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Flame Detection and Suppression System for Petroleum Facilities

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Abstract: *An adaptive model for fire (flickering flame in the infrared region) detection and subsequent suppression is presented. The model applies a Pyro-electric Infrared sensor (PIR)/Passive Infrared Detector (PID) for infrared fire detection. Sample analog signals were generated and simulated within the framework of the modeled PIR sensor/PID. The signals were modeled around the flame flicker region (1-13Hz) and outside the region. A Joint Time Frequency Analysis (JTFA) function was applied to model the Digital Signal Processing (DSP). This involved extraction of fire and non-fire features from the sample signals. A Piecewise Modified Artificial Neural Network (PMANN) and the Intraclass Correlation Coefficient (ICC) were employed in the decision framework. The PMANN generated polynomials which analyzed and 'memorized' the signals from DSP. The ICC further categorized cases as 'fire' or 'non-fire' by comparing data from the PMANN analyses. In cases of detected fire, valves to several fire suppression systems (like water sprinklers and foam injection lines) can be opened. Hence, the Solenoid Hydraulic Valve was modelled to be controlled by a Proportional Integral Derivative Controller (PIDC). The whole model of detection and suppression can be further developed, studied and subsequently implemented.*

Keywords: *Flame detection, passive infrared detector, digital signal processing, artificial neural networks, fire suppression*