INNOVATORS DAY 2025 – 24 HOURS HACKATHON

- **Problem Statement ID – SIH1736**
- **Problem Statement Title- AI based frame interpolation, video generation and display system for WMS services**
- **Theme- Smart Automation**
- **PS Category- Software**
- **Team Name – Vision Techies**

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Interpolation for Satellite Imagery Visualization

Solution Overview:

- Automated Video Generation: AI system retrieves satellite images from WMS every 30 minutes and generates smooth transition frames every minute using advanced frame interpolation.
- Interactive Map Overlay: The generated video is integrated into an open-source WebGIS interface like OpenLayers or Leaflet, allowing dynamic visualization on a map.

Problem Addressed:

- Seamless Visualization: Smooth, continuous video addresses the challenge of visualizing deformable objects (e.g., clouds) that change shape or disappear between frames.
- Open-Source Compatibility: Works with open-source libraries, offering a cost-effective alternative to commercial tools.

Innovation:

- AI-Driven Interpolation: Novel use of AI to handle complex frame interpolation by Fine Tuning existing models
- Device Utilization: Potential for on-device GPU/NPU utilization for efficient processing.

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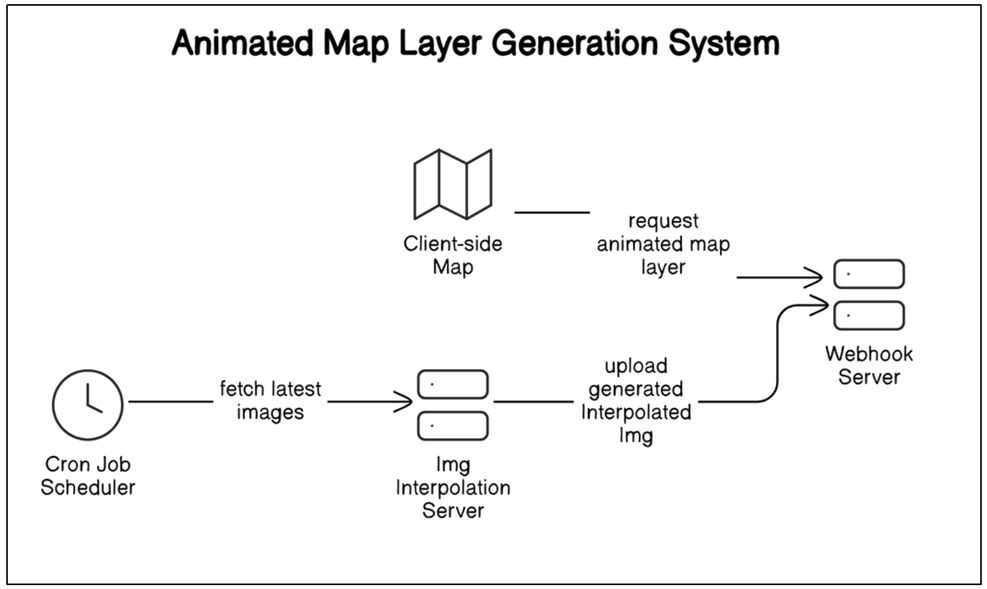
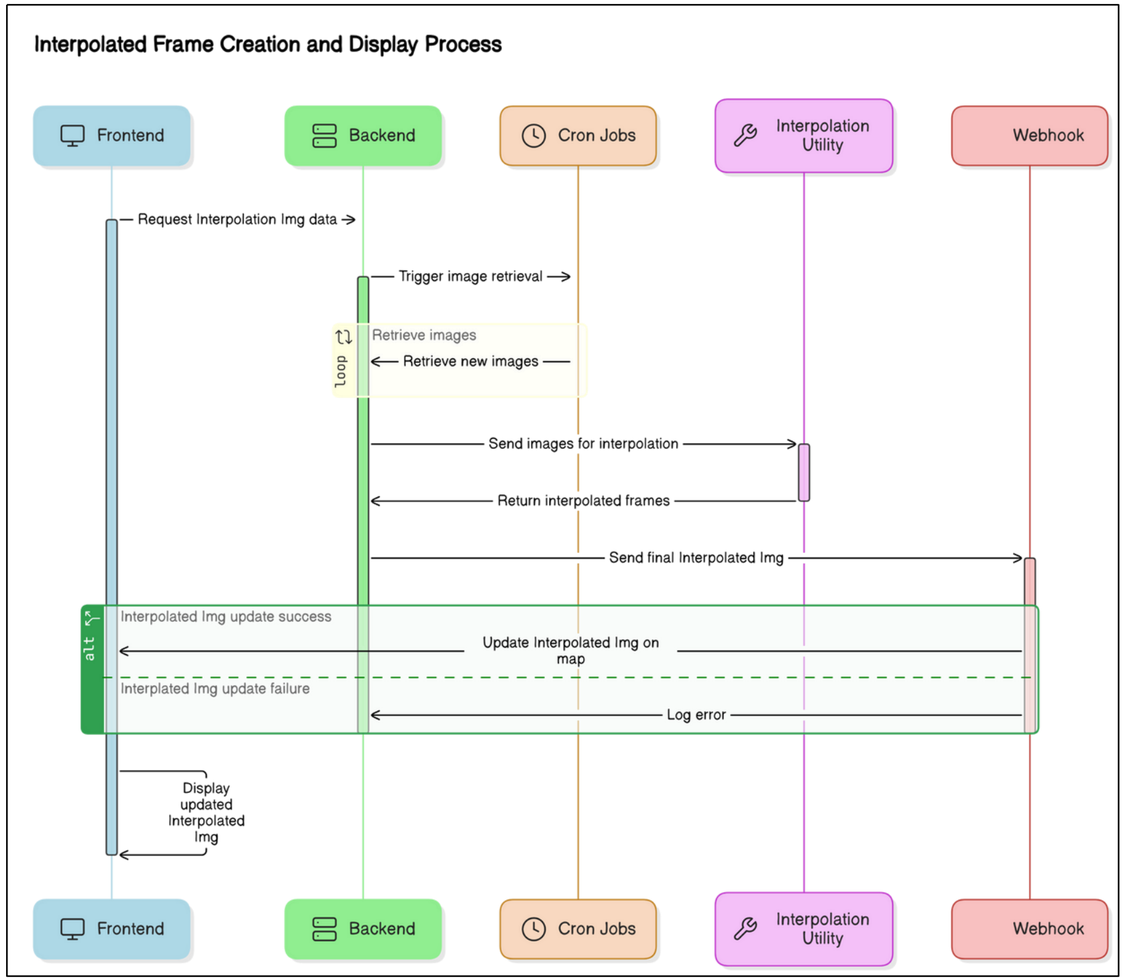
TECHNICAL APPROACH

Approach





Frontend Dependencies:

- HTML, CSS, JavaScript: Core web technologies.
- Leaflet: For interactive map visualization.

Backend Dependencies:

- Node.js: Manages API requests, connects to the interpolation service, stores, and serves images.
- Cron Jobs: Automates image retrieval from WMS.

AI Models:

- Python & TensorFlow FILM Model: Handles frame interpolation.
- Interpolation Microservice: Processes images and interacts with Node.js.

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FEASIBILITY AND VIABILITY

Potential Challenges

Server Load Management: High computational load from frame interpolation tasks can overwhelm the server, affecting performance and scalability.

Efficiency in Image Processing: Processing and generating interpolated frames from large volumes of satellite images may strain server resources.

Inconsistent Client-Side Resources: Availability of GPUs/NPUs on client devices can vary, affecting the reliability of using these resources.

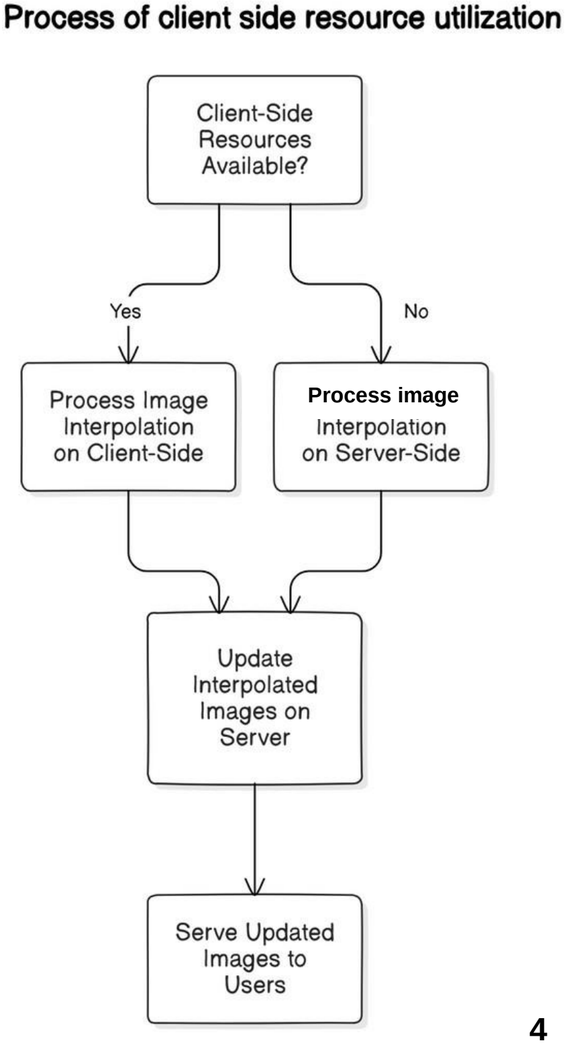
Strategy/Solution

Microservice Architecture: Deploy interpolation as a separate microservice to distribute the processing load and improve scalability.

Client-Side Computation: Leverage client-side GPUs/NPUs for temporary interpolation tasks, reducing the server's workload.

Load Management: Implement load balancing and caching strategies to handle server load efficiently and optimize performance.

Process Flow



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IMPACT AND BENEFITS

Social:

- Better Visualization: Smoother, detailed satellite imagery enhances user engagement.
- Increased Accessibility: Open-source technology makes advanced visualization tools widely available.

Economic:

- Cost Savings: Offers a cost-effective alternative to commercial software.
- Optimized Resources: Utilizes client-side GPUs/NPUs, reducing server costs.

Environmental:

- Enhanced Monitoring: Better tracking of environmental changes supports decision-making.
- Resource Efficiency: Distributed computing lowers reliance on energy-intensive server farms.

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RESEARCH AND REFERENCES

- **FILM Model for Interpolation:**
  a. **PDF Results of FILM Model Interpolation -** https://drive.google.com/file/d/17IySR3Dr6NXvXDtNY2OF4pwx1wPRMV31/view?usp=sharing
  b. **FILM Model Official Page -** https://film-net.github.io
- **Video Overlay on Map:**
  a. **Leaflet Video Overlay Feature -** https://leafletjs.com/examples/overlays/example-video.html
- **Microservices Architecture:**
  a. **Microservices Information -** https://microservices.io
- **Client-Side Computation to Reduce Server Load:**
  a. **WebGPU and AI/ML in Client-Side Computation -** https://gradientflow.com/webgpu-and-ai-andmachine-learning/