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Title: The Do-It-Yourself Geiger-Muller (DIYgm): Circuit Optimization and Evaluation

Abstract
A simple circuit for a Geiger Muller (GM) radiation survey meter, coupled to a Raspberry Pi computer, was designed as an outreach project for the general public and high school students. The original circuit design was primarily tested and characterized to perform basic experiments and measure environmental radioactivity. Analysis of the initial design showed major flaws, including significant noise in the signal, many instances of the Raspberry Pi computers crashing, and suboptimal user interface experience with the detector design. As a result, circuit components were reexamined, and alternative circuit designs were explored. To reduce circuit noise, certain electrical components were further evaluated for optimization purposes. The unshielded inductor was swapped with a shielded inductor to avoid signal interference. Transistors and capacitors were also exchanged to boost the voltage more reliably. To avoid destroying the Raspberry Pi computer, various circuit boards were created to focus on this issue which is believed to be a result of sending an overvoltage into the Raspberry Pi GPIO pins. Three alternative circuit designs were implemented, which include changing the voltage powering pin, introducing a Zener diode, and configuring an operational amplifier. To provide a more user-friendly interface, aesthetic changes were implemented including adding test points to easily assess the signal, increasing the size of the board for ease of soldering, and designing the circuit to hold the GM tube. Future work includes initiating a more robust testing environment to classify known problems and avoid similar issues in the future. These consist of quality checking the signal at each test point and verifying the integrity of GM tube performance.