Proposed False Alarm Detection System To Manage H2S Gas Detection in A Chemical Industry

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Abstract- *False alarm detection system is a web-based system use in a chemical industry to manage H_2S gas detection. False alarm detection system is reduced to help supporting team cost. The system will be reliable and fast tool in the daily work and will also be ensure security solution of staff.The objective of making the model is to automate the process of human intervention in sanitizing the hazardous chemical leak.The model will predict, and only if necessary; the team will be called to sanitize the manufacturing unit.The model also aims to minimize the cost involved in calling the team and save the time that is wasted in case of a non-hazardous leak.The data of the previous leaks will be used to train the machine learning algorithm and the major objective is to make sure a leak is not reported as hazardous in case of hazardous situation. Hence, we would work to reduce the false negatives to zero.The system which developed is very much useful for chemical industry that interested to properly detection of H_2S gas and contented with doing such project in technology like python with machine learning which provides me several features to make the user Interface and coding more attractive and easier to understand.*

Keywords- H_2S gas, Machine leaning, integer, Primary key

I. INTRODUCTION

This project was made for a chemical industry which had sensors installed in various parts of the factory to detect H_2S gas which is hazardous to health. Every time one or multiple sensors detected the H_2S leak, an emergency alarm rings to alert the workers. For every alarm, the industry calls a team which sanitizes the place and checks for the leak and this was a big cost to the company. A few of the alarms that ring is not even hazardous. The company gave us the data for each alarm with a final column stating the alarm was dangerous or not. The data was first pre-processed and analysis libraries like NumPy and Pandas were used to make it ready to be utilized by a machine learning algorithm. Problems like standard scaling; categorical data and missing values were handled with appropriate techniques. Then, we used Naïve Bayes model to make a classifier with first five column as independent columns and dangerous column as dependent/target column. Now whenever, there is a leakage and the alarm rings, the data is sent to us and we predict if it is dangerous or not. If found dangerous the only the team is called to sanitize the place and fix the leak. This saved a lot of money for the company.

Existing System: The existing system involves a team to be called at the manufacturing unit and thus every time, there is a leak, the team comes and sanitizes the place. There are various sensors already installed but even if one of them rings, the team is called for prevention measures. For every alarm the industry calls a team, which sanitizes the place and check for the leak and this was a big cost to the company.

Need for system: Reduce the cost of supporting team. When the supporting team used to come the labors had to wait out this used to affect the production as it used to go on hold as we wanted to increase our production. When the alarm (bell) used to ring the labors used to get restless and everything used to become more complex. Security people are work in chemical industry.

Operating Environment:

HARDWARE:
- Operating System: Windows 10
- RAM: 6 GB
- Processor: Intel Pentium Series and above
- Hard Disk: 2 GB

SOFTWARE:
- IDE: PyCharm.
- Browser: Chrome
- Server: Apache HTTP server
- Front End: HTML5, CSS3, JavaScript, Bootstrap
- Back End: SQLITE3
- Editor: Jupyter, Spyder
- Language: Python

Limitations in the existing system: The existing system has no machine learning algorithm and is completely human based, thus 99% of the times, the company incurs a cost to call

the special team which sanitizes the entire manufacturing unit.Also, a lot of time is wasted, and the production is paused every time a leak is reported, since the team comes, and everyone is asked to vacate**.**

Proposed System: False alarm detection system is a web-based system use in a chemical industry to manage H_2S gas detection. False alarm detection system is reduced to help supporting team cost. The system will be reliable and fast tool in the daily work and will also be ensure security solution of staff.

Scope: The model can further be implemented in different areas of the industry and can be enhanced by training with the relevant data. Machine learning algorithms used can be parameter tuned for each case. The model will require a huge amount of data to be processed and if results are as expected various industries can fine tune it and use it in their automation to reduce the over-head cost and bring down the physical workforce and effort.

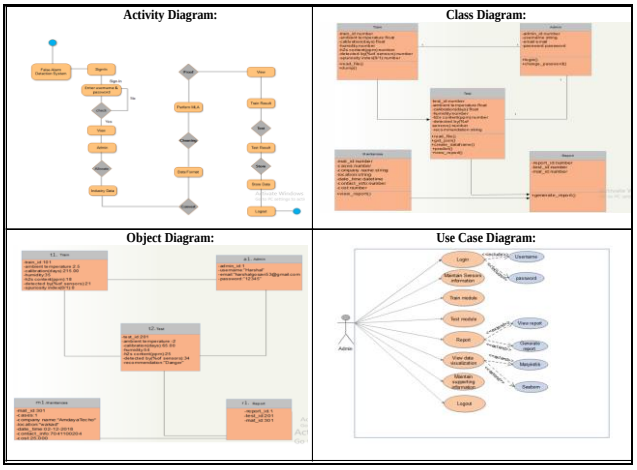
Objective: The objective of making the model is to automate the process of human intervention in sanitizing the hazardous chemical leak. The model will predict, and only if necessary; the team will be called to sanitize the manufacturing unit. The model also aims to minimize the cost involved in calling the team and save the time that is wasted in case of a non-hazardous leak. The data of the previous leaks will be used to train the machine learning algorithm and the major objective is to make sure a leak is not reported as hazardous in case of hazardous situation. Hence, we would work to reduce the false negatives to zero.

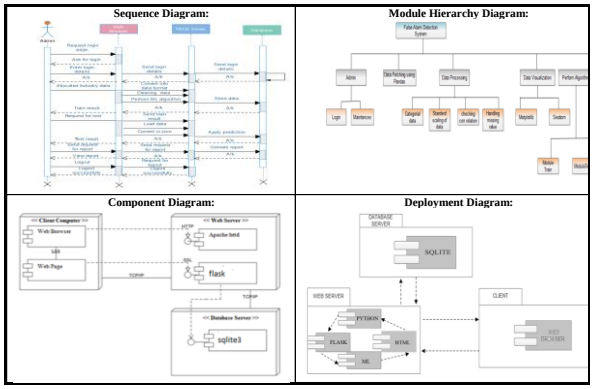
II. METHODOLOGY

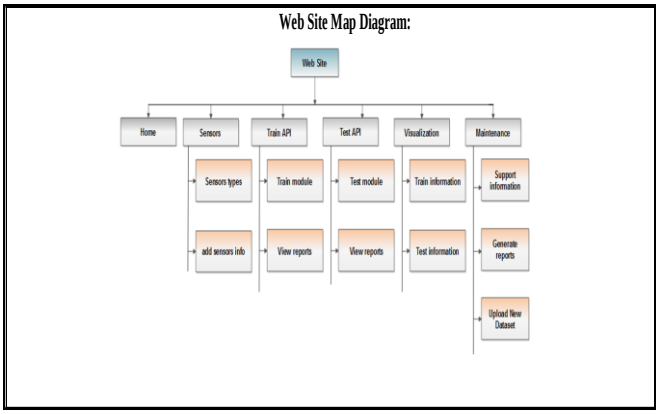
Modules:

1. Data fetching using pandas.
2. Data preprocessing –
   - Categorical data
   - Standard scaling of the data
   - Checking correlation
   - Handling missing values
3. Visualizing data using matplotlib and seaborn.
4. Horizontal splitting of the data using train test split techniques.
5. Training the classifier on the training data.
6. Analyzing result using confusion matrices for various classifiers.
7. Testing on the new test data.

Analysis and Design:



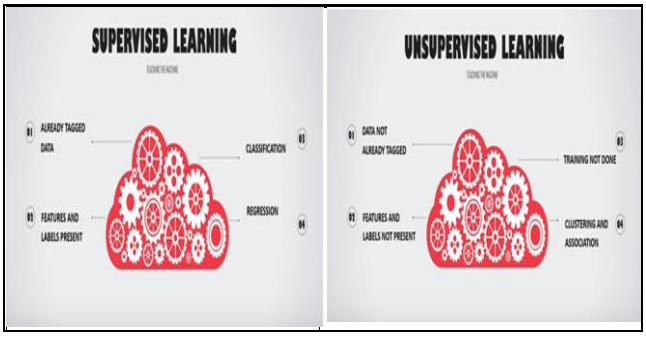


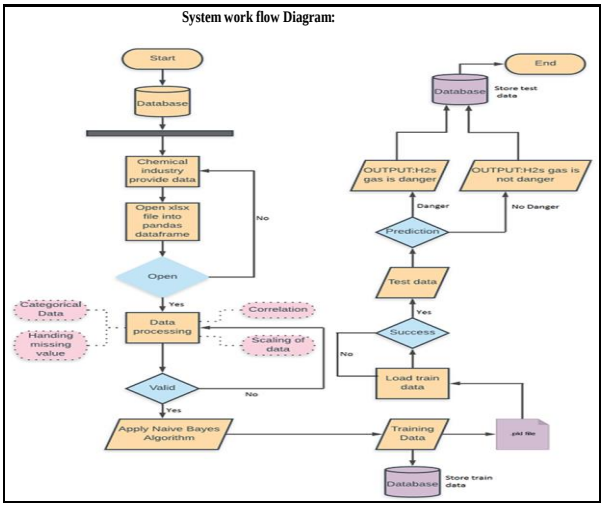


System work flow:

1. Machine leaning:

- Machine learning is a technique. We will provide data to machine;
- Machine looks the data it creates some rules.
- There are two type of machine learning: -

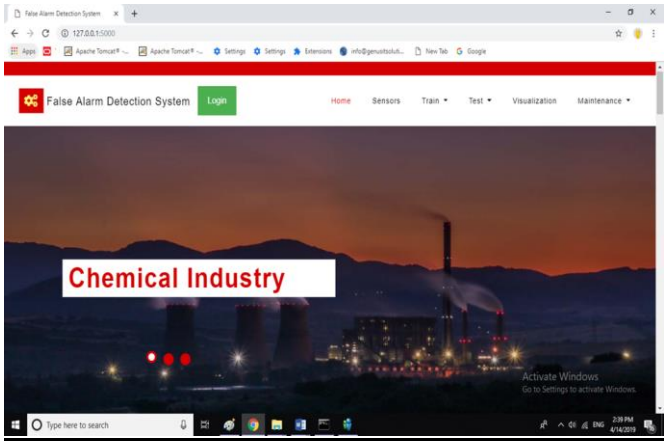




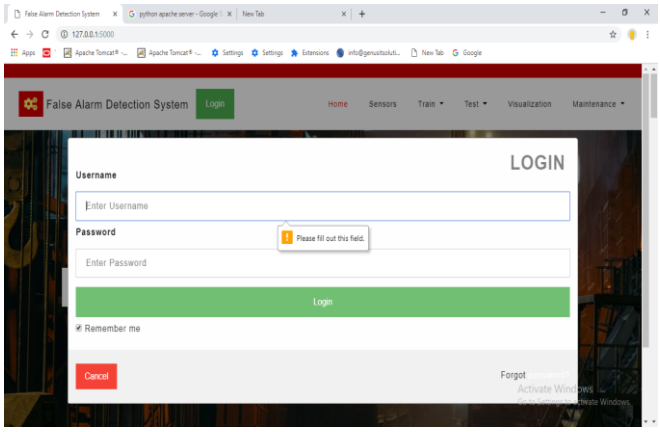
III. RESULTS

User Interface Design:

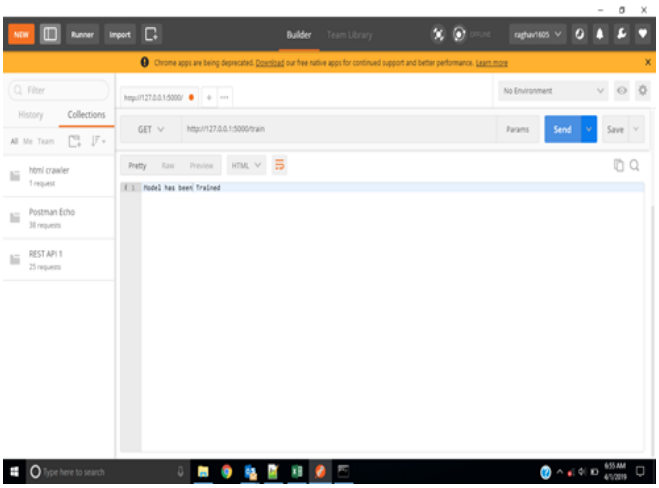
1. Home page:



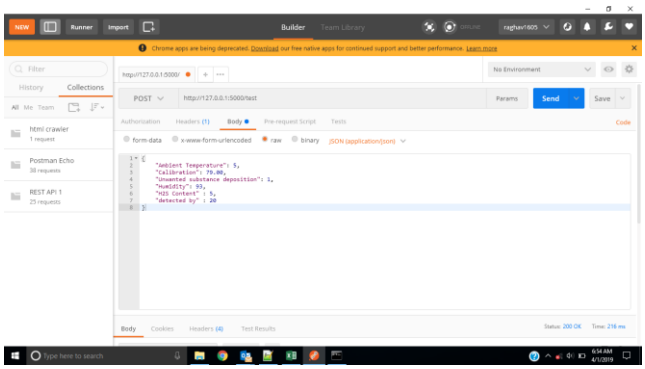
2. Login Validation Page:



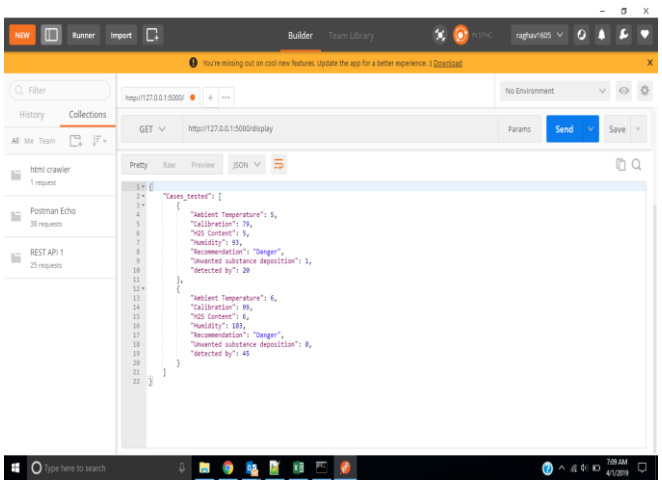
3. Train module:



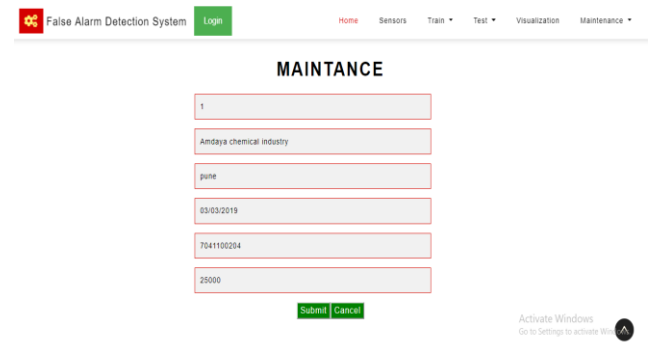
4. Train module



Display Result:



Maintenance:



Report:

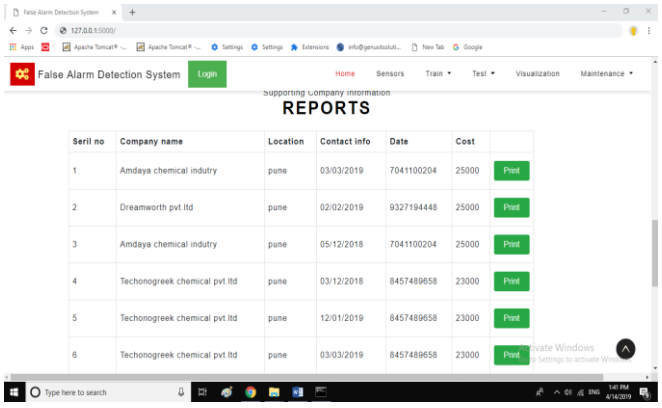


Table Structure:

Admin:

SR NO	FIELD NAME	DATA TYPE	SIZE	CONSTRAINT	DESCRIPTION
1	Admin_Id	Integer	10	primary key	admin identification no
2	Username	Text	20	not null	admin username
3	Email	Text	50	not null	Login email
4	Password	Text	10	not null	login password

Train:

SR NO	FIELD NAME	DATA TYPE	SIZE	CONSTRAINT	DESCRIPTION
1	Train_id	Integer	11	Primary key	It is unique identification
2	Ambient temperature	Real	10	not null	Ambient temperature is a degree format
3	Calibration(days)	Real	20	not null	Calibration is a day format
4	Humidity	integer	20	not null	Humidity is a percentage format
5	H_2S content	integer	10	not null	H_2s gas content is a ppm
6	Detected by (%of sensor)	integer	10	not null	Detected is a percentage format
7	Superiority	integer	10	not null	Supporting team prediction

Test:

SR NO	FIELD NAME	DATA TYPE	SIZE	CONSTRAINT	DESCRIPTION
1	Test_id	Integer	11	Primary key	It is unique identification
2	Ambient temperature	Real	10	Not null	Ambient temperature is a degree format
3	Calibration(days)	Real	20	not null	Calibration is a day format
4	Humidity	integer	20	not null	Humidity is a percentage format
5	H_2S content	integer	10	not null	H_2s gas content is a ppm
6	Detected by (%of sensor)	integer	10	Not null	Detected is a percentage format
7	Superiority Index (0/1)	integer	10	Not null	superiority represent danger or no danger

Maintenance:

SR NO	FIELD NAME	DATA TYPE	SIZE	CONSTRAINT	DESCRIPTION
1	Mat_id	integer	11	Primary key	It is unique identification
2	Cases	integer	10	Not null	Case of no
3	Company name	text	20	not null	Company name of details
4	Location	text	25	not null	Location of the company name
5	Date	date time	10	not null	It represents when supporting team came
6	Contact information	text	50	Not null	Contact details of the company
7	Cost	integer	30	Not null	Paying cost

Report:

SR NO	FIELD NAME	DATA TYPE	SIZE	CONSTRAINT	DESCRIPTION
1	Report_id	integer	10	Primary key	It represents unique identification
2	Test_id	integer	11	Foreign key	It is a reference of test table
3	Mat_id	integer	11	Foreign key	It is a reference of maintenance table

Drawbacks and Limitations:

If chemical industry help to provide new dataset to the maintenance team they have to send it manually (now automatic reflection is not possible).Each module does not give the accurate result hence every module is not perfect but every module is good.

The existing system has no machine learning algorithm.

It is completely human based thus 99% of the times, the company incurs a cost to call the special team which sanitizes the entire manufacturing unit.

A lot of time is wasted, and the production is paused every time a leak is reported, since the team comes, and everyone is asked to vacate.

Proposed Enhancements:

Whenever the H_2S gas is dangerous add that moment our system will give output by lighting the red light. The supporting system will get message only when H_2S gas is dangerous. The no of parameters we are using now in the system to check whether the H_2S gas is linking or no, in future we will increase the number of parameters to get the accurate result. In future we will provide such a functionality like chemical industry can directly upload new data set using admin panel to the maintains team.

IV. CONCLUSION

Working on the project was good knowledge and comprehend the important of planning and designing as a part of software development. The system which developed is very much useful for chemical industry that interested to properly detection of H_2S gas and contented with doing such project in technology like python with machine learning which provides me several features to make the user Interface and coding more attractive and easier to understand. For implementing the system use technology like; Python, NumPy, Pandas, Matplotlib, Seaborn and Machine learning algorithm

REFERENCES

[1] www.wikipedia.com
[2] www.allaboutcircuits.com
[3] www.microchip.com
[4] www.howstuffworks.com