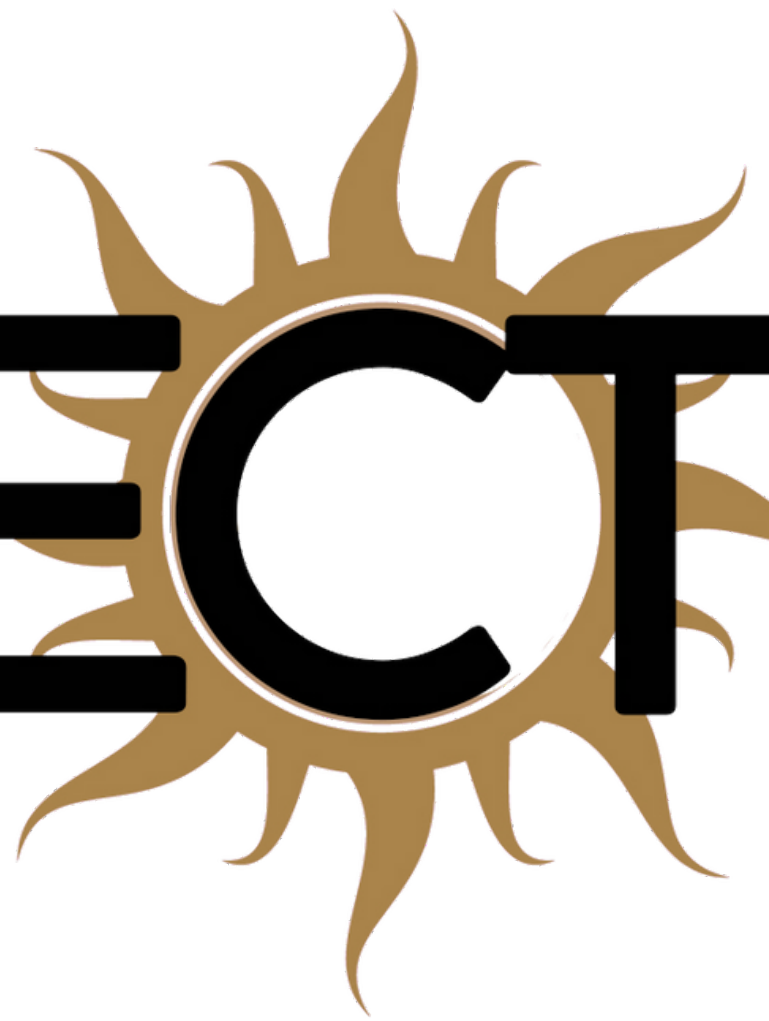


SPECTRUM



Name:

Murtada Ali

Nasima Mohammed Helal

Wessam Shehieb

Green by Design

Real-Time Hyperspectral Image Processing
An RGB-to-HSI Reconstruction Model for Efficient
Classification and Monitoring

PROBLEM STATEMENT

Identified Problem

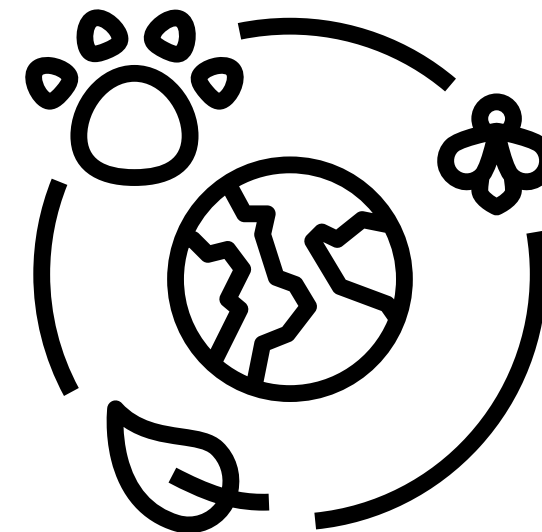
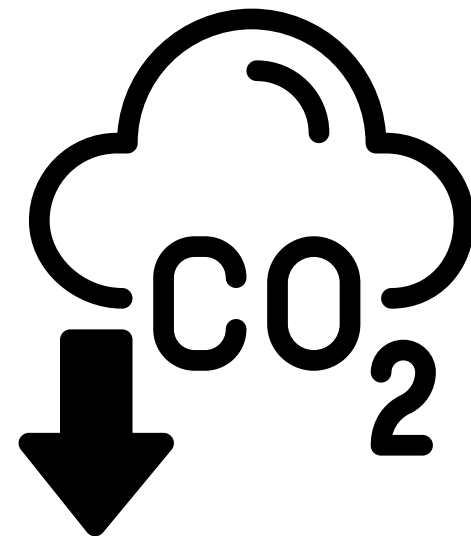
- Current environmental monitoring systems are too **slow**, **costly**, and **data-heavy** for **real-time** use.
- HSI/MSI cameras take **20–30 seconds** per image and generate large files, making rapid analysis and response impossible.
- This creates a major gap between data capture and decision-making, especially in fast-changing ecosystems.



PROBLEM STATEMENT

Significance of the Challenge

- Mangroves are crucial for **carbon storage** , **coastal protection** , and **biodiversity** .
- In the UAE, they directly support national sustainability goals like **Net Zero 2050** and the **Blue Carbon** Initiative.
- Without fast and scalable monitoring, ecosystem degradation goes undetected until it's too late for effective intervention.



PROBLEM STATEMENT

Who It Impacts

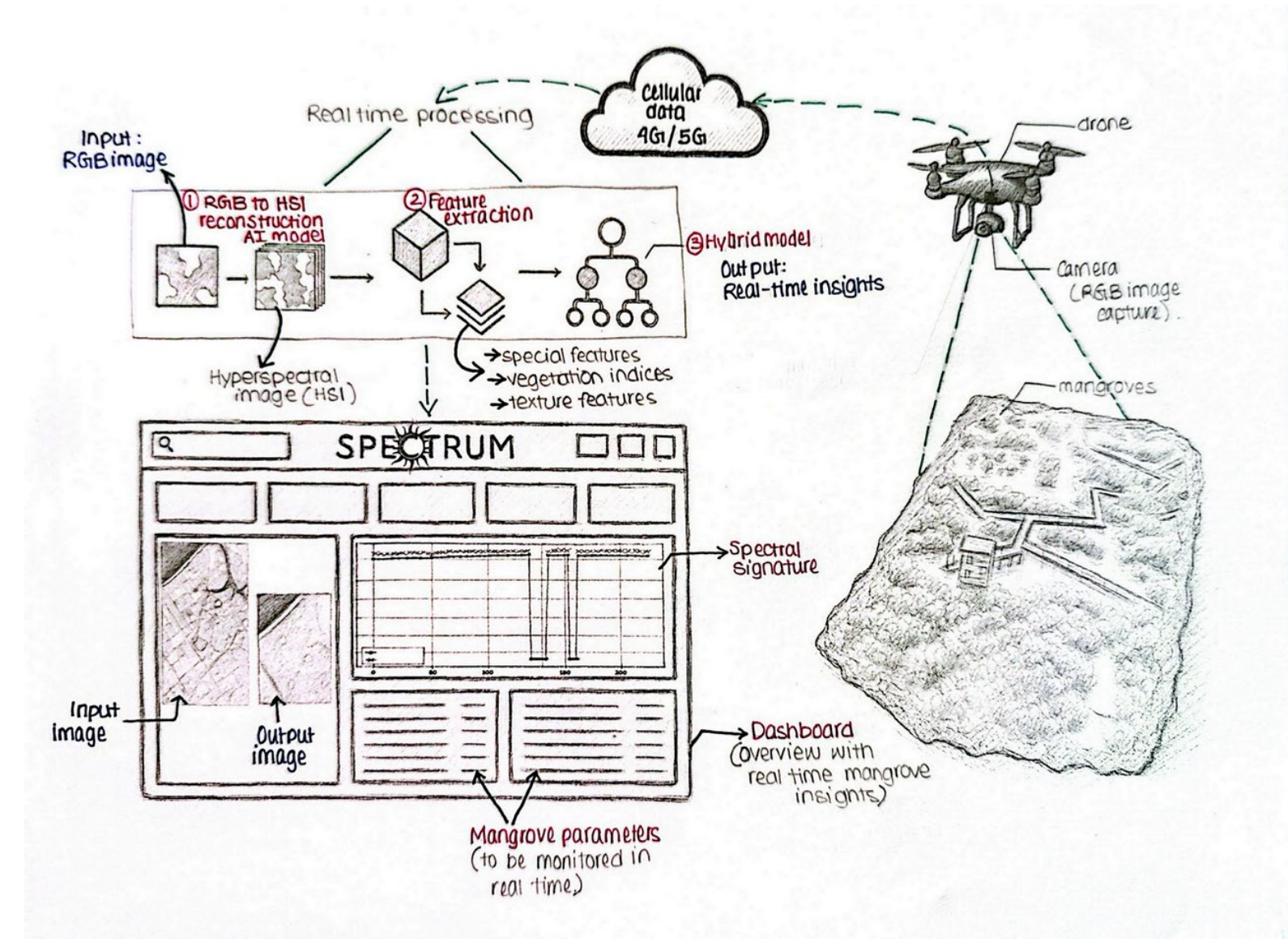
- **Environmental agencies** – struggle to monitor large coastal areas efficiently.
- **Researchers and conservationists** – lack accessible, real-time spectral data.
- **Government and policymakers** – face delays in assessing ecosystem health and policy impact.

Ultimately, communities and ecosystems suffer from slower climate response and biodiversity loss.

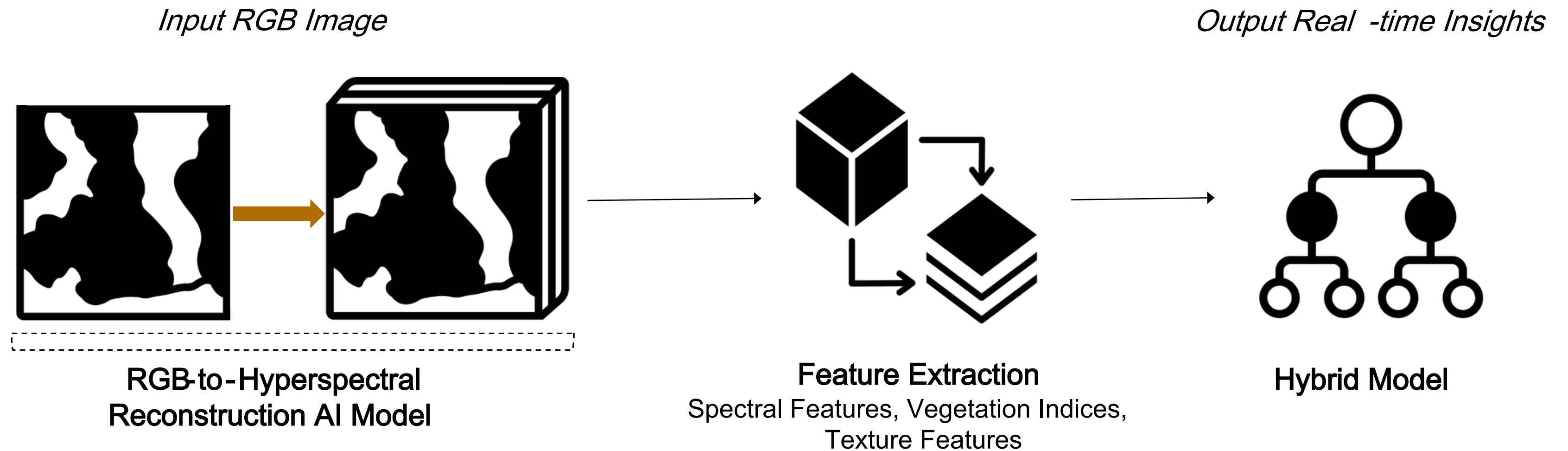
PROPOSED SOLUTION

Our Solution

- Spectrum is an AI -powered system that **converts regular RGB drone images into hyperspectral -like data in real time.**
- It enables **instant visualization** and analysis of vegetation health through a smart, **cross-platform dashboard.**
- The system combines AI models, drone imaging, and cloud connectivity (4G/5G) to deliver **real-time environmental insights** .

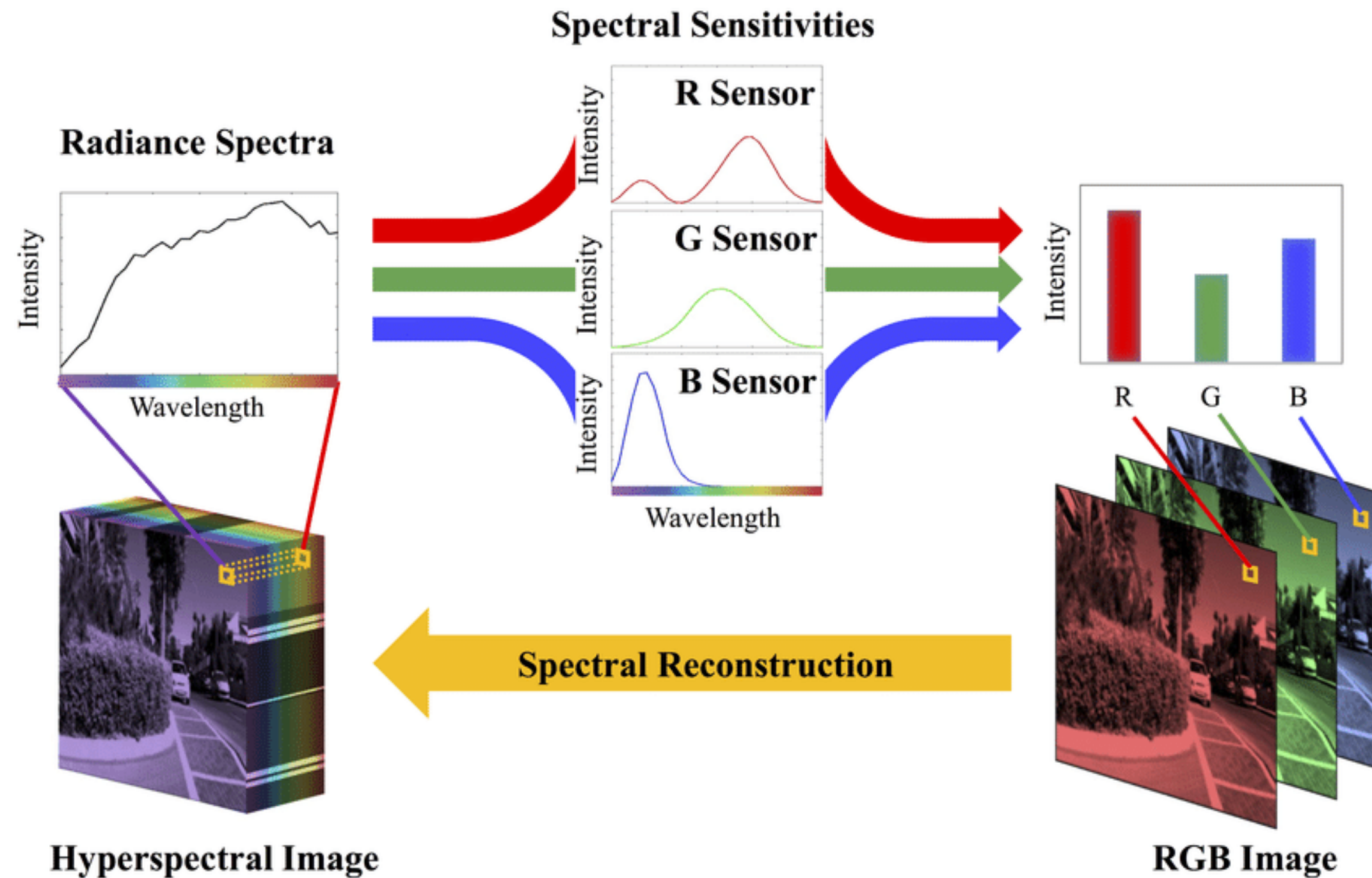


PROPOSED SOLUTION



PROPOSED SOLUTION

- RGB-to-Hyperspectral Reconstruction Model



PROPOSED SOLUTION

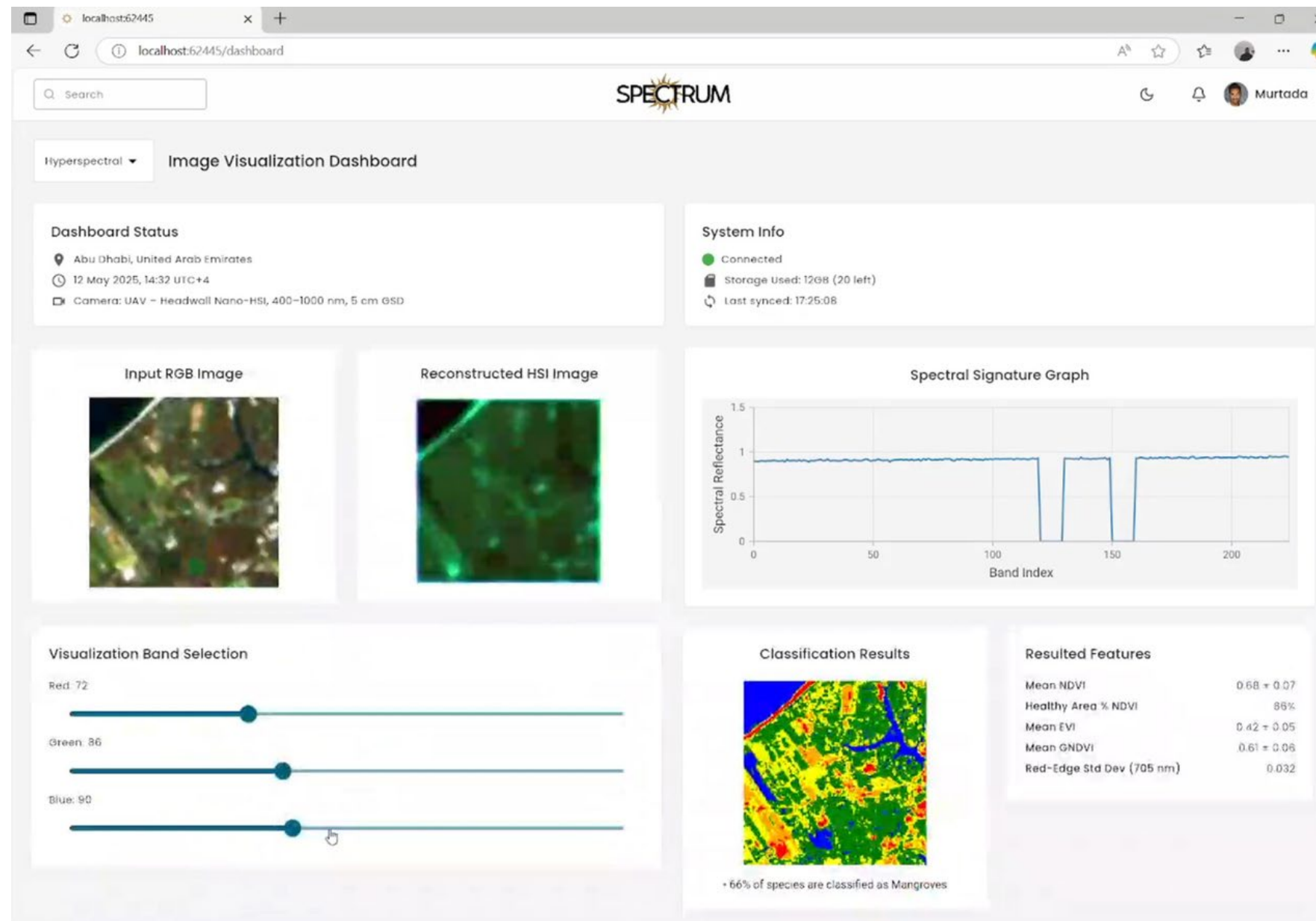
Notable RGB -to-Hyperspectral Reconstruction Model Implementations

- Marine Water Quality Monitoring – Accuracy 93.55%
- Agricultural Product Quality Assessment – Accuracy 93%
- Medical Imaging Enhancement – Accuracy 90%
- Material Segmentation in Imaging – Accuracy 90%
- Textile Color Measurement – Accuracy 92%



PROPOSED SOLUTION

How It Solves the Problem



- Removes the **need for expensive** HSI/MSI cameras by using standard RGB cameras with AI reconstruction.
- **Processes** images **within seconds** , closing the gap between data capture and decision -making.
- Offers an **end-to-end system** that combines image acquisition, AI analysis, and live dashboard insights for faster, data -driven environmental actions.

PROPOSED SOLUTION

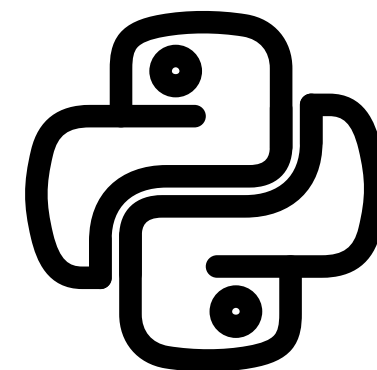
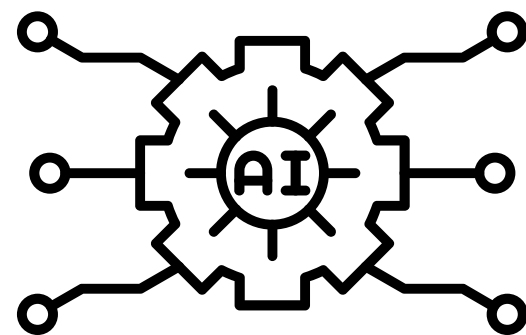
What Makes It Unique

- Uses **advanced U-Net** and **CNN models** trained on real hyperspectral datasets (HySpecNet -11k and GiQ) for high -accuracy reconstruction.
- **Compact** , **affordable** , and **scalable** , which is deployable on any drone with a regular camera.
- Bridges **speed** , **accuracy** , and **accessibility** ; delivering real -time insights that traditional systems cannot achieve.
- Developed under Ajman University Innovation Center, aligned with the UAE's sustainability and smart technology vision.



TECHNOLOGY/APPROACH

- AI-powered models (**U-Net & CNN**) re c o n s t r u c t h y p e r s p e c t r a l a n d m u l t i s p e c t r a l d a t a f r o m R G B i m a g e s.
- **IoT-enabled drone system** w i t h e m b e d d e d p r o c e s s o r a n d 4 G / 5 G c o n n e c t i v i t y f o r r e a l - t i m e d a t a t r a n s f e r.
- H y b r i d A I m o d e l a n a l y z e s **vegetation health** a n d c l a s s i f i e s m a n g r o v e t y p e s i n s t a n t l y.
- C r o s s - p l a t f o r m d a s h b o a r d v i s u a l i z e s l i v e e n v i r o n m e n t a l i n s i g h t s.
- B u i l t u s i n g P y t h o n , T e n s o r F l o w , P y T o r c h , a n d e d g e c o m p u t i n g h a r d w a r e (R a s p b e r r y P i / J e t s o n).



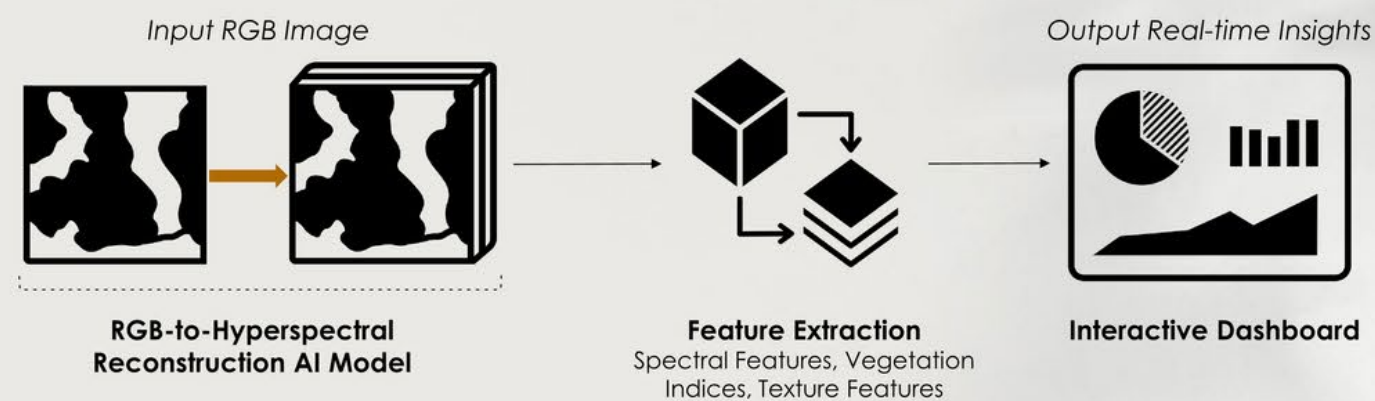
PROTOTYPE

Hardware Prototype

☀ FEATURES

- **Real-Time Monitoring**
Instant RGB capture + AI processing
- **Easy Deployment**
Lightweight, edge-ready model
- **Smart Insights**
Accurate classification & dashboards.
- **Low-Cost**
90% cheaper than traditional tools.
- **Flexible**
Works with any dataset or region
- **Eco-Friendly**
Supports sustainability and precision monitoring

☀ PROPOSED SOLUTION

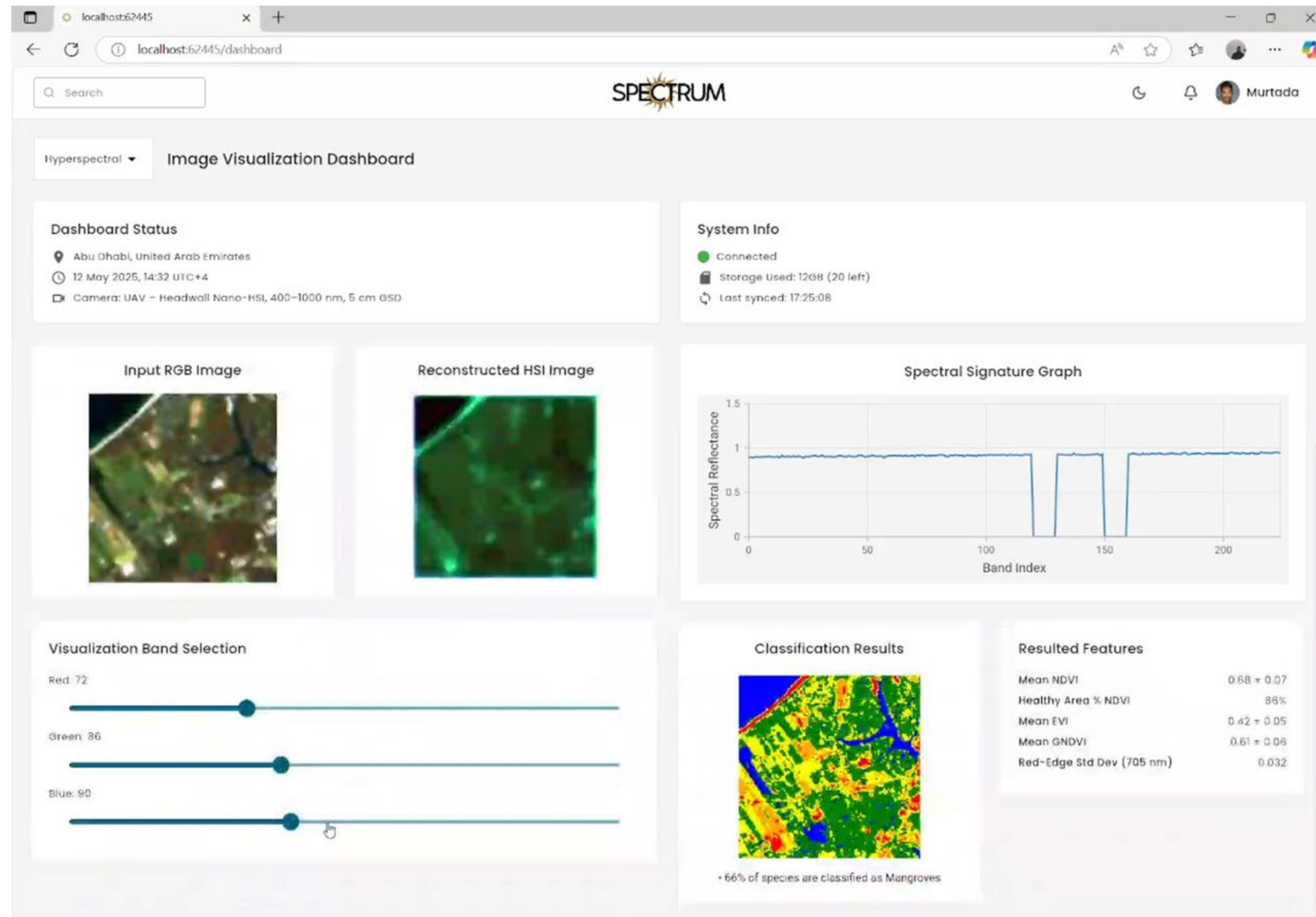


SPECTRUM



PROTOTYPE

Software Prototype



IMPACT & BENEFITS

- Outperforms current solutions in **speed** , **cost** , and **scalability** ; enabling real -time environmental monitoring.

MARKET COMPARISON

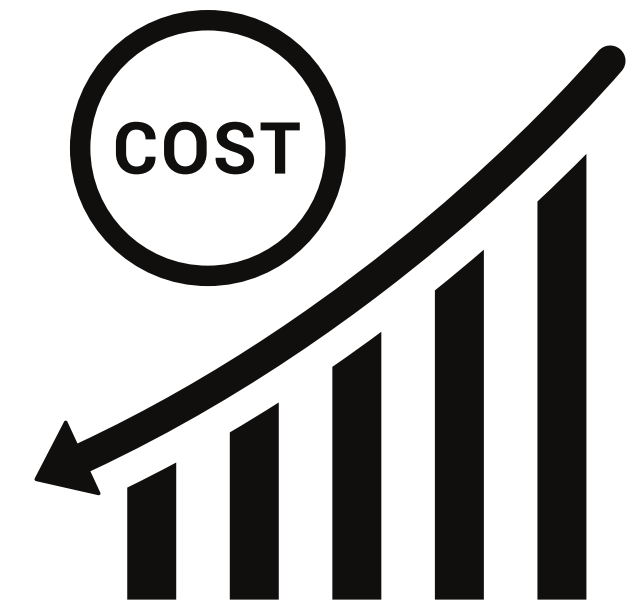
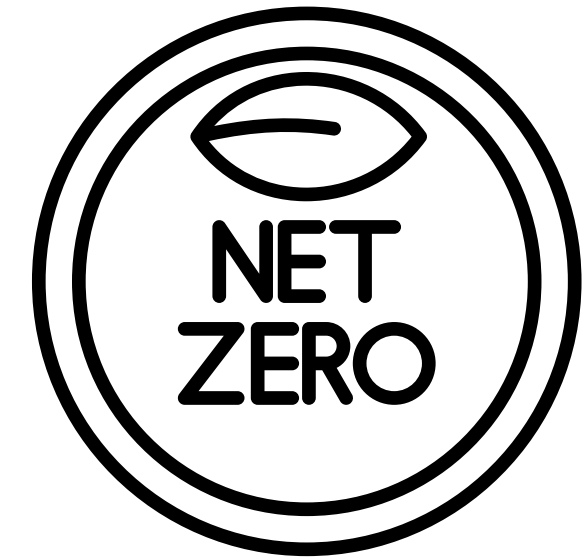
Mangrove Monitoring Technologies



SOLUTION	TECHNOLOGY TYPE	PROCESSING TIME	COST	DEPLOYMENT SIZE (MB)	SMART INSIGHTS
 SPECTRUM	AI-Enhanced RGB-to-HSI	Real-time	Low	2	★★★★★ (5.0)
Spaceborne Hyperspectral	Satellite HSI (PRISMA/ENMAP)	Days–Weeks	High	15,000	★★★★☆ (4.0)
Airborne Hyperspectral	Aircraft/Drone HSI	Hours–Days	Very High	1,300	★★★★★ (4.5)
Commercial Satellite	Multispectral Imaging	Hours–Days	Medium	500	★★★☆☆ (3.0)
Free Satellite Platforms	Sentinel/Landsat	Days–Weeks	Free	50	★★☆☆☆ (1.5)

IMPACT & BENEFITS

- Enables **real-time environmental monitoring** ; from hours or days to just seconds.
- Supports **UAE's Net Zero 2050** and **Blue Carbon** initiatives through faster mangrove conservation.
- Provides **affordable , scalable monitoring** using standard RGB cameras; accessible to more agencies and researchers.



IMPACT & BENEFITS

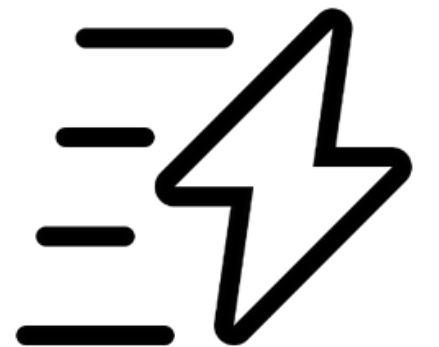
Real-time Processing

- RGB images can be captured much faster.
- With advanced servers, AI models can be processed in real-time.



Fast Deployment

- This approach can be validated quickly with minimal cost and readily available resources



Better Insights

- Since the classification will be performed using a hybrid model in real-time, it will generate deeper insights and more accurate predictions.



MARKET OPPURTUNITY

- USD 35B+global market for hyperspectral imaging by 2030.
- Strong demand in environmental , agricultural , and climate monitoring sectors.
- UAE & GCC investing heavily in AI and sustainability initiatives.
- Current HSI systems are slow, costly, and inaccessible .
- *Spectrum* offers a real-time, low-cost, scalable alternative using RGB drones.
- Ideal for agencies, researchers, and smart agriculture applications.



BUSINESS MODEL

Target Customer

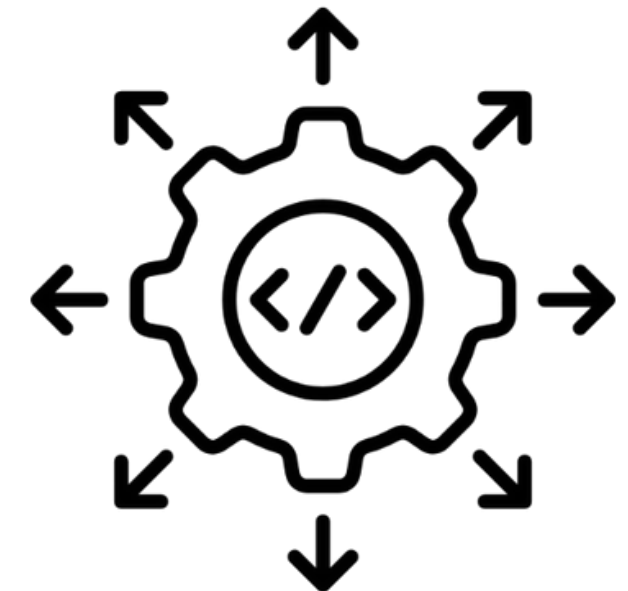
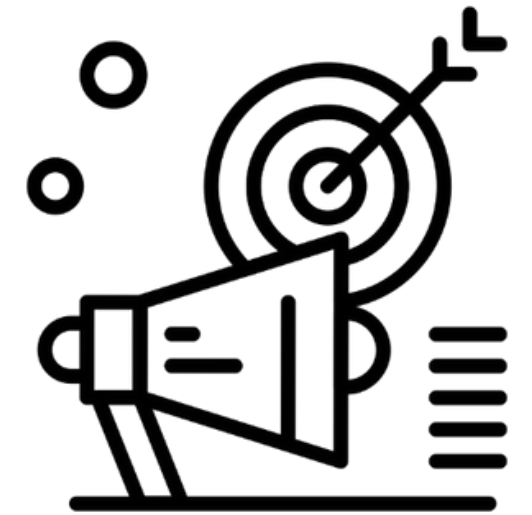
UAE Space Agency – responding to their Earth observation and environmental sustainability goals.

Value Proposition

- Enables spectral analysis with existing RGB satellites
- Low-cost, onboard -capable solution
- Real-time classification for change detection & ecosystem health

Deployment Advantage

- Up to **90% reduction** in cost vs traditional HSI/MSI payloads
- **<2MB model size** , ideal for edge devices & CubeSats
- Fast inference — supports **onboard or on -ground use**



Go-to-Market & Growth Strategy

1

Pilot Deployment

Collaborate with UAE environmental agencies and universities for real-world mangrove testing.

2

Expansion

Scale to agriculture and climate monitoring sectors across the UAE & GCC.

3

Commercialization

Launch subscription model for the Spectrum dashboard and AI-as-a-Service analytics.

4

Strategic Partnerships

Partner with drone manufacturers, space agencies, and sustainability programs to grow adoption.

5

Global Vision

Establish Spectrum as a global platform for AI-driven environmental intelligence.

TEAM & ROLES



Murtada Ali

AI and Software Developement



Wessam Shehieb

AI and Software Developement



Nasima Mohammad Helal

AI and Hardware Prototyping

THANK YOU!