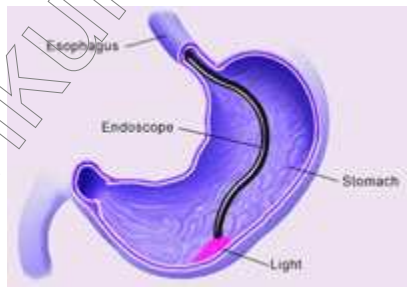
Endoscopy

Endoscopy is the **Medical technology** used to observe the internal organs like Gastrointestinal tract, Lungs etc using the instrument called Endoscope. Endoscopy helps easy diagnosis of defects inside the body. Endoscope can be directly inserted into the hollow organs of the body to take images. The Computerized Monitor will display the images of the internal organs.

The Endoscope consists of a **Flexible tube**, **Light delivery system**, **Lens system**, a **Charge Coupled Device** and a Plug in system to connect the device to computer. An Endoscope is a rigid or flexible instrument that functions through two fiber optic cables, one for the light system and another for collecting the images. There is an additional port for delivering the drugs or cleaning or biopsy.

The **Camera system** includes a Charge Coupled Device to take photographs of the internal organs. The CCD (Charge Coupled Device) enhances the image magnification, clarity and colour. The Endoscope is connected to a monitor system to view the internal details of the organ. The Endoscope transmits the magnified image to the monitor. The RGB filter system generates superior colour to the images. In **Video mode**, the CCD takes **30 Frames** of image per second.



Parts of Endoscope

The Flexible Endoscope has a Light guide plug, an Umbilical cable, a Control Head and an Insertion tube.

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1. **Light guide plug**

   The light guide plug is used to connect the light source. It has ports for air or water spray and a port for the suction channel.

2. **Umbilical cable**

   This cable connects the light guide plug to the head of the endoscope.

3. **Control Head**

   It is the major part of the Endoscope. It has handles to move the remote parts of the Endoscope and to control the Suction valve and Water or Air spraying valves.

4. **Insertion tube**

   It is meant to insert into the hollow organ of the body. The tip of the insertion tube has LEDs for lighting and a CCD for imaging. It also has openings of suction and air or water channels.

5. **Imaging system**

   It has a lighting system and an Imaging system. The Lighting system has thousands of **Optic fibers** to transmit light into the head of the Endoscope. The Imaging system has video camera unit or CCD, In Video imaging, a lens assembly with electronic chip is connected to the optic fiber. The individual sensors collect images as **Pixels** and finally make up the full image. The external **Video processor** then combines the individual images into a complete image to view in the monitor.

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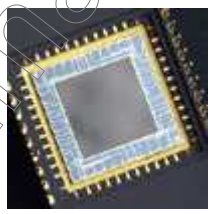
6. Charge Coupled Device or CCD

The head of the Endoscope has an **Electronic Chip** called **CCD**. It works on the basis of charge movements which can be converted into **Digital** values. CCD shifts the charge between stages with in the device. The **Capacitive Bins** in the CCD are meant for shifting the charges. The CCD is integrated with **Image sensors** so that digital imaging is possible.

The CCD has an **Epitaxial layer** of **Silicon** which is **Photo reactive** and a **Transmission** region. The Epitaxial layer of CCD is doped with **Boron** which forms the **p- region**. Some areas are doped with **Phosphorous** to form the **n- region**. A **Capacitive dielectric** called **Gate Oxide** is present on the top of the Silicon layer. **Polysilicon gates** are deposited through **Photolithography** to form the phased gates perpendicular the channels. The channels in the CCD prevent the thermally producing oxides so as to separate the charge packets of the columns.



The Lens assembly projects the image onto the Capacitive array of CCD. This causes accumulation of charge in each capacitor proportional to the light intensity of the imaging area. The **clocking gates** of the CCD change the state **high** and **low** and forward and reverse bias the **n** and **p** doped regions. This will cause **depletion** at the p-n junction so that the charge moves through the channels. The individual capacitor then transfers the charge to the neighboring capacitor like a **shift register**. Finally the last capacitor transfers the charge into a **Charge Amplifier** which then converts the charge into corresponding voltage. The **Control unit** converts all the

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charge levels into a series of Voltages. These voltages can be sampled and digitalized and stored in memory or displayed through the Monitor.

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