Design Documentation for False Alarm Detection in a Chemical Industry

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Introduction

Overview

This document provides the design details for the False Alarm Detection system developed for a chemical industry to minimize unnecessary emergency responses to H2S gas leak.

Purpose

The purpose of this document is to provide a comprehensive design overview of the False Alarm Detection system, including the problem it addresses, data description, system design, machine learning model, implementation, and results.

Scope

This document covers the entire lifecycle of the False Alarm Detection system, from data preprocessing to model deployment and result analysis.

Problem Statement

This project was created for a chemical industry with sensors installed throughout the factory to detect H2S gas, which is hazardous to health. Every time one or multiple sensors detect an H2S leak, an emergency alarm rings to alert the workers. For each alarm, a team is called to sanitize the area and check for leaks, which incurs significant costs. Some alarms are false and not hazardous. The company provided data for each alarm, indicating whether it was dangerous.

Data Description

Fields

1. Ambient Temperature
2. Calibration (days)
3. Unwanted Substance Deposition (0/1)
4. Humidity (%)
5. H2S Content (ppm)
6. Dangerous (0/1)

Data Preprocessing

1. Handling missing values
2. Standard scaling
3. Categorical data handling

System Design

Architecture Overview

The system architecture consists of data preprocessing, model training, hyperparameter tuning, and deployment for real-time prediction.

Components

Data Preprocessing: Using Numpy and Pandas
Model Training: Logistic Regression
Hyperparameter Tuning: GridSearchCV
Deployment: Flask Application

Machine Learning Model

Model Selection

The Logistic Regression model was chosen due to its simplicity and effectiveness for binary classification problems.

Preprocessing Steps

1. Handling outliers using IQR and Z-score methods
2. Scaling features using StandardScaler
3. Training the Model

Data was split into training and testing sets. A Logistic Regression model was trained on the training set.

Hyperparameter Tuning

GridSearchCV was used to tune hyperparameters for optimal performance.

Evaluation

Model performance was evaluated using accuracy, confusion matrix, and classification report.

Implementation

1. model.py
2. app.py
3. Postman_app.py

Results

The implementation of the False Alarm Detection system significantly reduced the number of unnecessary emergency responses, resulting in substantial cost savings for the company. The Logistic Regression model achieved high accuracy, providing reliable predictions for the alarms.

Conclusion

The False Alarm Detection system effectively minimizes unnecessary costs associated with false alarms in a chemical industry by leveraging machine learning techniques to predict the danger of H2S gas leaks.

SnapShot

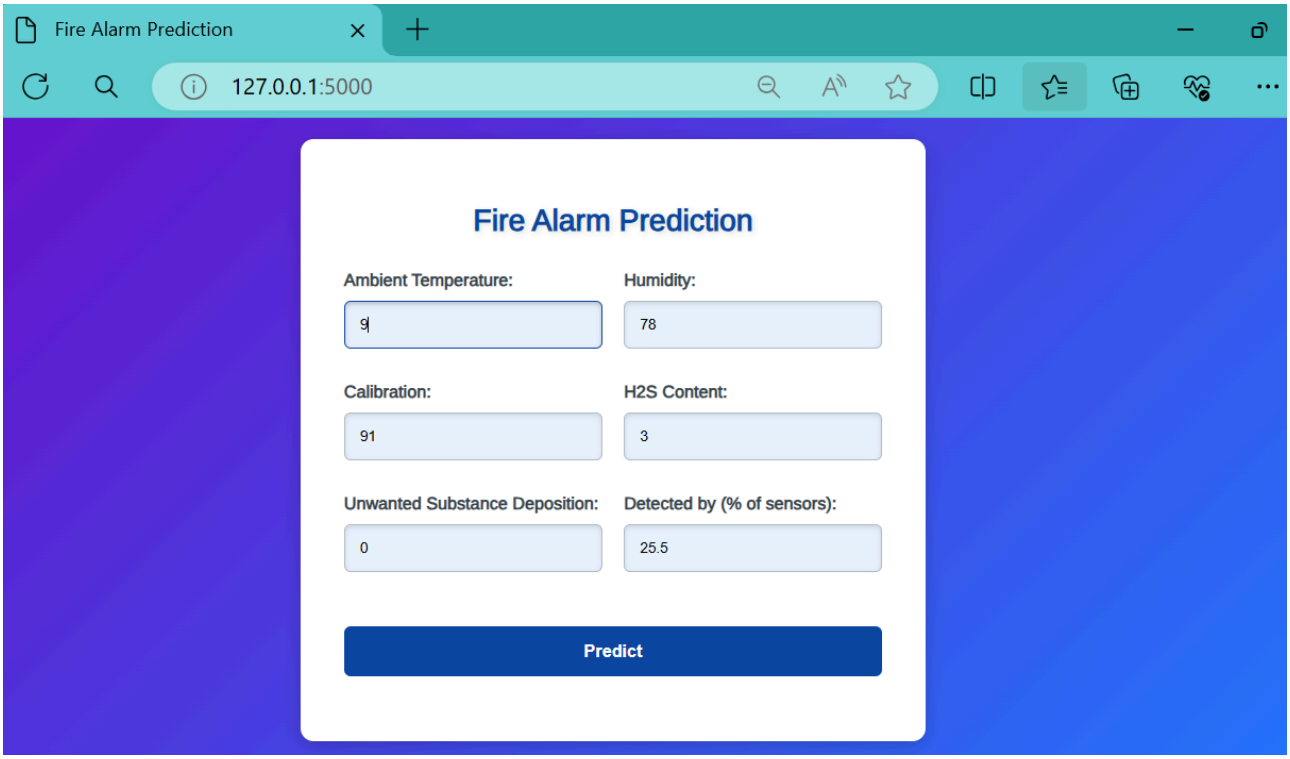

Fig : User Interface form to take input from user

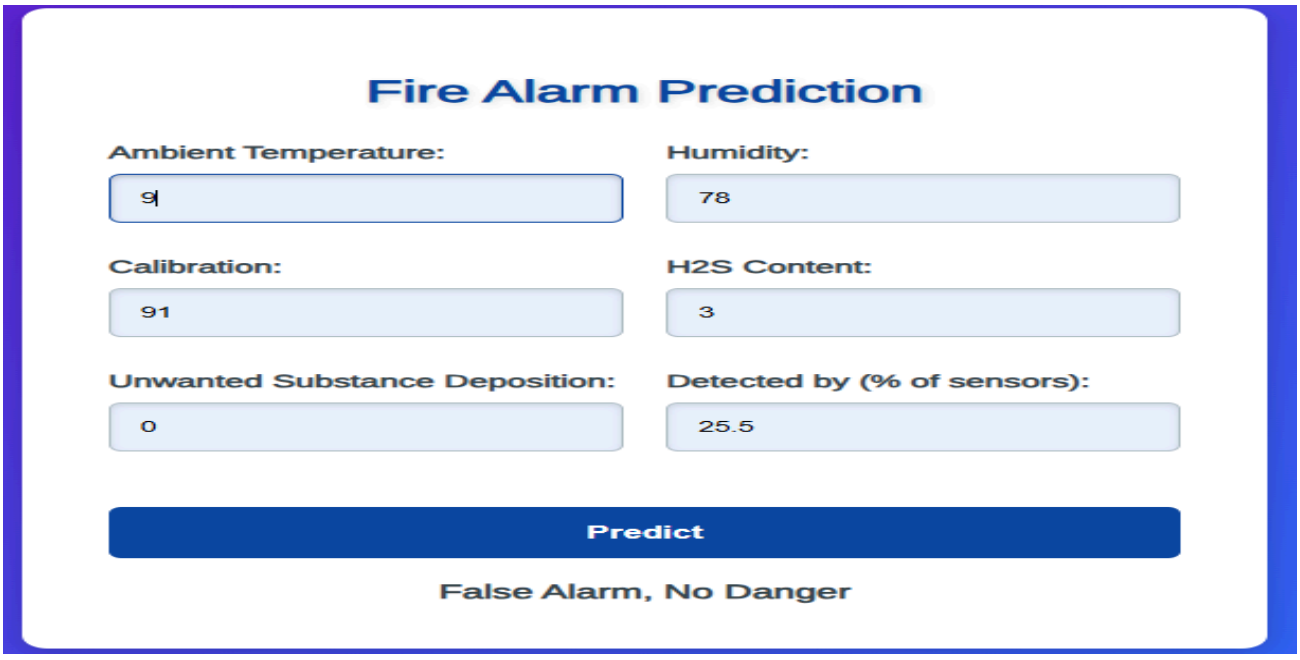

Fig : Display the Prediction from the model

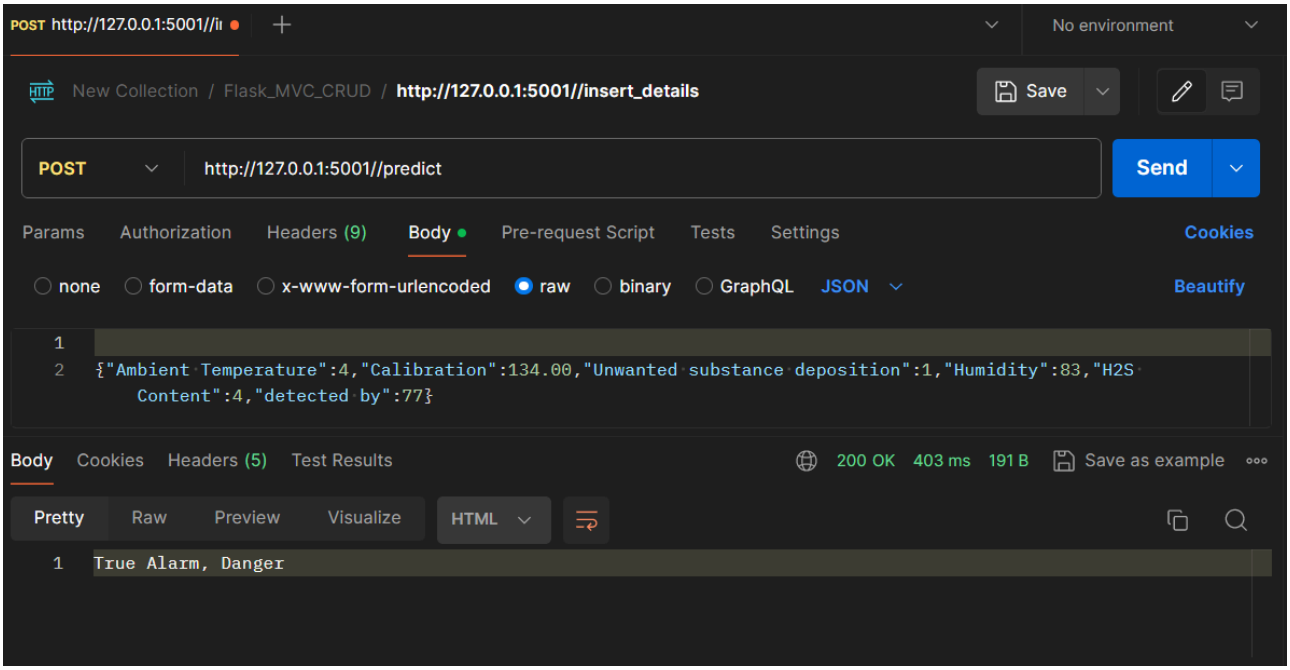

Fig : Testing with POSTMAN using url

	A	B	C	D	E	F	G
1	Ambient Temp	Calibration	Unwanted Substance Deposition	Humidity	H2S Content	Detected by(% of sensors)	Fire Alarm
2	4	83	134	4	1	77	0
3	7	90	57	7	0	38	1
4	7	90	57	7	0	38	1
5	9	78	91	3	0	25.5	1
6	9	78	91	3	0	25.5	1
7							

Fig : Maintain record of test and prediction data into CSV file