QUIS ON CCD PRINCIPLES

(1) TV Camera consists of three sections.

(2) They are Camera lens and optics, Transducer or pickup device and Electronics.

(3) Camera lens and optics forms optical image on the face plate of a Pick up device.

(4) Transducer or pick up device converts optical image into an electrical Signal.

(5) Electronics process the output of a Transducer to a CCD signal.

(6) Pick up device are of three types photo emissive material, photo Conductive material and CCD (charge coupled device)

(7) A charge couple device is a semiconductor device in which metal Oxide semiconductor (MOS) Capacitors are arranged in a grid.

(8) A Transducer which converts optical image into electrical signal is Called CCD

(9) CCD reads the image of picture by storing a group charges based On the image.

(10) And transfer these charges to a built-in amplifier, which converts Them into video signal.

(11) CCD's are made up of silicon wafers.

(12) Each silicon wafer contains several MOS chip capacitors.

(13) Silicon is sensitive to Light so silicon is used in CCD s.

(14) Silicon responds to wavelength spectrum
(300 nm 1000 nm)

(15) In CCD Sensor IC, Resolution depends on Number of photo Site on an area with 3:4 aspect ratio.

(16) One pixel or photo site or picture element or one CCD element Or MOS capacitor.

(17) One CCD sensor IC has 383 rows x512 columns photo site.

(18) Structure of CCD consists of image area connection pins, Gold bond wires, Bond pads, silicon chip, on chip amplifier Serial register.

(19) MOS capacitor consists of P type substrate, Holocorrios (GND) depletion region (potential wall) silicon dioxide as Insulator, Metal as positive.

(20) Deplition layer reduces when light falls on CCD chip.

(21) Charge collection in a CCD involves.
(1) Photons entering the CCD creates electron hole pairs.
(2) The electrons are then attracted towards the most positive Potential in the device where they create charge packets.
(3) Each packet corresponds to one pixel.

(22) Charge coupling or charge transfer process causes (1) Developed Charge packets moves through the CCD device and delivered to Output amplifier.(2) Conversion of charge packets takes place to Voltage.

(23) If V2 is more + ve then V1 the charge e mover to the new site.

(24) In a CCD element ,At the surface of the semiconductor where it Meets the oxide layer has a tendency to trap electrons.

(25) This will not allow the complete transfer of charge and the Charge packets will not be emptied completely to releave the Next scan.

(26) These traps of charge are called surface traps and causes Simear in picture .

(27) Buried channel CCD: charge transfer well below the surface To avoid surface traps.

(28) An extra layer of N type material below the oxide layer improves S/N and sensitivity.

(29) Three types of CCD formats are point scanning (2) line scanning. (3) Area scanning .

(30) Three types of CCD's based charge transfer are Interline transfer, Frame interline transfer .

(31) Interline transfer Type CCD consists of (a) A light receiving CCD,(b) A vertical transfer CCD,(c) A horizontal transfer CCD.

(32) Interline CCD consists of vertical Register, Horizontal register, Sensor and output amplifier vertical register .

(33) Frame Transfer Type of CCD
Consists of image Area, Storage area, H. Register, Pre amplifier. And output,mosk.

(34) Image area sensor + shift Register =Image area.

(35) Half field or zooms of storage time = storage area.

(36) Structure of FIT CCD has imaging area, storing area, and sensor V Register,

(37) FIT type CCD cosists of A Light receiving CCD, A Vertical Transfer CCD, A storage CCD, and a horizontal transfer CCD.

(38) Signal flow is from sensor -- Vertical transfer CCD -- storage Area – H.Transfer CCD-- Preamplifier.

(39) Silicon Based CCD's are monochrome in nature.

(40) Three techniques to extract color information from a scene are Color sequential capture (2) three chip color capture,(3) integral Color Filter Arrays patterns.

(41) Color image is created using CCD by taking three successive Exposures while switching in optical filters having the desired RGB characteristics.

(42) In integrated color picture arrays. Filters of the Opropriate Char Are placed on the chip during device fabrication.

(43) The advantage of CCD is
It has high degree of sensitivity

(44) A good CCD can produce an image in extreamely dim light.

(45) Low power consumption, No head amp as o/p of the device is 400mv.

(46) CCD's are used in Digital still and video cameras, Bar code Readers etc.