

CCTV Industry

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Abstract – Classification was carried out surveillance equipment in the industry and the optical elements used. Classification was carried out the matrix semiconductor photoconverter. Two systems have been developed to monitor certain processes in the industry in black and white cameras, color camera or thermal imaging cameras. Used cameras are connected in a closed circuit television (CCTV) camera, system and an internet connection (IP camera, Internet Protocol camera, Web camera) - IP system. The used monitors are picture in picture (PIP, Picture In Pucture). Observations can be carried out during the day and night.

Keywords – CCD matrix semiconductor photoconverters, Infrared security CCD cameras, Night vision devices

I. INTRODUCTION

Monitoring industry using black and white or color security cameras, solid state video camera (Camcorder, Handycam), digital cameras (PDA, Photographic Digital Apparatus), thermo vision cameras, equipment and night vision goggles, endoscopes, borockopes, fiberoscopes, periscopes, telescopes, visual tubes, microscopes and more.

II. CLASSIFICATION OF INFRARED (IR) SECURITY CAMERAS

There are two types of infrared security cameras: black and white and color.

Minimum illumination in black and white camera is 0,01 lx; 0,05 lx; 0,1 lx.

Minimum illumination for color cameras – 3 lx.

A resolution of the IR cameras, 360, 380, 420, 480, 600 Horizontal TV lines (TVL, TeleVision Lines).

The cameras can be installed in PID (PIR) (Passive Infrared Detector) detector, smoke detector, in a clock, a wall sconce, in chandelier, in glasses, rings, Spies, jewelry, earrings, necklaces, bracelets and more.

The cameras can be night or day surveillance and nighttime observation.

Security cameras work in the near infrared range (NIR) or in the far infrared range (FIR).

Infrared cameras can be integrated with the IR source (IR LEDs, Infrared Light Emitting Diode (s)), without built – IR

source or halogen projector for visible light (Floodlight camera).

Voltage of security cameras battery is +12 V.

The cameras can be a Wireless security camera (radio) and wire connection with headquarters.

Infrared cameras are divided in cupola, cylindrical, parallelepiped, board, cameras on a single chip.

Depending on the infrared camera assembly are divided into external, internal and secret cameras. Mounting has waterproof outside cameras.

Cameras are CCD (Charge Coupled Devices) camera or CMOS (Complementary Metal – Oxide – Semiconductor) camera.

The cameras can be connected to the Internet (IP camera and Web camera).

Infrared cameras can be connected in closed circuit television sistem (CCTV camera system).

The cameras can be a zoom lens with an option for rotation and tilt PTZ camera (Pan Tilt Zoom camera).

Information from infrared cameras unless it can be observed directly on a monitor and can be recorded continuously or for a specified period of time.

Video cameras may be digital and analog. Image standards PAL (Phase Alternation Line (s)), CCIR (Consultative Committee for International Radio), NTSC (National Television System Committee).

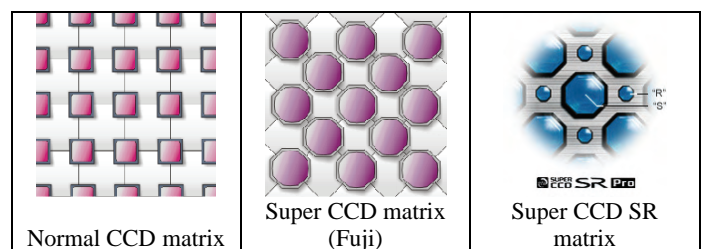
The observed object or process can be displayed on a cathode – ray tube (CRT, Cathode - Ray Tube), TFT LCD monitor (Thin - Film Technology Liquid Crystal Display screen).

Audiocompresion format Dolby Digital.

Record information on a magnetic medium (Mini DV (Digital Video) cassette, Compact Flash (CF); MultiMedia Card (MMC); Smart Media (SM); Secure Digital (SD); Memory Stick, Stick card (SC); USB flash drive or optical media; DVD (Digital Versatile Disk) drive and Blu – ray disk)

Video compresion formats MPEG2 (Motion Picture Expert's Group) 2 and JPEG (Joint Photographic Experts Groups).

III. CLASSIFICATION OF THE MATRIX SEMICONDUCTOR PHOTOCONVERTERS – FIG. 1 AND FIG. 2



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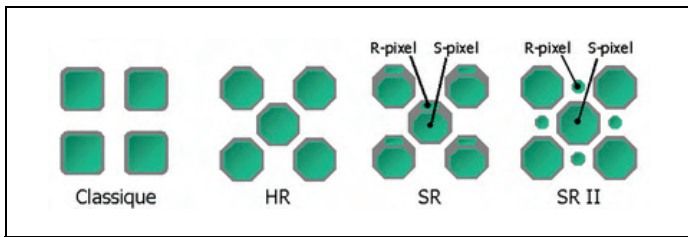


Fig. 2. Types of CCD matrixes

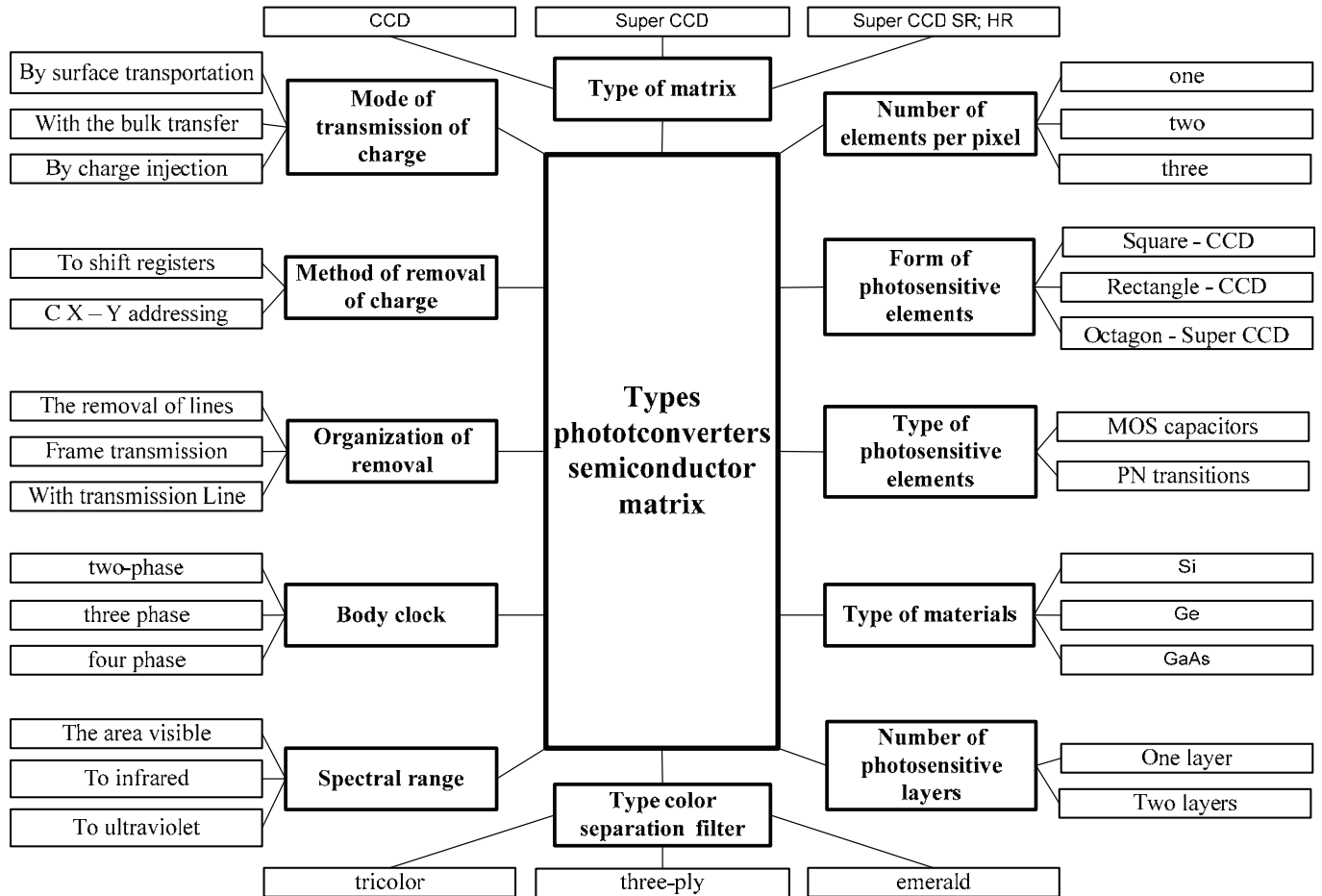


Fig. 1. Matrix semiconductor photoconverters

A. Super CCD matrixes semiconductor photoconverters

Under the new Super CCD matrix elements are angled 45° and have a shape of an octagon. This will reduce the area occupied by circuit buses. New principle available to the photosensitive elements resembles honeycomb. Thus increasing the effective resolution of 60% compared to traditional matrixes. These matrixes with higher resolution CCD and Super CCD matrixes.

B. Super CCD HR (High Resolution) matrixes

These are matrixes with very high dynamic range – fourth generation dies. The structure of the Super CCD SR lies in the combination of large photodiodes (S – pixel),

having greater sensitivity to small photodiodes (R – pixels), having less sensitivity.

Monitoring with very high resolution bright and dark sectors are used to Super CCD SR matrixes.

C. Other types of CCD arrays and CCD devices

Super Hole – Accumulation Diode CCD (Super HADCCD); Electron Multiplying Charge Coupled Device (EMCCD); Intensified Charge Coupled Device (ICCD).

IV. BLACK AND WHITE OR COLOR SECURITY CAMERAS FOR MONITORING IN INDUSTRY

A. Black and white security cameras

Application for continuous monitoring of industrial processes in normal and low light.

Parameters of IR security CCD cameras used to work near infrared range (NIR).

Parameters of the IR camera type KP – F2A company Hitachi:

- Maximum spectral sensitivity of - 760 nm (700 to 1000 nm);
- Signal format output - 30 fps;
- Dimensions of the sensitive element - 1 / 3" (8,47 mm) CCD;
- Number of pixels horizontally and vertically (H x V) - 658 x 496;
- Pixel size (H x V) - (7,4 x 7,4) μm;
- Sensitive area (H x V) - (4,87 x 3,67) mm;
- Horizontal resolution - 500 TV lines (TVL);
- Video Output - 1 V_{p-p} / 75 Ω BNC;
- Installation of the lens - C-mount;
- Distance (min) - 17,5 mm;
- Synchronization - Internal/ external;
- Minimum illumination of light - 0,3 lx;
- Signal/ noise ratio - 50 dB;
- Electronic Shutter speed - or off 1/ 60, 1/ 125, 1/ 250, 1/ 500, 1/ 1000, 1/ 2000, 1/ 4000 and 1/ 8000 s (second);
- Gamma - 0,45/ 1,0 elected;
- Automatic gain control - On/ off;
- Working temperature - (-10 ÷ +50) °C
- Supply voltage - 12 V DC;
- Power supply - 220 V/ 50 Hz;
- Dimensions - (44 x 44 x 87) mm;
- Weight - 170 g.

(Fps – frames per second (frame (s) per second), H/ V (Horizontal/ Vertical), pp (peak - to - peak), BNC (Bayonet Nut Connector), DC (Direct Current)).

In Fig. 3 is a spectral characteristic of infrared CCD camera type KP – F2A company Hitachi.

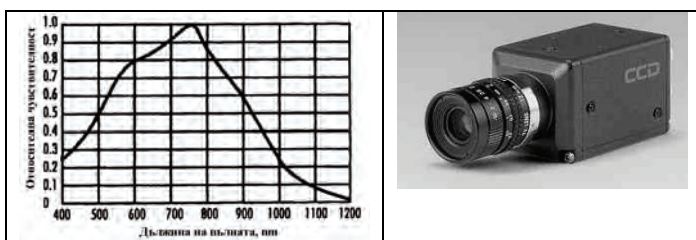


Fig. 3. Spectral characteristic and CCD camera

CMOS black – white camera company Conrad (2010):

- Supply voltage - (9 to 12) V DC;
- Login - audio/ video (A/ V);
- Antibloming – yes;
- Consumed current - 18 mA;
- Video Output - 1 V_{p-p} / 75 Ω;
- Standard - CCIR, 628 pixels (H) x 582 (V);
- Angle of acceptance - 70° x 63°;
- Signal/ noise ratio > 48 dB;
- Sensitivity - 0,5 lx;
- Dynamic Range - 78 dB;

- Photodetector sensor - OV7410;
 - Aperture - 2,0;
 - Focal length - f = 3,7;
 - Number of pixels - 365 496;
 - Length of the camera - 44 mm;
 - Chamber diameter - 24 mm.
- A/ V (Audio Video), OV (Operational View)

B. Colour security cameras

Color video camera for surveillance PIH70XX/ H

- Lighting - 0,01 lx;
- Digital signal processing (DSP);
- Horizontal resolution - 480 TV lines;

C. PDA

PDA are classified in different signs: the number of sensor arrays: one CCD, three CCD matrixes, the number of photodetectors (PD) in a pixel: PD one, two PD, the number of color filters: with three filters, four filters.

V. DEVICES AND NIGHT VISION GOGGLES

Application: monitoring of processes and equipment in the industry at very low light.

A. Night vision devices (NVD)

A major element in them is electro converter EOP (EIT, Electron Image Tube).

NVD four generations. When I - st generation NVD currents are sensitive photocathode (PC) 60 μA/ lm. In III – Generation NVD photocathode is gallium arsenide, a microchannel plate amplified coated with ion barrier. Spectral sensitivity of the PC is 450 to 950 nm. In Fourth Generation NVD currents sensitivity of PC is 1800 μA/ lm, Watt sensitivity (λ = 830 nm) - 190 mA/ W, the resolution - 64 lp/ mm, halo - 0,75 mm, signal/ noise ratio – 25, reliability - 10 000 pm, detected distance - 480 m. Tube type used is "Gated filmless tube". Microchannel plate (MCP) consists of a bundle of optical fibers to 10⁶, which increase the brightness.

B. Night Vision Goggles

Reference data for night vision goggles with a double pipe type "Diana TT", production company OPTIX – Panagyurishte.

1. Magnification (1x).
2. Field of view (FOV) - 50,9 degrees.
3. Resolution - 45 ÷ 57 lp/ mm.
4. Finding rangem - ~ 270 m.
5. Orientation range - ~ 225 m.
6. Detection range (Recognition range) ~ 105 m.
7. Range of Recognition (Identification range) ~ 55 m.
8. Focus range - 0,2 m ÷ ∞.

9. Operating wavelength diode to illuminate - 880 nm.
 10. Exit pupil relief - 25 mm.
 11. Exit pupil diameter - 18 mm.
 12. Eye basis - fixed - 66 mm.
 13. Inter - pupil (ary) distance (IPD) 6 mm - 54 ÷ 98 mm.
 14. Diopter adjustment - + 4 ÷ - 6 diopters (dpt).
 15. Power supply alkaline battery – 1,5 V.
 16. Power supply lithium alkaline accumulator - 1,2 V.
 17. Life of the battery - 30 hours.
 18. Built in automatic disconnection at illumination higher that 5 ÷ 10 lx.
 19. Weight - 630 grams.
 20. Overall dimensions (Length x width x height) - 103 x 106 x 64 mm.
 21. Operating temperature – 50 °C ÷ + 50 °C.
- Couple lp/mm- lines pairs per millimeter.

VI. THERMOVISION SYSTEMS OR THERMAL IMAGING CAMERAS

Sensitive elements in thermo vision systems for the far infrared part of the spectrum are the photodetectors (after 6 μm). On the thermal imaging system, except transmission by object falling and disturbing radiation emitted by the environment and reflected radiation from surrounding objects.

Application of IR systems: monitoring of temperature change, sites of chemical industry (process of formation of parts, cooling rates of the polymer melt, temperature distribution of injection molds, drawing optical fiber) oil industry (temperature control in tanks); Construction (analysis of thermal insulation breakdown) electronics (production of semiconductors, thermotransfer, especially in powerful components and appliances), medicine (distribution of skin temperature, diagnostics of the thyroid gland, subcutaneous location of disease outbreaks) measuring temperature of the sheet; detection of flying objects (airplanes) to measure the temperature of the Sun, Moon and planets, border guards and others.

VII. ENDOSCOPES, AND BOROSKOPES FIBEROSKOPES MONITORING IN INDUSTRY

Application: For monitoring and non – destructive control and diagnostics of internal surfaces of machinery, equipment, tools, assemblies and components which are not accessible to the naked human eye.



A. Video image endoscope (VID) series:

- Diameter - 6/0mm - 8/0mm;
- Operating length - 1.0 m ÷ 6.0 m;
- Articulation - 2 or 4 ways (120° left/ right and (or) over 160° up, 130° down, 100° left/ right);
- Image Sensor - 1/ 4"color super - HAD PZS (Hole - Accumulation Diode Positioning Zone Sensor);
- Resolution - 330 TV lines;
- Video Output - NTSC/ PAL;
- Camera/ Image control - on the handhold;
- Handhold - aluminium with a black powder treatment;
- Survey direction - 0° forward;
- Objectives - are provided with the objective of 58° angular field where the color code black and the objective of 90° angular field where the color code red is;
- Covering of tube - Tungsten armor;
- Bending radius of the tube - 50mm;
- Operating temperatures - Operating end: - 10° ÷ 80° C;
- Body (case) and cable of the lighter: - 10 °C ÷ 50 °C;
- Bars.

VIII. CONCLUSION

Classification is done by the authors of the matrix semiconductor photoreceivers, classification of the cameras and classification of devices for monitoring processes in industry. Proposed are two systems for monitoring CCTV and IP. Elected representatives are typical of instruments for monitoring during both day and night. Here are the basic parameters and characteristics of the equipment.

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