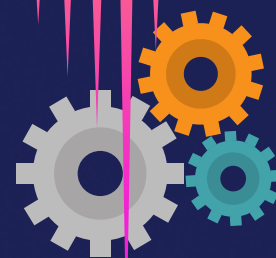# SANJAYA

UNLOCKING MACHINE SECRETS

Problem statement : Development of motion amplification video techniques for vibration analysis

THEME : Manufacturing and automation

Team name : AutoMatrix

ANALYSING PROBLEM STATEMENT

To develop an automated motion amplification video generation system, and enabling constant monitoring to detect and amplify subtle machinery vibrations, also providing real-time SMS alerts to prevent potential damage and accidents in industrial settings.

Proposed SOLUTION

Constant monitoring

A video capturing device which can be a usual **mobie phone mounted** on a **tripod** can be used to **constantly record** video of industrial equipment.

Video segmentation & processing

fixed duration video segments are isolated and processed, **abnormalities are analysed**. **Recurrent nerual netwrok** is used for amplification.

Ticket management system

If any abnormalities is observed in any of the segmented videos a **ticket will be raised** with **type of the abnormality, machine id and magnified video**.

Alert mechanism

As soon as any abnormality like noise, shock or excessive vbiration is detected a **sos message** will be sent to **owners mobile**.

How does it Amplify?

Spatial decomposition

- The extracted frames from video are **downsampled** using **gussian and laplacian pyramids.**
- Here we first decompose the video sequence into **different spatial bands**
- Then temporal processing is performed on each band.

Temporal processing

- We consider the **time series** corresponding to the value of a pixel in a frequency band and apply filters to extract the frequency bands of interest.
- The pixel is then multipled with **magnification factor alpha**.And added to the original to obtain final output.
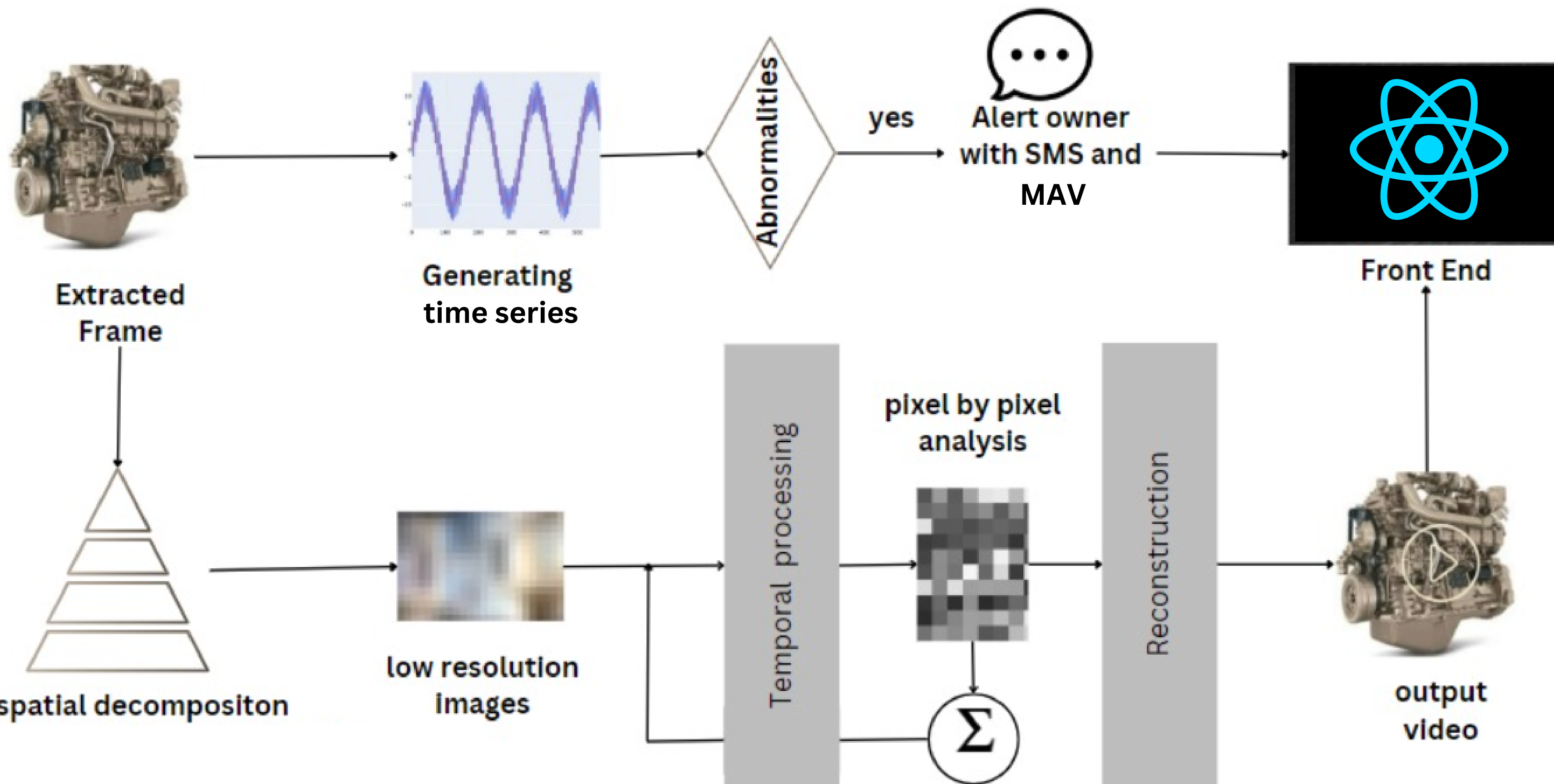
BENIFITS & USECASES

- **Early fault detection :** By amplifying subtle motions, the system can detect early signs of wear and tear.

- **Operational insights :** Displacement graphs and FFTs graphs provide insights into the operational health.

- **Predictive Maintenance :** Address potential issuse before they arise or esclate.

- **Precised diagnosis :** It provides a clear visual representation of motion irregularities, aiding in accurate diagnosis of mechanical problems.

BENIFITS & USECASES

- **Automobile Industry :** Detect issues in gearboxes and transmissions by analyzing motion amplification to ensure smooth gear shifting and reduce wear.

- **Power Plants :** Monitor the motion of cooling tower fans to prevent imbalances and maintain efficient cooling in power generation facilities.

- **Industrial Manufacturing :** Ensure precision in product assembly by monitoring the motion amplification of robotic arms and automated machinery for consistency.

- **Pulse rate prediction :** Contactless pulse rate prediction using motion amplification video of wrist.
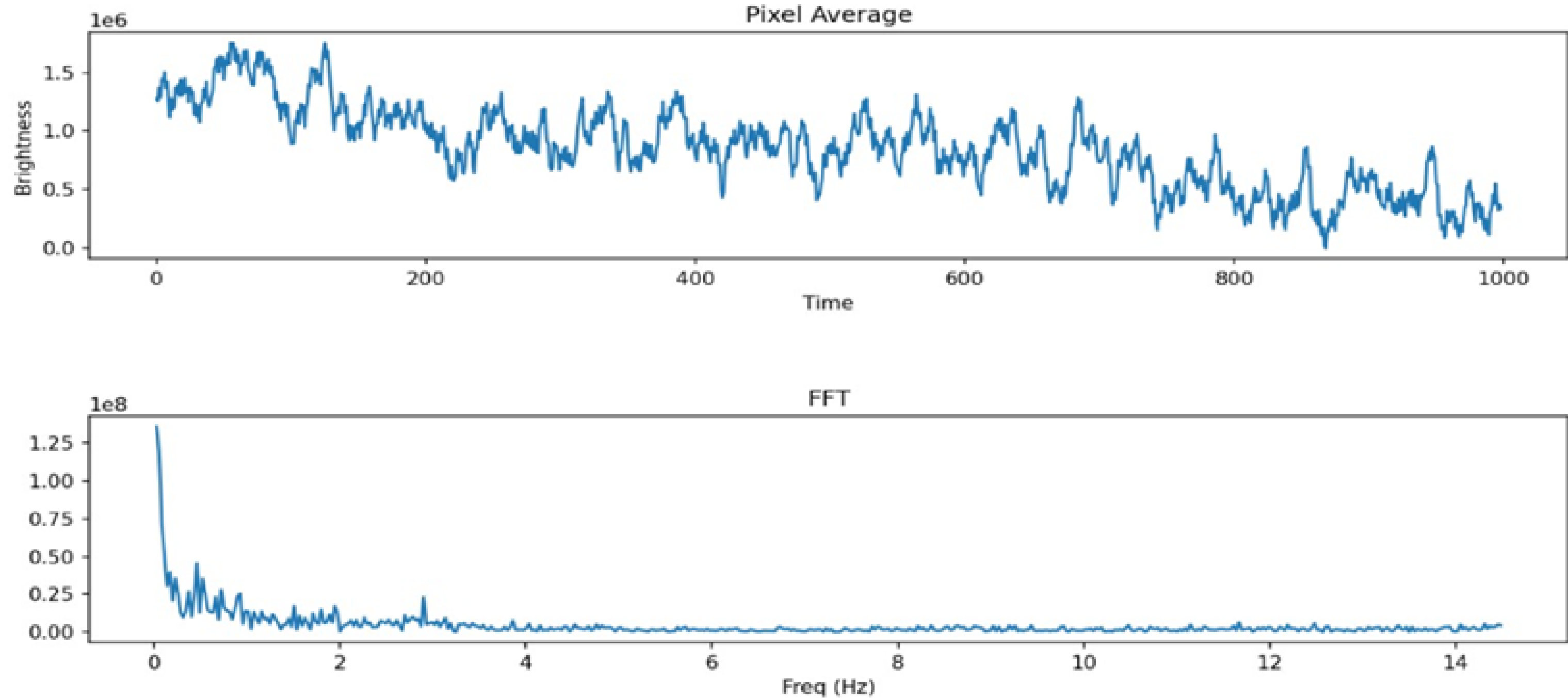
SOURCE VIDEO

OUTPUT MAV

FAST FOURIER TRANSFORM GRAPH

Future Scope

01 **Extensive Domain**
with small adjustments, the model can be used for wide applications and a variety of domains.

02 **Integration with IOT**
Design sensors and specialised cameras, allowing an increase in the quality of monitoring and data collection.

03 **Embedding with CCTV servers**
Using CCTVs for constantly recording videos and running analysis on top those videos

BOTTLENECKS

- Need for stable and fixed video capturing source.

- The system may sometimes identify false positives, leading to unnecessary maintenance or downtime.