Research Migration Project

Name of the Participate: Nampally Vignesh Kumar Varma

Title of the Project: Simulation of an Event-Driven Pet-Aware Intrusion Detection Circuit using eSim

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Theory:

Conventional intrusion detection systems based on PIR sensors often generate false alarms due to pet movements. This project presents an event-driven, pet-aware intrusion detection circuit that distinguishes between human and pet motion based on pulse-width analysis of the PIR sensor output. The proposed circuit operates only during motion events, thereby reducing unnecessary power consumption.

The PIR sensor output is modeled as a voltage pulse whose width depends on the nature of the moving object. A resistor-capacitor (RC) integrator converts the pulse width into a proportional voltage. Short-duration pulses generated by pets produce a low RC voltage, whereas longer pulses from human motion generate a higher voltage. This voltage is then compared with a predefined threshold using a transistor-based comparator to generate the alert signal

Circuit Diagram:
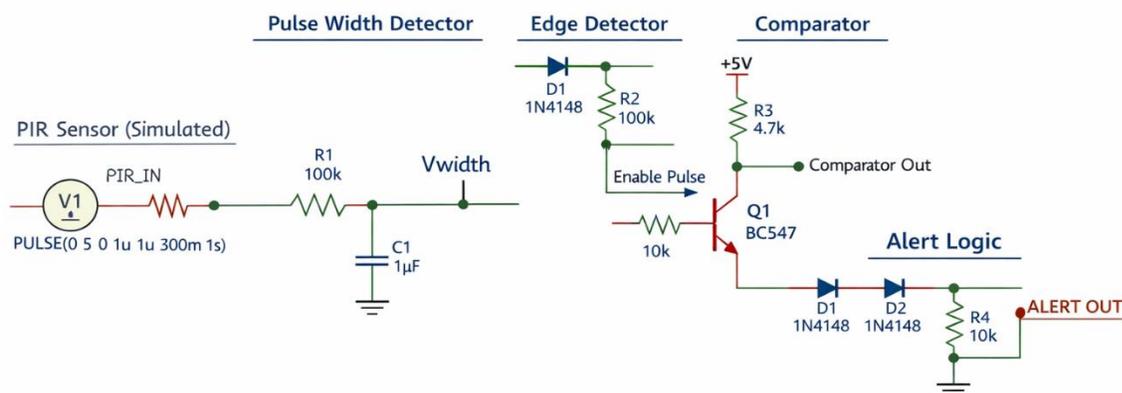
Simulation results:

sample output waveform

Transient response showing PIR Input, RC Pulse Width, and Alert Output
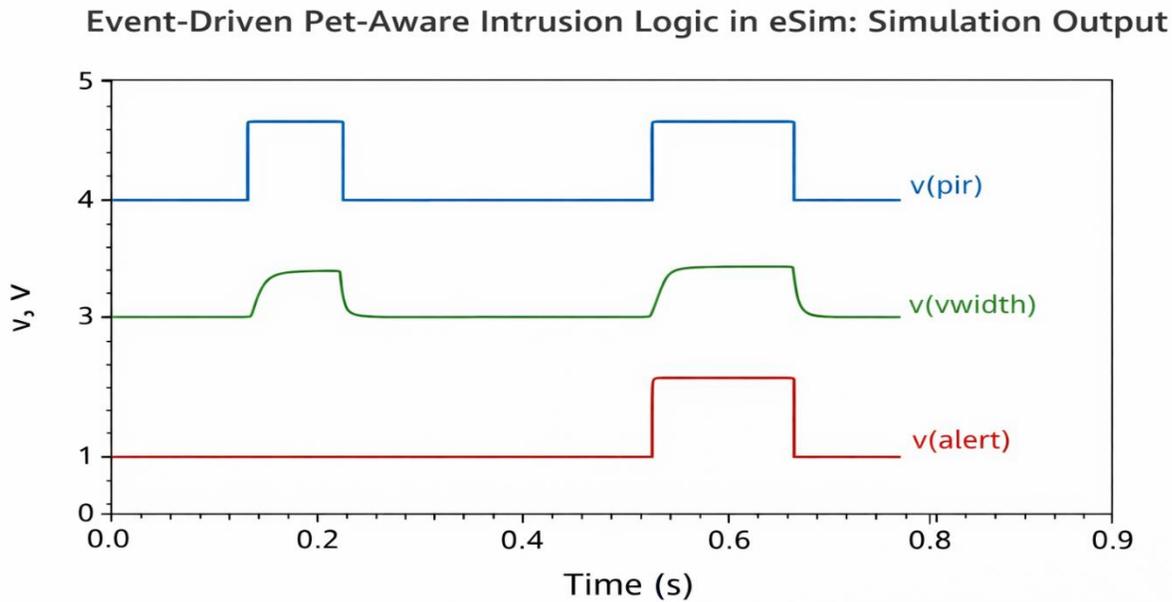
Conclusion: The event-driven pet-aware intrusion detection circuit was successfully designed and simulated using eSim. The system effectively reduces false alarms and consumes power only during motion events, making it suitable for real-time and low-power security applications

References:

1. https://www.electronicshub.org/pir-motion-sensor/
2. https://ngspice.sourceforge.io/
3. https://esim.fossee.in/