ABSTRACT

Radioactive sources include radionuclides. A radionuclide is an atom with an unstable nucleus, i.e. a nucleus characterized by excess of energy, which is available to be imparted. In this process, the radionuclide undergoes radioactive decay and emits gamma rays and subatomic particles, constituting the ionizing radiation. So, radioactivity is the spontaneous emission of energy from unstable atoms. Correct radionuclide identification can be crucial to planning protective measures, especially in emergency situations, by defining the type of radiation source and its radiological hazard. The gamma ray energy of a radionuclide is a characteristic of the atomic structure of the material. This project introduces the application of subtractive clustering method for a classification system of radioactive elements that allows a rapid and efficient identification. In software implementations, clustering algorithms, usually, are demanding in terms of processing time. Thus, a custom implementation on reconfigurable hardware is a viable choice in embedded systems, so as to achieve real-time execution as well as low power consumption. The proposed architecture for the hardware of subtractive clustering is scalable, allowing for the inclusion of more of subtractive clustering unit that operate in parallel. This provides greater flexibility to accelerate the hardware with respect to the time and area requirements. The results show that the expected cluster center can be identified with efficiently. The identification of these points can classify the radioactive elements present in a sample. Using the designed hardware, it is possible to identify more than one cluster center, which would lead to the recognition of more than one radionuclide in radioactive sources. These results reveal that the proposed hardware to subtractive cluster can be used to design a portable system for radionuclides identification.

Keywords: Subtractive clustering, reconfigurable hardware, radionuclide identification.