World Journal of Engineering Research and Technology

WJERT

www.wjert.org

SJIF Impact Factor: 5.924

COSMIC RAY DETECTOR BY THERMINO PARTICLE DETECTOR USING WEBCAM

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Article Received on 07/02/2022 **Article Revised on 28/02/2023** **Article Accepted on 19/03/2023**

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ABSTRACT: By using Thermino particle Detector software and Webcam resolution 1280 X 720 pixels, one can detect the high energy particles like Cosmic Rays, Alpha, Beta and Gamma Radiations etc., To detect Cosmic Rays, arrange the webcam with certain arrangements and connect it to the system or PC. The software can identify the Cosmic Rays at particular moments and record at regular intervals of time. This software just integrates the images to get some kind of "long exposure". This way, one can record the particles and particle traces are not removed. Webcam contains CMOS Sensor which should be adjusted the minimum energy parameter.

KEY WORDS: Thermino Particle Detector, CMOS Sensor, Cosmic Rays, Alpha Particles, Beta Particles, Gamma Particles etc.

INTRODUCTION

Present paper describes that one can detect Cosmic Ray Particles by Thermino particle Detector using commercial Webcam. By using this project everyone can easily detect not only Cosmic Ray Particles but also Alpha, Beta and Gamma radiations with low cost from normal webcam.

COSMIC RAYS

Cosmic Rays are travelling with speed of speed of light, are clusters of particles. They originate from the space They Produce different characteristics when they entered into the atmosphere. In 1912 Victor Hess discovered in balloon experiments and got Nobel Prize in 1936. Cosmic ray particles are not directly observed on the surface of Earth. This is because cosmic ray "primaries"—that is, the particles that arrive at the outer edge of Earth's atmosphere collide with atmospheric nuclei and give rise to "secondaries." Some secondaries are fragments of the colliding nuclei, including neutrons, and others are short-lived particles created from the energy of the collisions. Secondary nuclei soon have their own collisions. It is the secondaries (neutrons and short-lived particles such as muons) that are observed at sea level. Primaries must be studied by using either high-altitude balloons or spacecraft.

COSMIC RAY DETECTOR PROCEDURE

WEBCAM

A Webcam may be a small digital video camera that connects to a computer. It is also referred to as an internet camera which will capture pictures or motion video. These cameras accompany software that must be installed on the laptops, systems, pcs that help to transmit its video on the web in real-time. It's the power to require pictures, including HD videos, but its video quality are often lower as compared to other camera models.

A webcam captures digital pictures because it is a data input device. These images are forwarded to the PC that moves them to a server. Then, these pictures are often transmitted to the hosting page from the server. Now a day, most of the webcams are connected to the USB or Fire Wire Port on the PC or embedded into the display with laptop computers. It includes characteristics such as:

a) Especially form a video telephony perspective, the value of webcams is taken into account lower as compared to other models of camera.
b) The maximum resolution of a webcam is low as compared to most handheld cameras.

The webcam features are mainly hooked in to the PC processor also as an OS of the PC. They will provide advanced features like image archiving, motion sensing, custom coding or maybe automation. Furthermore, webcams are used for social video, video broadcasting, and computer vision and mainly used for security surveillance and in videoconferencing.

The web camera comes with high resolution video calls with video quality support up to 1280 X 720 pixels alongside the newest version of Skype, video chat & a high quality video experience for the user. The device has been designed for recording high quality videos for You Tube or other uploads with 5 glass lens that assures the user to capture a picture with HD quality. The webcam has an inbuilt and high quality isolated microphone that helps to avoid unnecessary noise during video chats and while recording HD videos, alongside an automatic low light correction features for a coffee light environment. The webcam has been designed with a universal clip which will be easily attached to your laptop or computer screen or used as a represent a disk or shelf with different angles. It also can get easily fixed with tripod ready universal clip that completely fits with the Laptop and LCD monitors.

WEBCAM ARRANGEMENT

Figure 5: Camera

Figure 6: Screwdrivers set

Using Web Camera HD 720P (1280X720) which is easily available in the market or in online, we detect the cosmic rays along with Thermino Particle Detector Software. Before that, webcam should be modified. With careful attention, make the changes in such a way that to restore its originality. The light sensitive element CMOS is present inside the webcam. The CMOS sensor is constituted by a pixel of matrix. Each pixel includes a photodiode and a conversion circuit / amplifier that convert the charge originated in the photodiode into a voltage that is read, pixel by pixel, and subsequently digitized into a numerical value ranging from 0 to 255. To select the color a tiny color filter (red, green and blue) is positioned above each pixel, resulting in a "mosaic" of colored pixels, then the image is processed in a timely manner (interpolation) to reconstruct the originalimage.

The active element, sensitive to particles, is that the Photodiode shown within in the image above. The ionizing particle enters into the sensitive area from the top window and produces in its passage several hundred holes or electron pairs are collected by the anode or cathode of the diode and produce the signals that is subsequently digitized.

Some of the sensors:

Silicon Bang Gap = 1,115 eV

Couple production energy $\frac{e}{h}(300^0K)$ = 3.62 eV

Electron ionization power = 80 $\frac{e}{\mu m}$

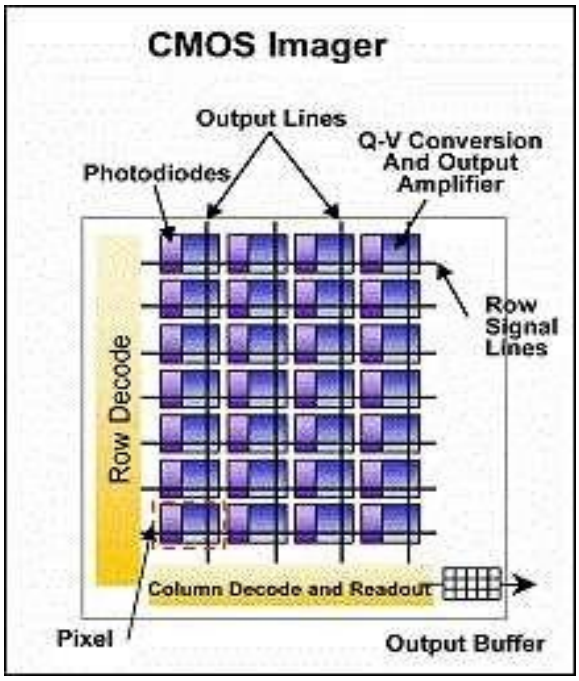

Figure 7: CMOS image Sensor diagram of Webcam.

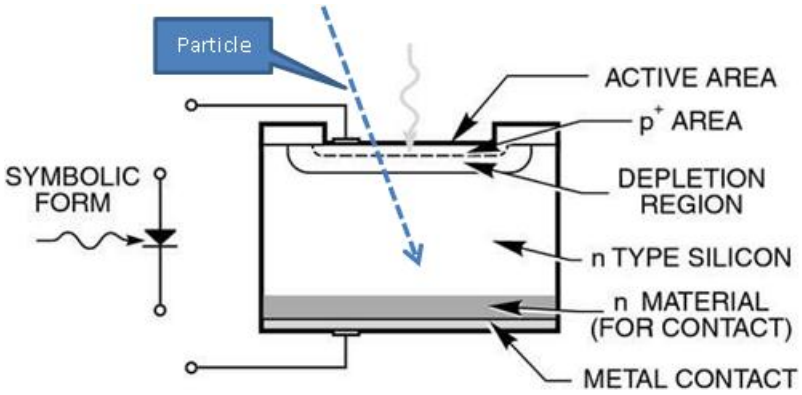

Figure 8: Circuit Diagram of CMOS sensor.

WEBCAM MODIFICATION

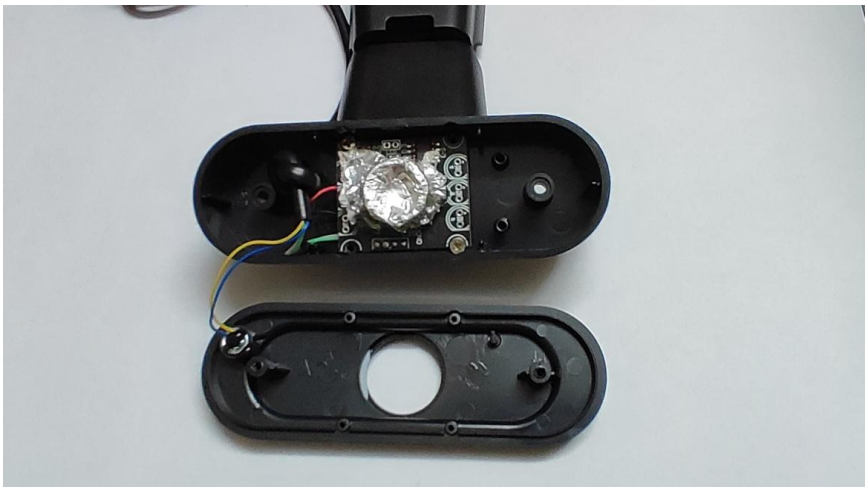

Figure 9: Camera Lens covered with Aluminum foil.

Camera Lens can be taken off as shown in the figure 9. The remaining part of Camera lens should be covered with Aluminum foil to avoid the CMOS Sensor can detect by the light. The above figure 9 gives an idea to cover the lens with Aluminum foil. The Altered camera mounted again with covers which are previously removed.

THERMINO PARTICLE DETECTOR SOFTWARE

To capture the pictures recorded with the webcam it's been realized the Theremino Particle Detector software. This software simply performs the mixing of the pictures so on achieve a kind of "long exposure". During this way the particle tracks aren't erased at every acquisition cycle but accumulate frame by frame. Within the picture below an example of a recording is shown.

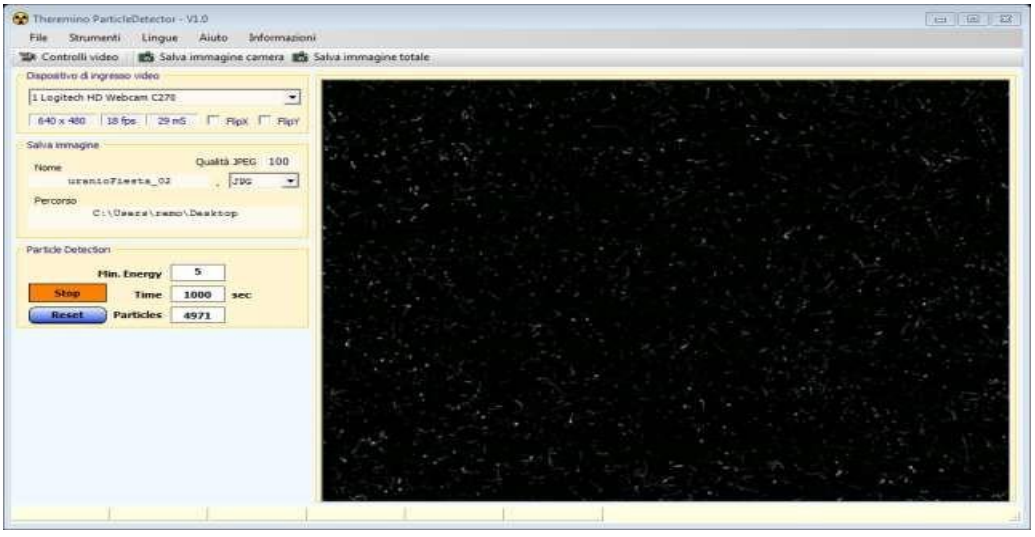

Figure 10: The Picture of Thermino Particle Detector software in the system.

This software gives liberty to adjust minimum energy (0 to 300) in such way that not to count unwanted events caused by the CMOS Sensor noise.

By using START / STOP buttons everyone can Start and Stop the program to record the events continuously and automatically it counts the time and record the event (particles) detected.

RESET button can be used to restart and recount the time and the event counter. At the time of recording, the events which are identified are counted in the box “Particle Detection” and also record the time in the “Time” as shown below.

While running the program or event, events which are reflected on the screen by particle detection are counted and clearly shown on the box “Particles” and the recording time also shown in the box “Time” which can show in the following figure. “Counts per Seconds (CPS)” gives the ratio between Particles and Time.

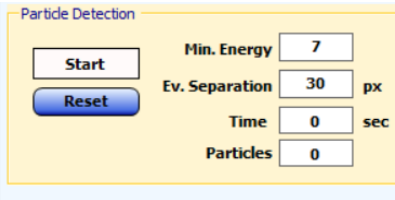

Figure 11: It shows the particle detection with time and particles.

To get the best results we can set the webcam with the following parameters which are shown in the following figure

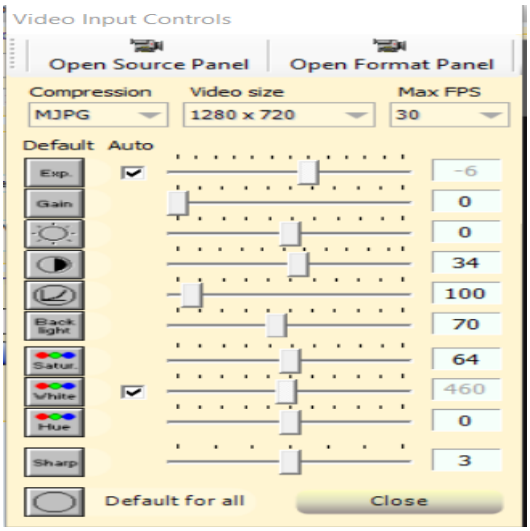

Figure 12: It shows the different parameters of the Thermino Particle Detector Software.

The Parameters are to be set before recoding the event:

Resolution: 1280 X 720

Exposure: - 7 (Corresponding to 1 per 10 seconds)

Gain: 255

Sharp: 255

Back Light: 0

The Software itself adjust the Parameter "Minimum Energy", which omits form the survey the events caused due to the noise of the CMOS sensor. The dispensation of noise has the exponential function from the studies as seen in the semi-log graph given below. Most of the noise cancelled by arranging the comprised values between 0 and 25.

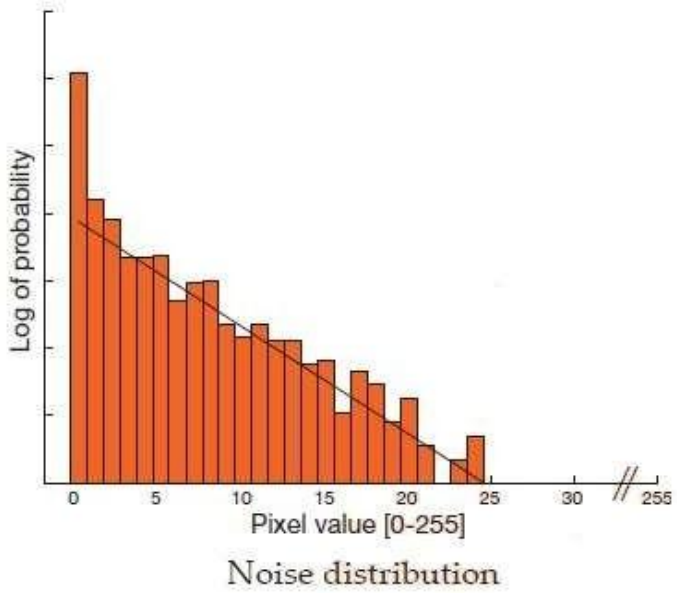

Figure 13: It shows the Noise Distribution comprised from 0 to 25.

DETECTION OF COSMIC RAYS

Cosmic Muons Can detected by the Webcam Sensor. Just set its level so concerning maximizes the delicate surface and taken an uncovering enduring many hours. The two concepts beneath are relative to two calculations.

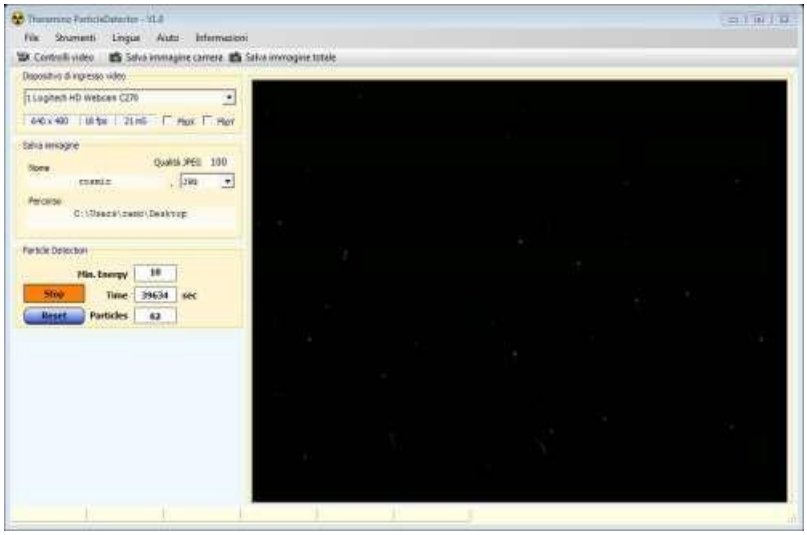

Figure 14: Detector of Cosmic Rays at time 1.

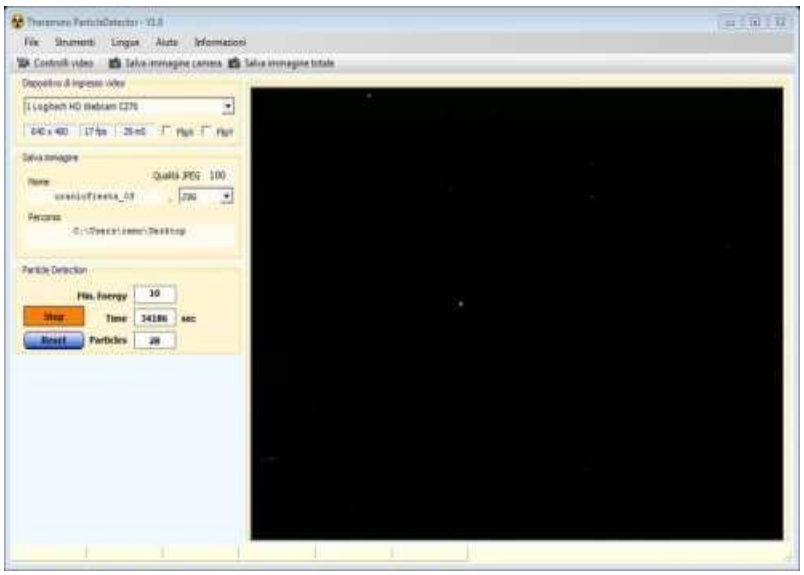

Figure 14: Detector of Cosmic Rays at time 2.

First measurement: At the time of 34,186 Seconds, 28 cosmic rays detected

Second measurement: At the time of 39,634 Seconds, 62 particles detected.

The presence Cosmic Rays differ from place to place. If Cosmic Rays hit the particles heavier than them, they deviate their direction., If pollution is more, the presence of Cosmic Ray Particles is less in that area.

CONCLUSTION

The Webcam and Thermino Particle Detector are so sensitive to Cosmic Rays such as Muons, however the little surface of the sensor, limits the possibility of extensive use.

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