Development of Microcontroller-Based System for Radiation Monitoring in CPS

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Objectives

To monitor radiation levels in and near the place where radioactive materials or other contaminated sources are present.

Background

Bangladesh has entered the era of nuclear energy and has become an important player in the field of world nuclear power after the inauguration of nuclear power plant (NPCBL). Using Nuclear energy for the betterment of humankind involves radiation risk. Radiation monitoring is very important for radiation workers on regular basis.
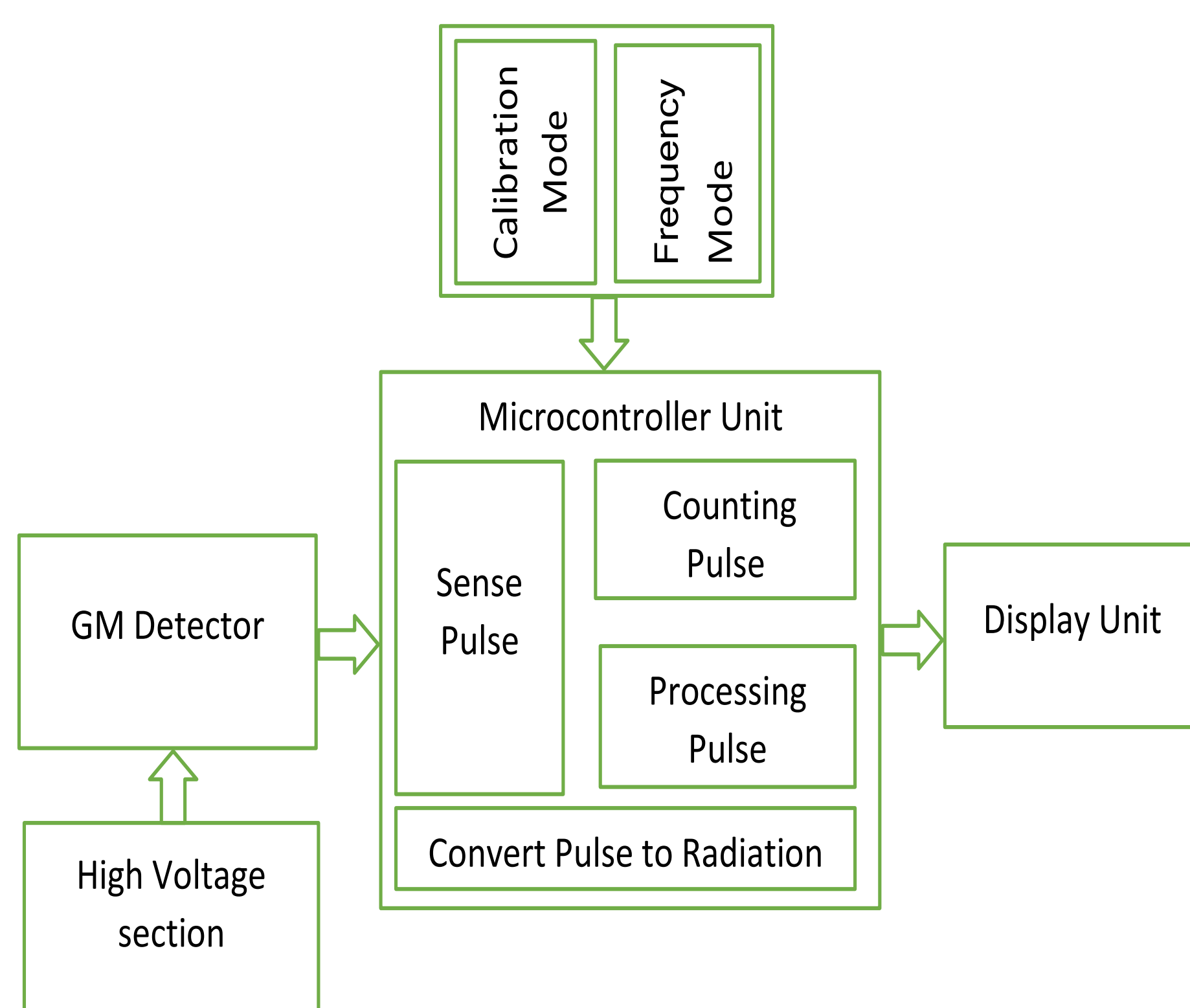

Figure 1: Basic block diagram of the system

Methods

This system consists of a Geiger Mueller (GM) tube as the detector, a high voltage generator to bias the detector, a microcontroller unit that involves pulse sensing, pulse counting, pulse processing circuits, and a display unit to show the measurements. This designed device has two modes of operation namely calibration mode (CM) and Frequency mode (FM). A thick-walled pancake type ZP1324 Geiger Mueller(GM) tube is used as the detector. This detector operates within 450-550 volts range and detects only gamma rays [12]. The HV circuit generates about 500 volts from a +3.7 volts lithium battery. This +3.7 volts battery is boosted and regulated into +5 volts supply for powering the device.

Performance Analysis

The developed system was tested by supplying different types of the wave from the signal generator to the system and the performance was assessed.

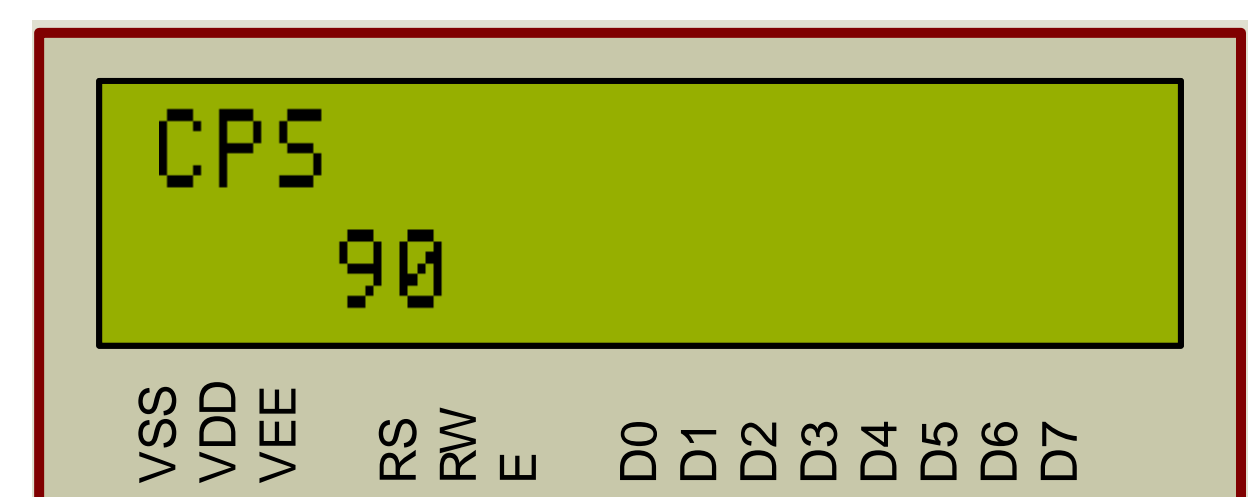$$Error = \frac{true\ value - observed\ value}{true\ value} \times 100\%$$
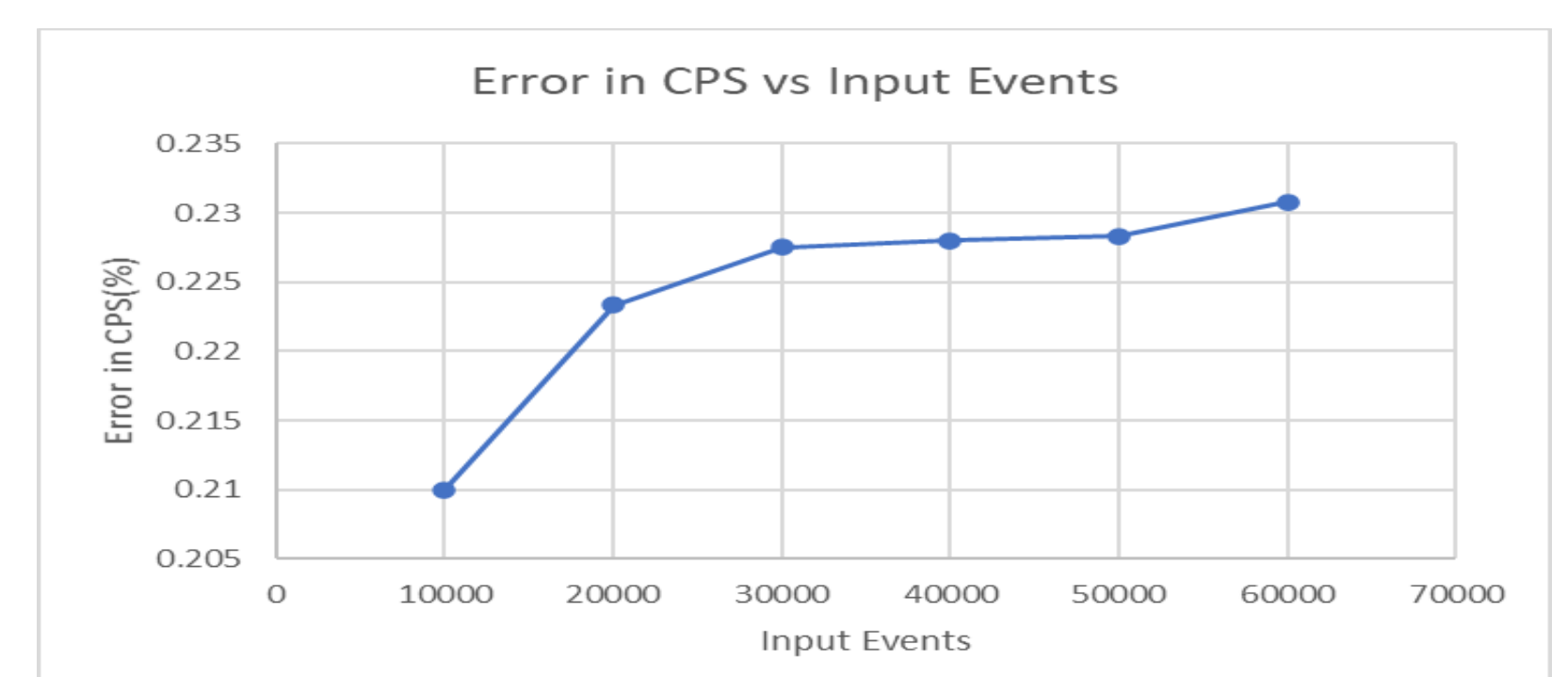

Figure 2: CPS Measured by the System

Figure 3: Error in CPS Vs Inputs Event

Conclusions

The radiation monitoring meter is calibrated with Cesium-137 and produces a linear response from 0 to 65535 Count Per Second(CPS). The effect of dead time is significant at 15000 CPS. The mean error for the square wave is 0.27379359, the sawtooth wave is 0.27379359, the triangle wave is 0.263617949 and the sine wave is 0.285939744 where the error is negligible.

Acknowledgments

References

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