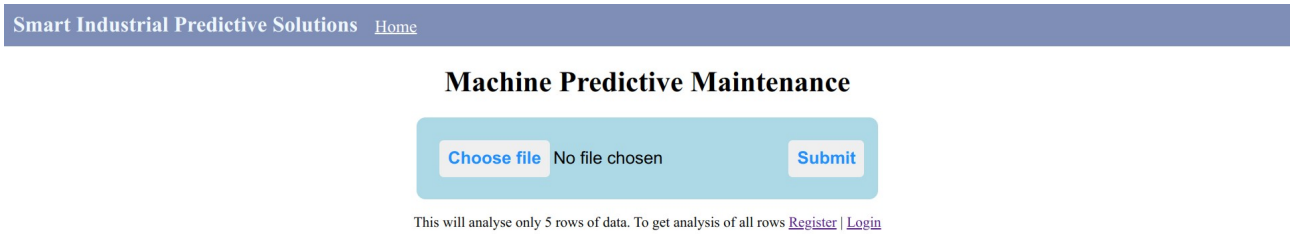
11. Web Application

11.1. Intro

Our web app is a subscription-based predictive maintenance application tailored for industrial settings. Leveraging cutting-edge machine learning algorithms, it offers real-time insights into machinery health, allowing proactive maintenance to prevent costly breakdowns. Key features include a user-friendly interface, limited trial version and full analysis reports. Subscribers gain access to comprehensive reports, empowering them to optimize maintenance practices, reduce downtime, and enhance operational efficiency.

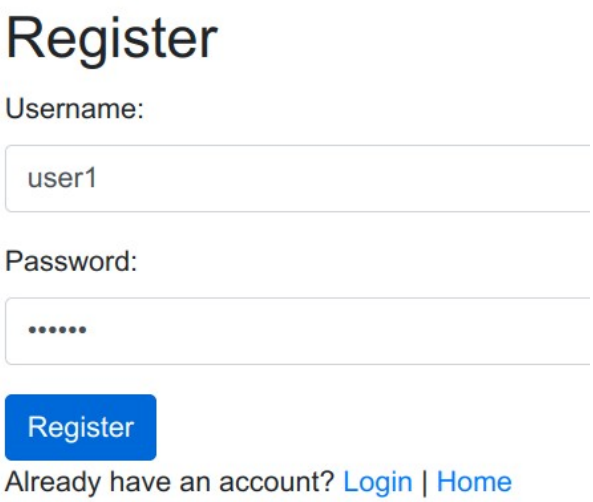
The trial version offers users a valuable sneak peek into the world of predictive maintenance. It provides a limited yet insightful experience, allowing users to explore the app's capabilities and witness its potential benefits. During the trial, users can access a subset of predictive maintenance insights, enabling them to understand how the app can enhance machinery health monitoring and maintenance planning. This trial version is an excellent opportunity for users to gauge the app's value before committing to a subscription, ensuring informed decision-making and a seamless transition to the full-featured app for comprehensive predictive maintenance analysis.

11.2. Trial version

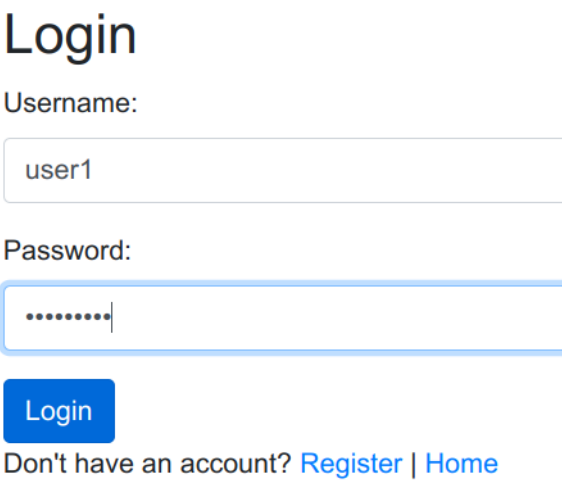


In the trial version, all you need to do is upload a CSV file with your machine's data and once you hit "submit," you'll instantly receive a failure report that provides valuable insights into your machinery's health and potential maintenance needs. It's a quick and easy way to experience how our app can help you prevent breakdowns and save on maintenance costs.

11.3. Registering

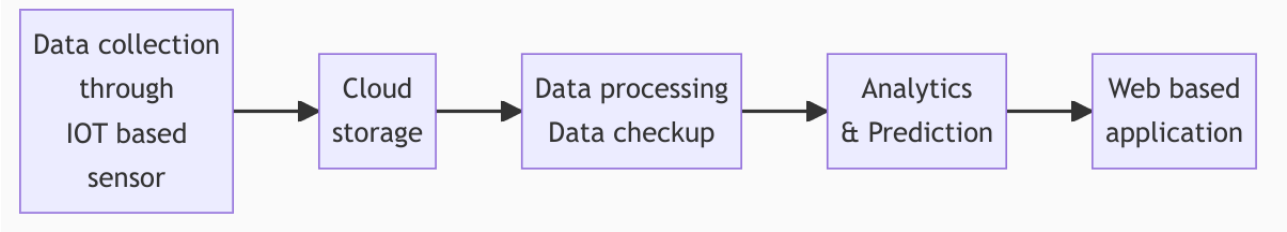


By registering, you unlock the full potential of our app, granting you access to comprehensive analysis reports that delve deep into your machinery's health and maintenance needs.



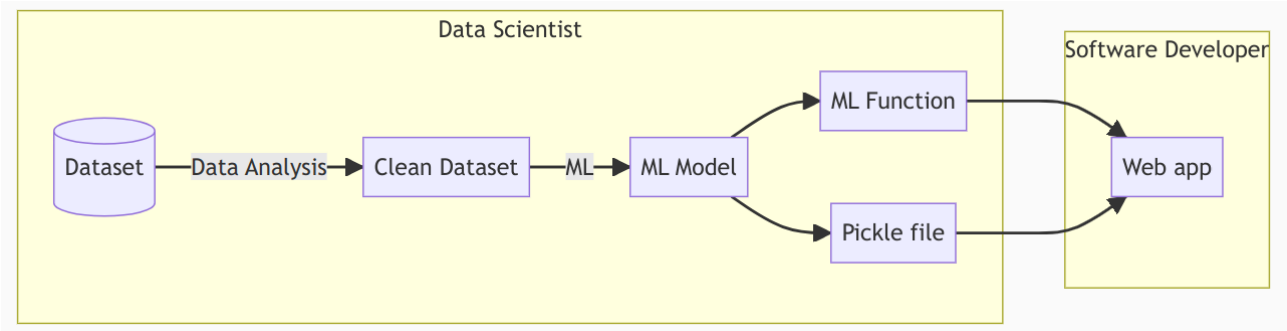
Once you log in, you'll gain immediate access to full analysis reports powered by our machine learning model. It's as straightforward as uploading a CSV file, and just like that, the detailed failure report will be available for instant download.

11.4. Business mode in web app



Our business model simplifies predictive maintenance by following a streamlined process. It begins with IoT-based sensors that collect real-time data from your machinery, which is securely stored in the cloud. Before analysis, the data undergoes thorough processing and checks to ensure accuracy. Using advanced analytics and machine learning, we predict maintenance needs and potential issues. Finally, users can conveniently access these insights through our user-friendly web-based application. This end-to-end approach ensures efficient and effective predictive maintenance for industrial operations.

11.5. Data Analysis & Machine Learning Model in web app



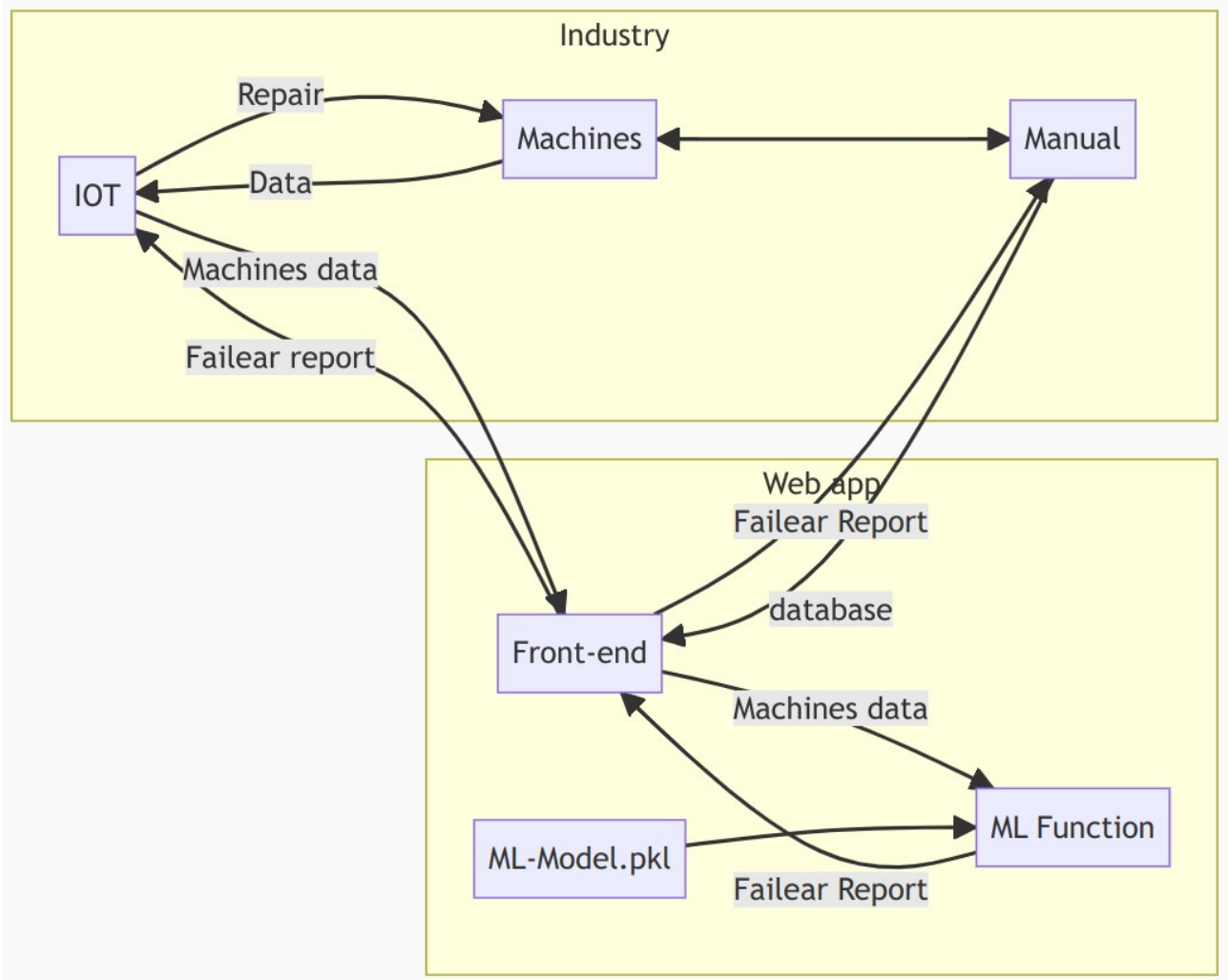
In our workflow, the machine learning (ML) model is at the core of our predictive maintenance system, serving as the brain behind the operation. Data scientists first analyze and clean the dataset to prepare it for training. They then employ the dataset to train the ML model, which includes creating a machine learning function. Once the model is trained, it's saved as a pickle file. The software developers take over from there, integrating the ML function into our web application. This collaborative effort between data scientists and software developers ensures that our web app delivers accurate and valuable predictive maintenance insights to our users.

`ML Function` gets csv file of machines' data and returns failear dataframe of all machines.

```
def ml_function(csv_path, model_path):
    # loading pre-trained model from model_path
    # pandas dataframe(df) from csv_path
    # df cleaning & preprocessing...
    ...
    ...
    # failear_df prediction from df using the ML model
    return failear_df
```

The "ML Function" is a pivotal component of our predictive maintenance system. It accepts a CSV file path containing machinery data and a pre-trained model path as inputs. Within this function, the pre-trained model is loaded, and the provided CSV data is processed and cleaned to ensure its suitability for analysis. Following data preparation, the function applies the ML model to make predictions related to machinery failure, resulting in a failure dataframe. This dataframe contains crucial insights about the potential failures of all the machines under analysis. The "ML Function" plays a critical role in our system's ability to proactively identify maintenance needs and enhance operational efficiency.

11.6. Web app architecture



In our system architecture, the web application serves as the central hub connecting various components for streamlined predictive maintenance. The journey begins with data collection, where machinery data is sourced from IoT devices (represented by "IOT") and manual input (represented by "Manual"). This data flows into the web application's front-end (represented by "Front-end"), where users can interact with the system. Within the application, the data is further processed and analyzed using the "ML Function" and a pre-trained ML model ("ML-Model.pkl"). The result of this analysis is the generation of comprehensive failure reports, which are then made available to users through the front-end. Users can access these reports, gaining insights into machinery health and maintenance needs. Additionally, the web application facilitates bidirectional communication with the industry, allowing data exchange for analysis and providing repair instructions when necessary.

The industry side of the architecture involves data provision to the IoT devices and the web application. Machinery data is sent to the web application for analysis, while repair instructions are communicated back to the industry for action. This two-way flow of data ensures a closed feedback loop, enabling proactive maintenance and optimizing industrial operations. Moreover, the web application maintains a database of machinery data, ensuring a historical record of maintenance-related information and facilitating further analysis. This comprehensive architecture streamlines predictive maintenance, minimizing downtime and enhancing machinery reliability in industrial settings.

11.7. Upload CSV format

Type	Air temperature [K]	Process temperature [K]	Rotational speed [rpm]	Torque [Nm]	Tool wear [min]	Power
L	276	316	1244	15	192	29575
H	333	302	1925	77	32	12799
M	286	311	2678	80	50	15481
...	...	...	...	...	...	...
H	338	301	2214	34	245	90977

Our CSV upload format adheres to a structured table with specific columns essential for predictive maintenance analysis. These columns include "Type," "Air temperature [K]," "Process temperature [K]," "Rotational speed [rpm]," "Torque [Nm]," "Tool wear [min]," and "Power." While users have the option to include additional columns for machine names or identification numbers, the core columns mentioned above must be present in the uploaded CSV file. The resulting report CSV file exclusively contains data related to machines experiencing failures. To facilitate easy identification of the failing machines, an additional column labeled "Index" is incorporated into the report CSV, ensuring clarity and precision in pinpointing the machines in need of attention within the predictive maintenance process.