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Environmental Area Radiation Survey Meter

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***Abstract*— Now a days presence of Gamma Radiation became major problem in many industries. The paper discusses radiation measuring device equipped with radiation sensor. This survey meter EARM7IBD detect gamma rays. The radiation is invisible and not directly detectable by human senses, therefore the radiation sensor used in Environmental Area Radiation Survey Meter (EARM) is based on Geiger Muller Tube as a reliable detector. EARM allows the operator to detect and records the radiation level emitted to the environment. This unit is micro controller based and displays the radiation field on 5 digit display and generate the audio alarm through piezo electric buzzer and visual alarm indication through large LED lit windows, when field exceeds a preset value set through a keypad. Current output of 0-1mA is provided which is isolated from the system.**

***Index Terms*—Gamma Radiation, Geiger Muller, EARM**

I. INTRODUCTION

The radioactive elements and their radiations are indispensable part of the nature. Gamma radiations present in the environment above certain limit is hazardous for the human beings and not directly detectable by human senses. In this project, EARM is used to detect the gamma radiations in the environment using GM tube (LND7128).

The proposed system Environmental Radiation Survey Meter, consist of linear power supply, high voltage conversion circuit as a supply voltage for detector sensor. GM tube which is used as a radiation detector is quiet cheap as compare to other detectors. This affects cost of system assembly and therefore it can be used in area where radiation occurs such as various industries, as it detects even a small increase in radiation because of its high sensitivity.

Radiation detectors have become an essential tool for emergency personnel who may have to respond to unknown accidents, incidents, or terrorist attacks, which could involve radioactive material. More and more ordinary citizens are interested in personal radiation protection, as well. So this project helps to detect the radiation present in the environment and system model is shown in fig.1.

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Fig.1

II. TYPES OF DETECTORS

1) Scintillation Detectors:

Scintillation detectors use crystals that emit light when gamma rays interact with the atoms in the crystals. The intensity of the light produced is proportional to the energy deposited in the crystal by the gamma ray. The sensitive volume of a scintillation detector is a luminescent material (a solid, liquid, or gas) that is viewed by a device that detects the gamma-ray-induced light emissions [usually a photomultiplier tube (PMT)]. The scintillation material may be organic or inorganic; the latter is more common. Examples of organic scintillators are anthracene, plastics, and liquids. Sodium iodide detector is example of scintillation detector.
Advantages of sodium iodide detectors are,
It can be produced in large crystals with good efficiency.
It produces intense burst and the light as compared to other scintillation detectors.
Limitation of Scintillation detectors is, It is very costly as compared to other detectors.

2) Gas-Filled Detectors:

A gas-filled detector is basically a metal chamber filled with ionized gas and containing a positively biased anode wire. When gamma rays incident on this gases ionization takes place and gas filled detector works on the ionization principle. This detector is nothing but the GM tube as shown in fig.2.
GM tube which is used as a radiation detector is quiet cheap as compare to other detectors. This affects cost of system assembly and therefore it can be used in area where radiation occurs such as various industries, as it detects even a small increase in radiation because of its high sensitivity.
Hence in this project we are using the gas filled detector which is GM tube LND7128.

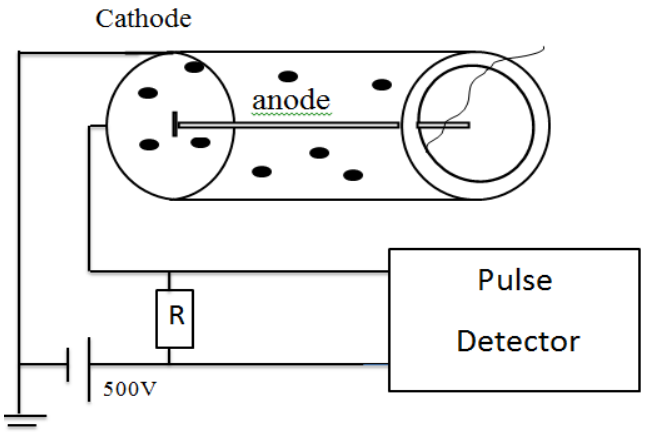

Fig.2 Geiger Muller tube

3) Semiconductor Detectors:

Semiconductor detectors, also called solid-state detectors, are fundamentally different from scintillation detectors: They rely on detection of the charge carriers (electrons and holes) generated in semiconductors by energy deposited by gamma ray photons.

In semiconductor detectors, an electric field is applied to the detector volume. An electron in the semiconductor is fixed in its valence band in the crystal until a gamma ray interaction provides the electron enough energy to move to the conduction band. Electrons in the conduction band can respond to the electric field in the detector, and therefore move to the positive contact that is creating the electrical field. The gap created by the moving electron is called a "hole," and is filled by an adjacent electron. This shuffling of holes effectively moves a positive charge to the negative contact. The arrival of the electron at the positive contact and the hole at the negative contact produces the electrical signal that is sent to the preamplifier, and on through the system for analysis. The movement of electrons and holes in a solid-state detector is very similar to the movement of ions within the sensitive volume of gas-filled detectors such as ionization chambers.

III. BLOCK DIAGRAM

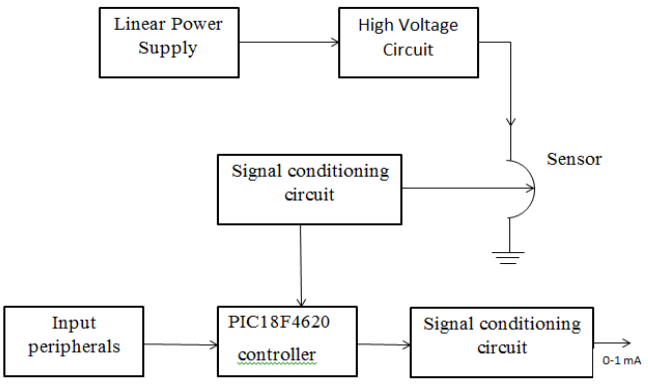

Fig.3 Block Diagram

A. Working

Fig.3 shows the block diagram of system. In EARM system linear power supply provides 5v supply to high voltage circuit. HV circuit generates high voltage 400v-900v which is required for GM tube to detect the gamma rays. Gamma Radiation is detected by sensor LND 7128 and because of higher voltage the electrons are ionised initially and produce voltage pulses whose output pulses is given to the signal conditioning board in the form of pulses (counts/ sec). The signal conditioning unit generates a TTL pulse for every pulse crossing the threshold. The TTL Signal is fed to micro controller for further processing. Micro controller counts the TTL pulses as per function setting and are converted to engineering units and displayed on display. 7 segment display is interfaced to the controller and radiations detected are displayed on it. Keypad is used as input block. It consist of 4 press keys namely Menu, Shift, Arrow, Enter keys. Shift and Arrow key can also perform Acknowledgement and Reset operation respectively.

IV. SPECIFICATION OF SYSYTEM

- EARM system is highly sensitive and isolation is provided up to 1mA
- Radiations are detected with internal as well as external detector.
- Measurement radiation range is from 0.1 to 100Rad/hr.
- Accuracy of 98% is provided.

V. CONCLUSION

Using GM tube EARM is able to measure gamma radiation in the environment. It gives very accurate result.

VI. FUTURE SCOPE

This radiation detector EARM system can be later use as detector for long ranges and also for controlling the radiations and we can measure the radiation from the long distance by using USB communication.

ACKNOWLEDGMENT

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REFRENCES

[1] *Geiger Muller Tubes; issue 1*" published by Centronics Ltd, UK.
[2] Glenn F Knoll. *Radiation Detection and Measurement*, third edition. John Wiley and sons, 2000.
[3] F. Adams and R. Dams, "*Applied Gamma-Ray Spectrometry"* Pergamon Press, New York, 1975.
[4] Khalil Arshak, *Member, IEEE,* and Olga Korostynska *"Thin- and Thick-Film Real-Time Gamma Radiation Detectors*" IEEE Sensors Journal, VOL. 5, NO. 4, August 2005.

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