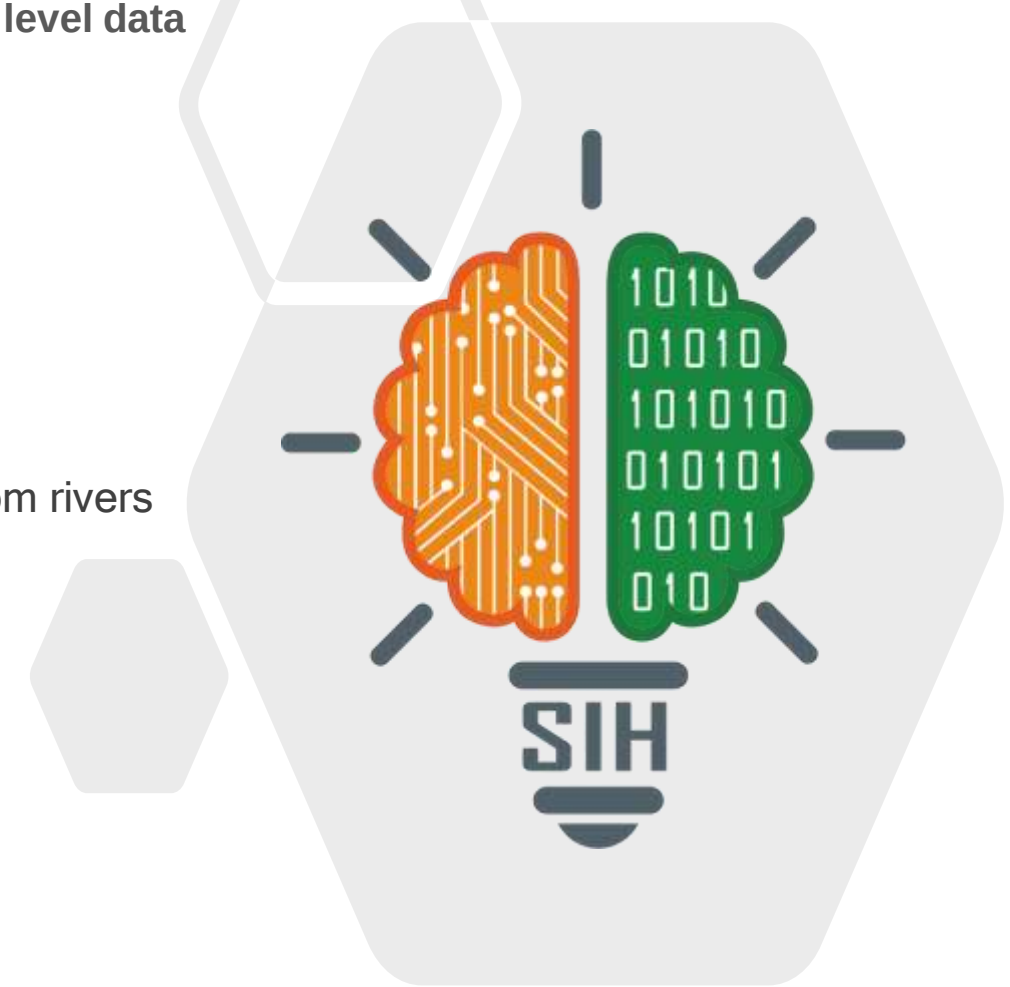
SMART INDIA HACKATHON 2025

Development of a mobile application for secure water level data collection from rivers using Image processing



- **Problem Statement ID –** SIH25248
- **Problem Statement Title –** Development of a mobile application for secure water level data collection from rivers using image processing.
- **Theme –** Miscellaneous
- **PS Category –** Software
- **Team ID –** 111481
- **Team Name –** GrayCode

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IDEA & APPROACH

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A mobile-first solution that leverages **image processing, geofencing, and cloud integration** to modernize **river water-level monitoring** for flood forecasting, water management, and disaster preparedness.

Proposed Solution

- Mobile app with GPS/geofencing to validate monitoring site location
- Live camera capture of gauge posts
- Image processing to auto-read water levels from gauge photos
- QR code scanning for site authenticity
- Role-based access – field staff, supervisors, analysts, and public uploads
- Cloud dashboard for real-time monitoring and anomaly detection

How It Addresses the Problem

- Ensures tamper-proof and authenticated water-level data collection
- Eliminates manual errors and delays in reporting
- Provides real-time visibility across multiple sites for supervisors
- Works in remote/rural areas with poor connectivity
- Supports data-driven decision making for flood preparedness

Innovation & Uniqueness

- First-of-its-kind integration of image processing + geofencing + QR validation
- Offline-friendly, scalable, and low-cost compared to IoT hardware setups
- Provides tamper detection & anomaly alerts for data integrity
- Bridges the gap between manual monitoring and AI-enabled forecasting
- Potential to expand into AI-powered flood prediction with historical trends

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TECHNICAL APPROACH

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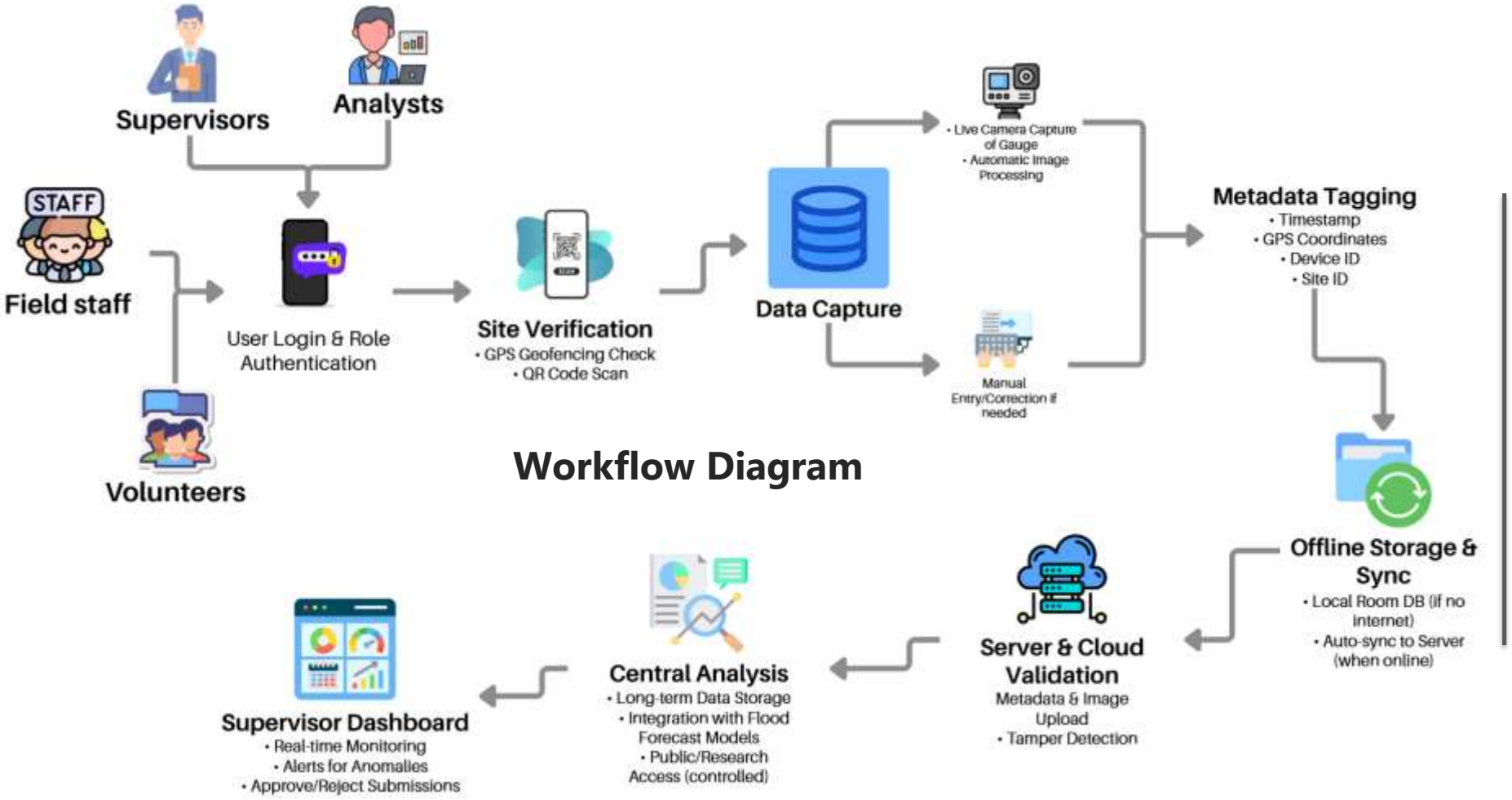

Workflow Diagram

Tech Stack

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FEASIBILITY & VIABILITY

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✔ Feasibility

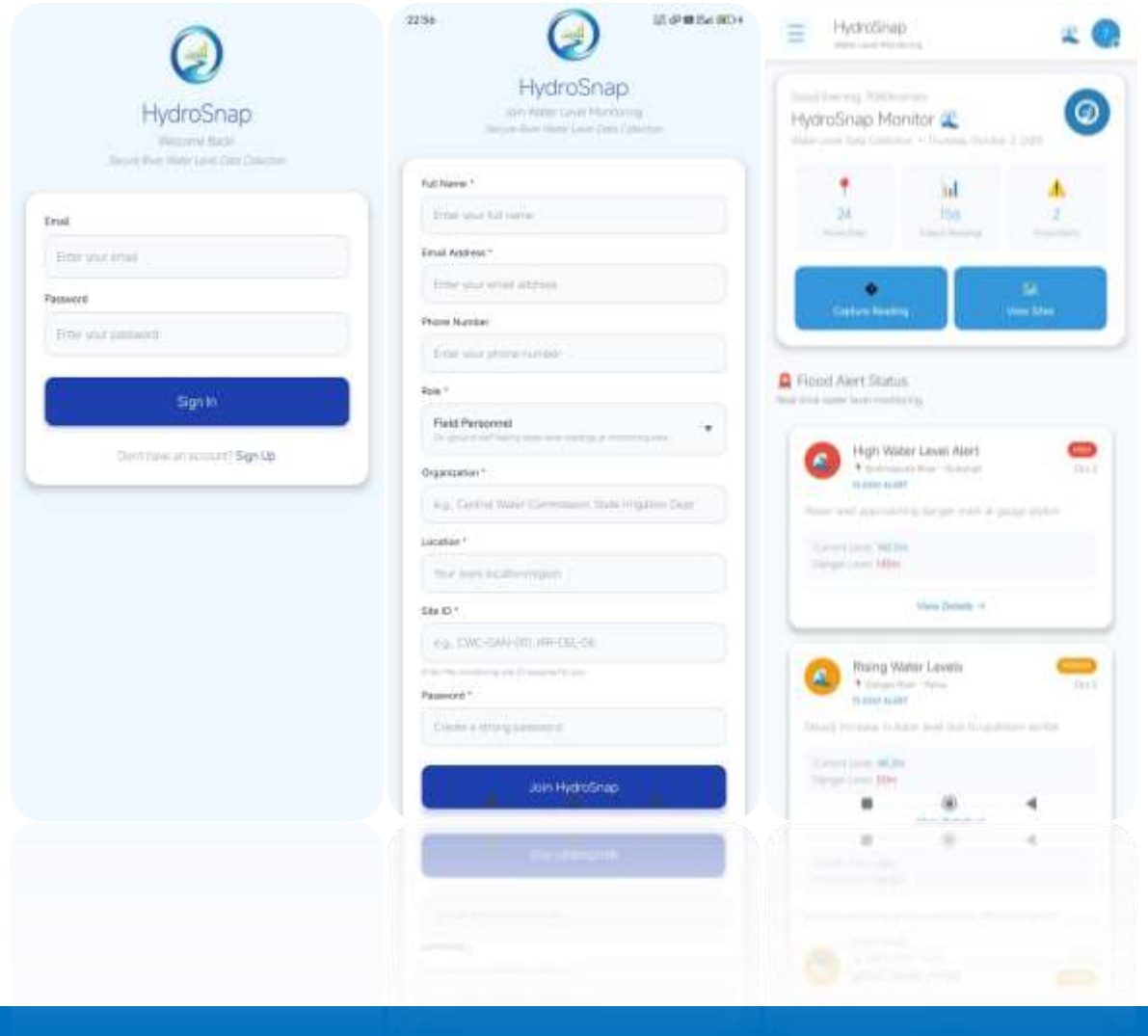
- Mobile app + camera = cost-effective water level monitoring
- Cloud backend ensures secure storage & real-time updates
- Image processing + ML ensures accurate water level detection
- Scalable solution for both rural & urban river monitoring

💡 Strategies to Overcome

- Offline data capture with later sync
- Automated image preprocessing to reduce errors
- Partnerships with water authorities & disaster management agencies
- Awareness & training for local volunteers/officials

⚠ Potential Challenges & Risks

- Poor internet connectivity in remote riverbanks
- Variations in lighting/obstructions affecting image accuracy
- Device/camera damage in harsh environments
- Limited adoption by local authorities without incentives



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IMPACT & BENEFITS

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IMPACT

- Early detection of rising river water levels & flood risks
- Faster response by disaster management & local authorities
- Improved community preparedness & safety awareness
- Strengthened resilience in flood-prone rural & urban regions

BENEFITS

- **Social**: Safer communities, reduced loss of life & property
- **Economic:** Lower disaster recovery costs, protection of livelihoods
- **Environmental:** Better river monitoring, sustainable water resource management
- **Technological:** Encourages AI/ML-driven monitoring & digital disaster management adoption

HydroSnap

A smart mobile application that uses image processing and AI/ML to monitor river water levels in real-time, enabling early flood detection, secure data collection, and informed decision-making for communities and authorities.

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RESEARCH & REFERENCES

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- **Water Level Monitoring & Gauge Reading (Image-based, remote sensing)**
  - Field performance of the GaugeCam image-based water level measurement system General water level monitoring systems (with sensors + imaging)
  - Research on Water Gauge Recognition Based on Deep Learning - using YOLO / digit detection for gauge recognition

- **Geofencing, QR + Location-based Verification**
  - Use of QR + geofencing to validate physical location and restrict action when outside boundary
  - Reading QR Codes on challenging surfaces" – method for QR decoding on irregular surfaces

- **Hybrid Human-in-the-Loop ML / Verification**
  - Auto-read gauge values via ML (segmentation / OCR) and flag low-confidence cases for manual verification
  - Collect labeled dataset from field images to refine the models

- **References**
  - https://patents.google.com/patent/US11544916B2/en
  - https://www.researchgate.net/publication/286509070_On_the_Use_of_Location-Based_Services_and_Geofencing_Concepts_for_Safety_and_Road_Transport_Efficiency
  - https://www.uoc.edu/en/news/2024/method-to-read-qr-codes-on-irregular-surfaces
  - TensorFlow: https://www.tensorflow.org/resources/models-datasets
  - Expo Go: https://expo.dev/go
  - Firebase: https://firebase.google.com/docs/auth
  - Supabase (Database): https://supabase.com/
  - Chart.js: https://www.chartjs.org