Receiver with IoT Device.**



**Figure: 2 Diagram of the proposed Healthcare System with Pill Camera using IoT for Endoscopy**

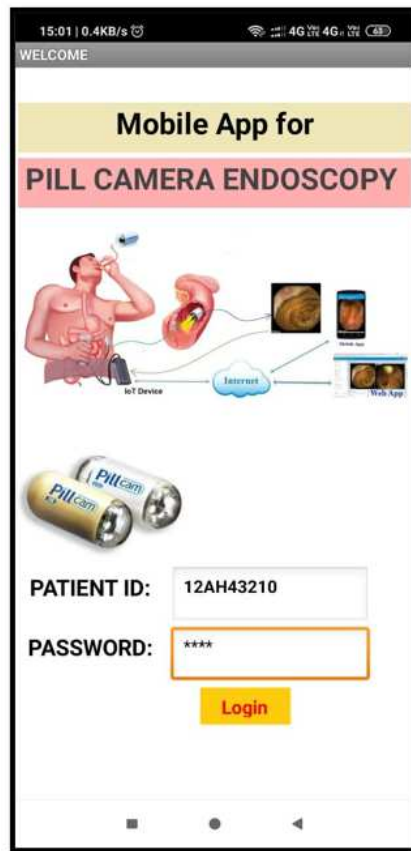
Figure 2 shows the Pictorial representation of the proposed system of the block diagram shown in figure 1 and the uploaded image in the cloud can be viewed in a mobile App as well as in a web browser with a URL.

Pill camera sensor array receiver belt consists of RF receiver which receives the AM modulated image signal and LNA Low Noise Amplifier using to amplify the signal with low noise and mixer is used to the down-conversion of the frequency with AM Demodulator circuit, the Demodulated signal is given to NodeMCU with the baud rate of 9600 bits per second and NodeMCU upload the image signal to cloud as an array of data. A battery is used to powered RF Receiver, Low Noise Amplifier, Mixer, Demodulator, and NodeMCU.

The inhaled pill camera is controlled using an IoT device and required images are captured and ASIC RF transmitter transmits an image to a wearable belt and it contains an IoT device uploaded to a cloud database (Internet). The uploaded images can be viewed on the website or mobile app. The analysis of captured images is made to find the illness.

The App is designed using MIT App inventor for displaying pill camera endoscopy photos.

MIT App inventor is Graphical User Interface Programming online app development tool, which is used to design app with block coding. It is open source for creating a simple app it required less than 15 minutes. The designer is used to design an app to the front view and Blocks is used to program by using block coding which is user-friendly for coding.



**Figure: 3 Screen Shot of Mobile App for Pill Camera Endoscopy Login Screen**

Firestore is used as a background to store the image array database in the cloud. Even very complex apps with sensors like Accelerometer sensor, Light Sensor, and Location Sensor, and cloud access can be done with the help of MIT App Inventor.

To Access the patient endoscopy image Patient ID and Password are entered using the Login screen.





**Figure: 4 Screen Shot of Mobile App to Pill Camera Endoscopy image**

Screenshot of mobile app screen2 used to control the light and capturing of endoscopy images in pill camera as shown in Figure 4.

## V. CONCLUSION

A novel approach for Personal Healthcare System with Pill Camera using IoT for Endoscopy proposed in this paper is useful to upload the captured images to the cloud and used to monitor, diagonalized, and make treatment. The system enables cloud storage as a database that can access at any time, anywhere using the website or mobile app. In the Future cloud computing is used for diagonalizing the captured images and also image processing like filtering, noise cancellation, and enhancement is done to increase the accuracy of diagonalization. The image capturing and light controls are made with the help of IoT through a website or mobile app. This proposed method optimizes the endoscopy pill camera image capturing.

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