Predictive Maintenance for Automatic Production Systems

CSE 495
Preliminary Presentation

Abdurrahman BULUT

Supervisor: Pr. Dr. İbrahim SOĞUKPINAR

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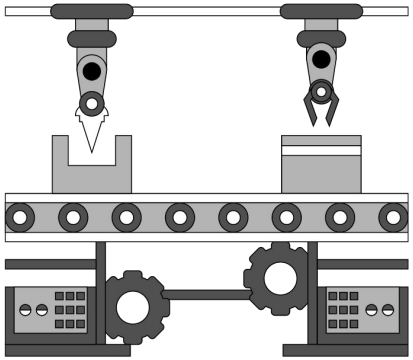
Project Definition



- What is the project about?

- Automated production systems are manufacturing systems that use automated equipment, such as robotics, sensors, and computer-controlled machinery, to perform production processes.

- If the problems that may arise in these machines are not detected early, problems may arise in terms of both financial and time.

- The system will collect and analyze data from sensors installed on the manufacturing equipment, including vibration, pressure, voltage, temperature, and other relevant data points. It will use this data to create a predictive model that can identify patterns and anomalies in the equipment's behavior that may indicate potential faults.

Keyword: Predictive Maintenance

Related Works

Deep learning-based hybrid approach for real-time predictive maintenance in automated production systems

Burak Bozkurt, Ilker Ustoglu, Goksel Misirli, Hakan Anil

Dataset: A real-world dataset from an automotive assembly line.

Results: Achieved a 96.53% accuracy in predicting downtime of the automated production system using the proposed deep learning-based hybrid approach.

A deep learning-based approach for bearing fault diagnosis

M. M. Rahman, A. H. Chowdhury, A. M. A. Hossain, M. A. Matin

Dataset: A bearing dataset from the Case Western Reserve University.

Results: Achieved a 98.67% accuracy in bearing fault diagnosis using the proposed deep learning-based approach.

Deep neural networks for predictive maintenance: A survey of industrial applications

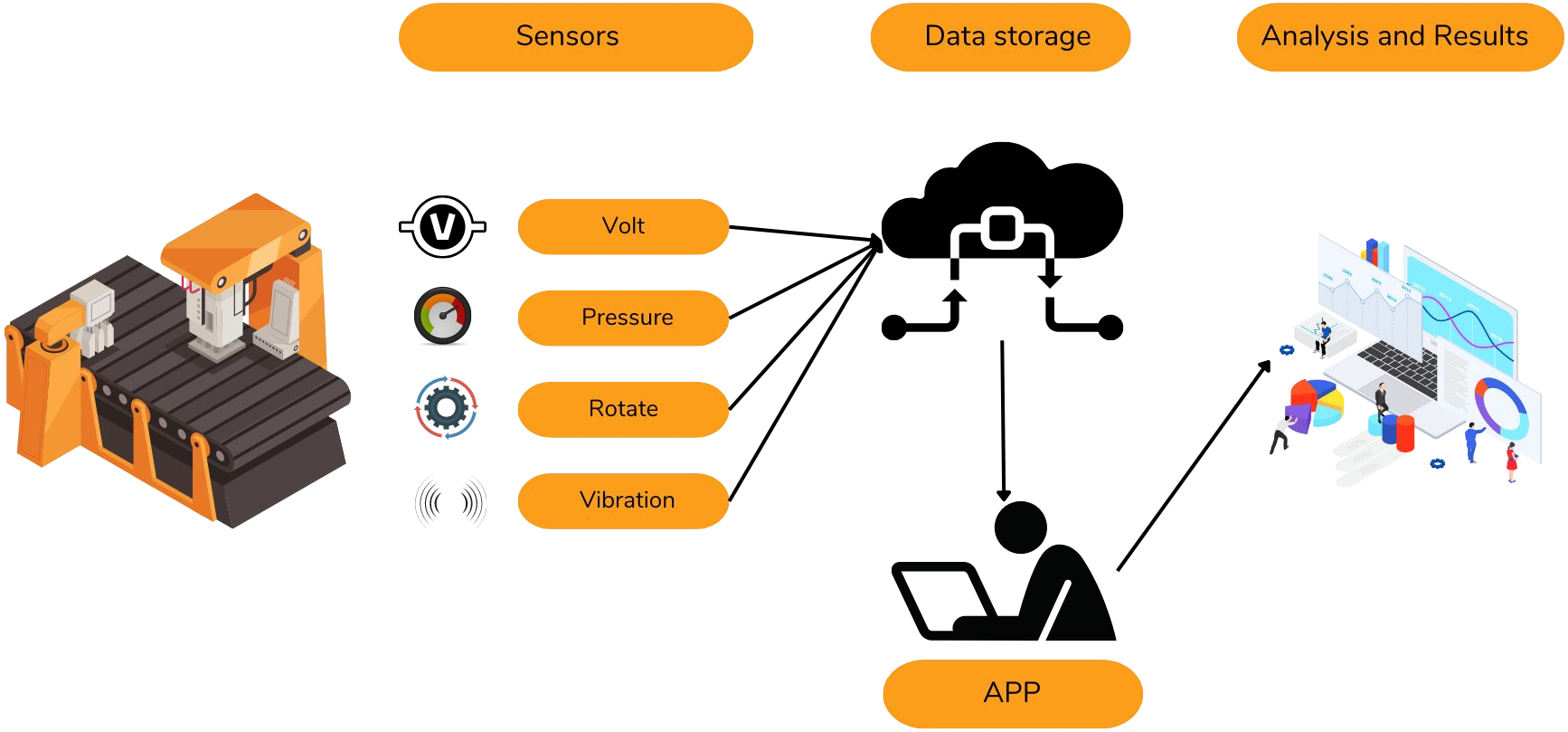
X. Wang, L. Gu, J. Zhou, M. C. Zhou, J. Sun, Y. Cai, Y. Ding, Y. Yao

Dataset: Various publicly available datasets, including the NASA Turbofan engine degradation dataset and a bearing dataset from the Case Western Reserve University.

Results: Presented a survey of deep neural networks used for predictive maintenance in various industrial applications, highlighting the benefits and challenges of these approaches.

According to some studies, early detection provides an advantage of 30% in terms of time and 40% in prolonging the life of the machine.

Project Design Plan



Project Requirements - 1

- Finding a comprehensive dataset is very important.
- It is necessary to determine the parameters that affect the healthy of the machines. (volt, pressure etc.)
- It would be helpful to analyze machine learning algorithms that are frequently used in past research and the algorithms that gives best result.
- User should be able to upload events logs to the app via interface.

	datetime	machineID	volt	rotate	pressure	vibration
0	2015-01-01 06:00:00	1	176.217853	418.504078	113.077935	45.087686
1	2015-01-01 07:00:00	1	162.879223	402.747490	95.460525	43.413973
2	2015-01-01 08:00:00	1	170.989902	527.349825	75.237905	34.178847
3	2015-01-01 09:00:00	1	162.462833	346.149335	109.248561	41.122144
4	2015-01-01 10:00:00	1	157.610021	435.376873	111.886648	25.990511

Sample Data

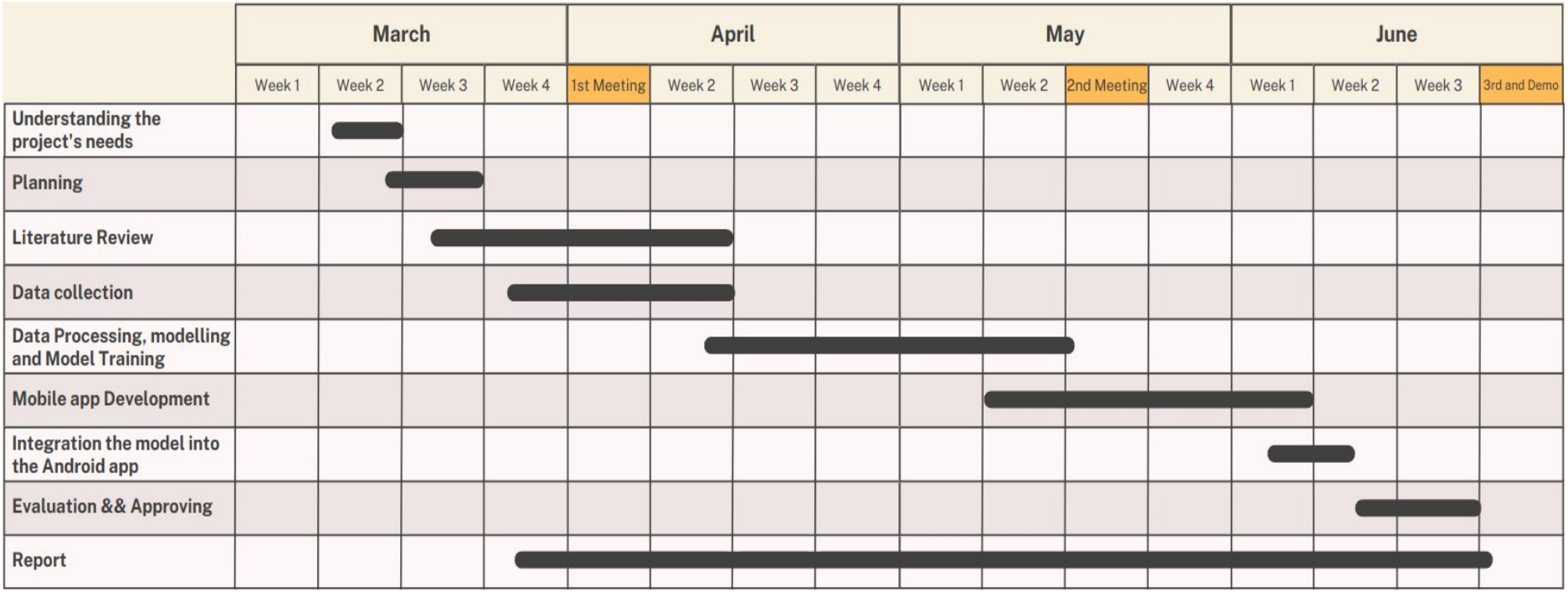
Project Requirements - 2

- Dataset: Microsoft Azure Predictive Maintenance, Kaggle

- The algorithms that I may use are follows:
  - Newton-Cg
  - ARIMA
  - Linear Regression
  - Gaussian
  - Poly SVC

- Some required technologies and libraries are:
  - Python
  - Colab
  - Numpy
  - Pandas
  - Scikit-learn
  - Matplotlib
  - Android Studio – Flutter or
  - React

Project Timeline



Success Criteria

- The success rate of the created model is at least %80
- Calculation of analysis results in less than 20 miliseconds
- 2 file types should be supported to upload the data. (.xlsx - .csv)

Resources

1. “Microsoft Azure Predictive Maintenance”, ARNAB, “https://www.kaggle.com/datasets/arnabbiswas1/microsoft-azure-predictive-maintenance”

2. “A Deep Learning Based Approach for Bearing Fault Diagnosis, “https://www.researchgate.net/publication/313125160_A_Deep_Learning_Based_Approach_for_Bearing_Fault_Diagnosis”

3. “Artificial intelligence for fault diagnosis of rotating machinery: A review, “https://www.researchgate.net/publication/326742898_Artificial_intelligence_for_fault_diagnosis_of_rotating_machinery_A_review”

4. “Fault Handling in Industry 4.0: Definition, Process and Applications”, “https://www.mdpi.com/1424-8220/22/6/2205”

5. “An Industry 4.0 Dataset of Contextual Faults in a Smart Factory”, “https://www.sciencedirect.com/science/article/pii/S187705092100314 8?via%3Dihub”