The two best performing Machine Learning (ML) Models are proposed to Ideabytes on the basis of accuracy and reliability for the detection of anomalous vibration and prediction of temperature, respectively. The ultimate goal is to augment the efficiency of Ideabytes’ existing cloud-based monitoring and alerting services currently provided to their customers.

Ideabytes offers its clients Internet of Things (IoT) solutions that measure and log various parameters like temperature, humidity, vibration, pressure, etc.[1] To monitor and visualize such data Ideabytes provides web dashboards and mobile apps. However, for clients to better manage their processes, Ideabytes needs to provide a way to predict certain events, such as increases in temperature and anomalous vibration. Lack of such a service can potentially lead to spoiling products worth millions of dollars and the malfunction of important equipment [2]. For Ideabytes customers that store vitally important health products (vaccines, medication, etc.) it is a matter of compliance with industry regulation [3].

While Ideabytes’ current monitoring application allows for the real time data collection and display, it is not designed to plan for preemptive actions. Machine learning models that can predict future values and detect performance anomalies with a decent level of accuracy will help Ideabytes’ customers make informed decisions prior to machine failures and lower the risk of damaged merchandise.[4]

Specific criteria need to be met by built machine learning models. To be considered a success, proposed models:

·        Should have accuracy above 70%.

·        Should have recall above 70%.

·        Should be able to predict temperature after 1 hour, 4 hours, and 8 hours for freezer storage.

·        Should be able to detect anomalies for machine vibration, i.e.:

a)      Identify the anomaly

b)     Detect outside of  range vibration values

c)     Detect vibration trending to higher values

·        Should be designed to integrate with Ideabytes monitoring and alerting system.

Chapter 1 of this report consists of the introduction, models criteria, and scope of the project. Chapter 2 describes various machine learning algorithms that were considered for temperature prediction and vibration anomaly detection models. Chapter 3 describes the process of evaluation of ML algorithms and the best two chosen algorithms. Chapter 4 describes the process of training and testing the chosen models and their implementation. Chapter 5 consists of results of models’ integration into Ideabytes cloud environment. Chapter 6 consists of conclusion.

The project is limited to the application of industry standard ML algorithms and built with the use of Python based ML libraries. The data is limited to temperature readings from industrial freezers and vibrational measurements from compressors provided by Ideabytes. The alerting thresholds and setting up alerts for Ideabytes mobile apps is not included in the scope of this project and will be handled by Ideabytes upon implementation of machine learning models.

[1] Ideabytes, “Ideabytes IOT: Wireless Data Loggers,” Data Loggers for Industrial IoT, https://www.ideabytesiot.com/Industries/industrial-iot.html (accessed Jun. 13, 2024).

[2] “Decades of research destroyed after freezer fails at Swedish University,” The Guardian, https://www.theguardian.com/world/2024/feb/05/decades-of-research-destroyed-after-freezer-fails-at-swedish-university (accessed Jun. 13, 2024).

[3] “Immunization Handbook for Medical Officers (2017),” Ministry of Health and Family Welfare | GOI, https://main.mohfw.gov.in/?q=Organisation%2FDepartments-of-Health-and-Family-Welfare%2Fimmunization%2Fimmunization-handbook-medical-officers2017-0 (accessed Jun. 13, 2024).

[4] Ideabytes, “Temperature Regulation in Milk Processing.” Ideabytes Software India Pvt Ltd, Telangana