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Vadlamudi - 522 213, Guntur District

Department of Computer Science and Engineering

Project Review
on

AQUA PLASTIC DETECT

Under The Esteemed Guidance of
Mrs.R.Pushpalatha
Assistant Professor
CSE Department

Presented By
Batch No: **D8**

Sk.Sabiha Sultana	23FE1A05P1
Joycee Fleroma.V	23FE1A05N7
Hemanth Rapolu	23FE1A05J5
Lokesh Salimetty	23FE1A05K2

AQUA PLASTIC DETECT

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ABSTRACT

Microplastics are Tiny Plastic particles that contaminate drinking water and pose serious risks to human health and the environment. Current detection methods rely on costly laboratory techniques that are not accessible to common users. To address this, our project **Aqua-Plastic Detect** introduces a website-based simulation that analyzes uploaded water sample images and estimates whether the Plastic present inside the water or not. Additionally, a 3D virtual model of a detection device with labeled parts is presented to visualize how a real-world solution could work in the future. This project serves as a prototype to raise awareness and demonstrate the potential of affordable, portable detection systems.

INTRODUCTION

- Plastic pollution has become a major global concern, especially in water bodies.
- Every year, millions of tons of plastics enter oceans, rivers, and lakes, breaking down into **microplastics (<5mm** in size**)**.
- They originate from industrial waste, packaging materials, cosmetics, and degradation of larger plastics.
- These particles are harmful to aquatic life and may cause long-term health risks in humans.
- There is no Portable, Affordable system for real-time detection of Microplastics.

INTRODUCTION

- Current detection methods (FTIR, Raman spectroscopy) are costly, lab-based, and not accessible to the public.
- Our project, **AQUA -PLASTIC DETECT**, proposes a simulation-based website and a 3D prototype device to demonstrate how detection could be simplified and made user-friendly.
- Along with this, we present a **3D virtual model of a POLY-SCAN device** to visualize how a real-time detection device could look and function in the future.

LITERATURE SURVEY

S.No	Paper Title	Methodology	Drawbacks	Proposed Methodology to overcome those drawbacks
1.	Polarized Scattering (2021)	In-situ light scattering + ML	Lab apparatus; natural variability	Future Integration in field devices
2.	Low-cost Raman Prototype (2021)	Budget optical Raman device	Limited sensitivity	Affordable for broad deployment

LITERATURE SURVEY

S.No	Paper Title	Methodology	Drawbacks	Proposed Methodology to overcome those drawbacks
3.	μ-Raman + ML (2023).	Deep learning on Raman spectra.	Lab-only equipment required.	Human machine teaming speeds process.
4.	Fluorescence Imaging + ML (2025)	Nile Red + imaging + ML	Lab-based, uses dyes	High resolution for small MPs

EXISTING SYSTEM

The current systems for detecting microplastics rely entirely on laboratory-based technologies. While accurate, these systems have the following limitations:

- Require **specialized laboratory equipment**.
- **Expensive and time-consuming** processes.
- Not accessible for everyday users.
- Cannot be used in real-time scenarios (e.g., testing drinking water at home).

  Thus, there is a pressing need for innovative solutions that are cost-effective, easy to use, and capable of reaching the general public.

EXISTING SYSTEM

- **Optical Imaging Systems:** Use high-resolution cameras + microscopes to detect microplastics in filtered water samples.
- **Turbidity/Optical Scattering Sensors:** Low-cost sensors that measure how light scatters in water, giving an indication of suspended plastics; portable but not very specific.
- **Underwater Drones with Imaging Systems:** Research prototypes use cameras + AI to detect floating macro-plastics in oceans and rivers; useful for large debris, not microplastics.
- **FTIR Spectrometers (Fourier Transform Infrared):** Used in labs to identify plastic particles based on their infrared absorption spectrum; highly accurate but bulky and costly.

EXISTING SYSTEM DRAWBACKS

- **Lab methods** = Accurate but expensive, slow, and non-portable.
- **Low-cost methods** = Portable but less accurate and non-specific
- **Emerging IoT systems** = Promising but still experimental.

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PROPOSED SYSTEM

- The Proposed system is named **AQUA-PLASTIC DETECT**.
- It is designed as a **website-based simulation tool** for detecting microplastics in water samples.
- Users can **upload images** of water samples through the website.
- The system uses **image analysis techniques** to estimate whether the plastic particles are present in the sample.
- Alongside the website, a **3D virtual model** of a detection device **(Poly-Scan)** is created.
- The 3D device model contains labeled parts such as **sensors, motherboard, battery, LEDs, and display unit**.

PROPOSED SYSTEM

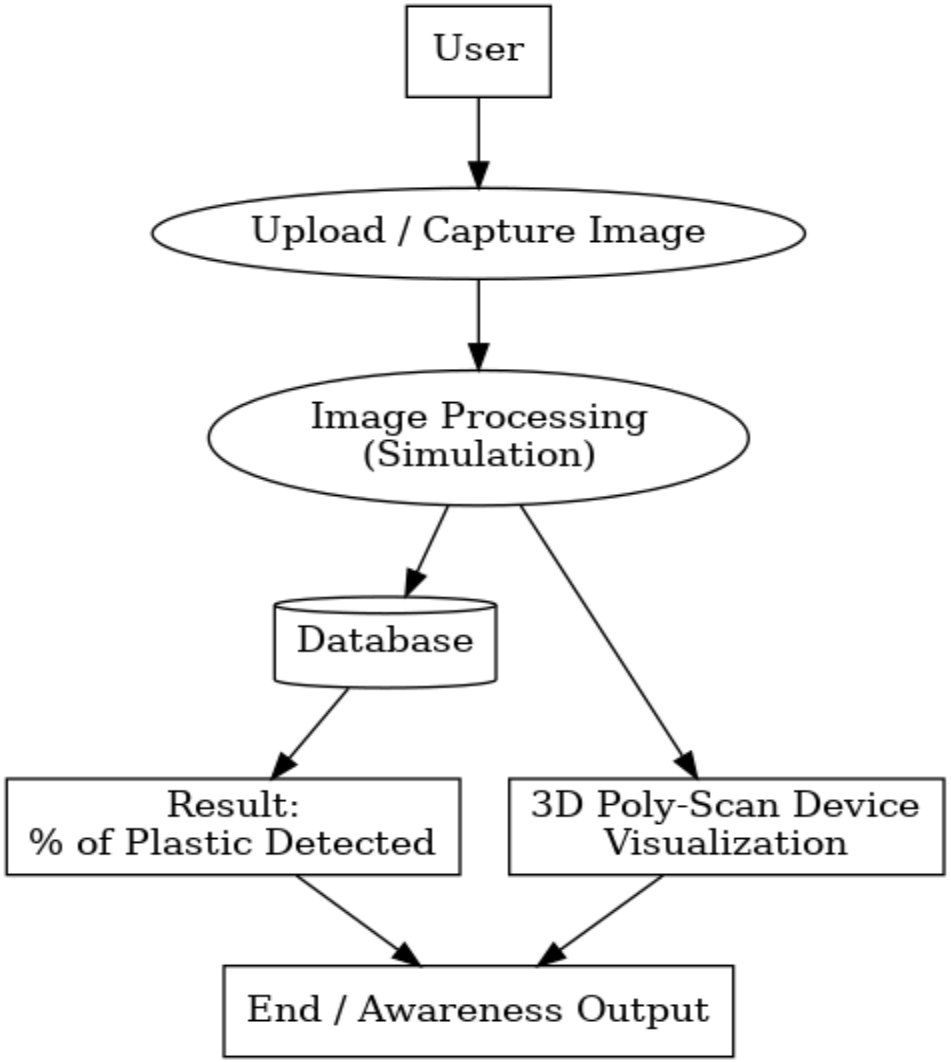
- This device visually explains how a **future real-time detection system** could function.
- The proposed system makes microplastic detection appear **simple, affordable, and user-friendly** compared to existing lab methods.
- Though real detection of microplastics is not yet possible without advanced sensors, the simulation creates an **awareness model**.
- It also acts as an **Educational and Awareness tool** for students, researchers, and the public.

PROPOSED SYSTEM

POLY-SCAN DEVICE

DEVICE TESTING IN THE WATER FOR PLASTIC.

SYSTEM ARCHITECTURE



PROPOSED METHODOLOGY

1. Image Upload-

- Users upload a water sample image through the website.

2. Preprocessing-

- The system resizes and enhances the image to remove noise and improve clarity.

3. Feature Detection-

- The tool scans the image for unusual particles based on color, shape, and texture that may indicate plastic.

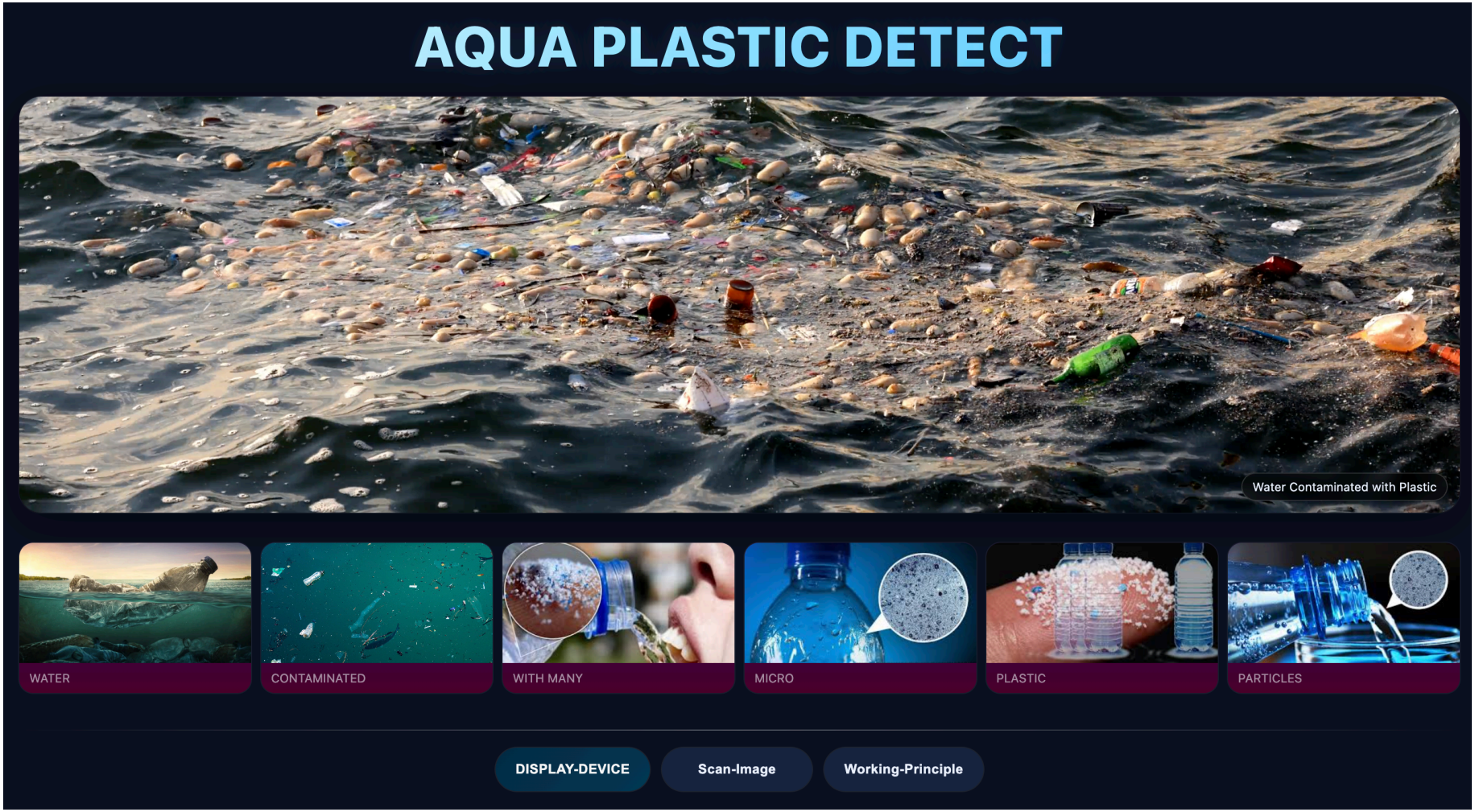
4. Analysis & Decision-

- The system applies simple rules or a trained model to decide if plastic-like particles are present.
- A confidence score (e.g., 80% likely) is generated.

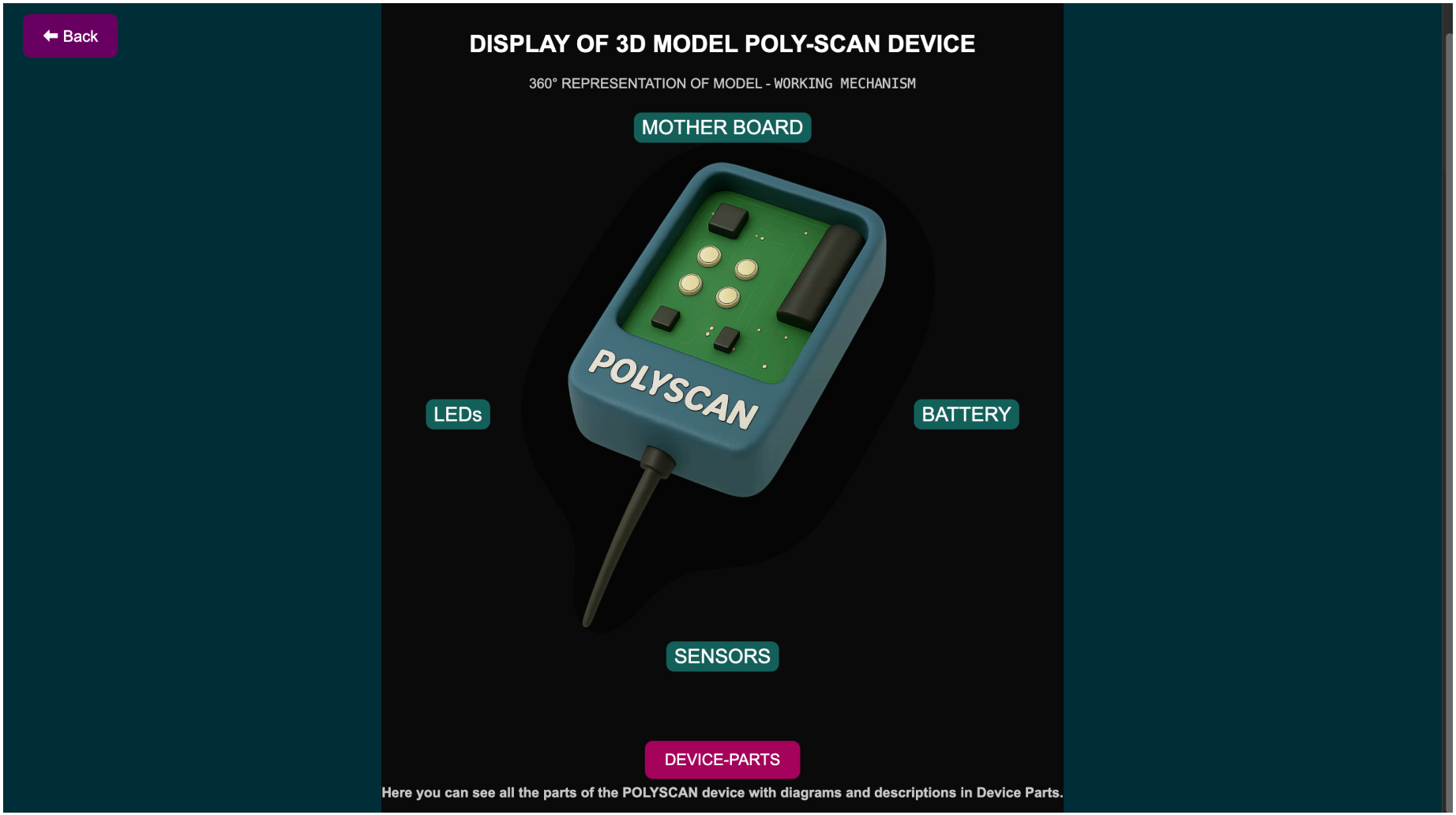
PROPOSED METHODOLOGY

5. **Result Display-**
   - The website shows the result with highlights/marks on the detected regions.
   - A note is displayed that this is a simulation for awareness, not a lab test.
6. **3D Poly-Scan Device Visualization-**
   - A 3D model of the future device is provided.
   - Users can view labeled parts like sensors, motherboard, LEDs, battery, and display.
   - It demonstrates how a real detection device might work.
7. **Educational Purpose-**
   - The tool explains microplastic pollution in water.
   - It serves as an awareness and learning platform for students, researchers, and the public.

RESULTS OF THE PROJECT



HOME PAGE



DEVICE-DISPLAY PAGE

1.SENSING UNIT (to detect plastic in water):

Turbidity Sensor (e.g., SEN0189)-

•Detects water cloudiness.

•If plastic particles are present, turbidity increases.

•Inexpensive and easy to connect with Arduino/ESP32.

IR LED + Photodiode Pair-

•Plastic scatters light differently compared to clean water.

•By shining IR light and measuring the scattered signal, you can simulate "plastic detection."

Ultrasonic Sensor-

•Measures sound wave scattering in water.

•Can help detect foreign particles (basic, not specific to plastic).

Low-cost Camera + Image Processing (OpenCV)-

•Captures water images and detects unusual shapes/colors.

•This is closest to your website simulation approach..

2.PROCESSING & CONTROL UNIT:

Microcontroller (MCU)-

•Core brain of the system, processes sensor data.

•Example: Arduino, ESP32, STM32, Raspberry Pi Pico.

Signal Conditioning Circuit-

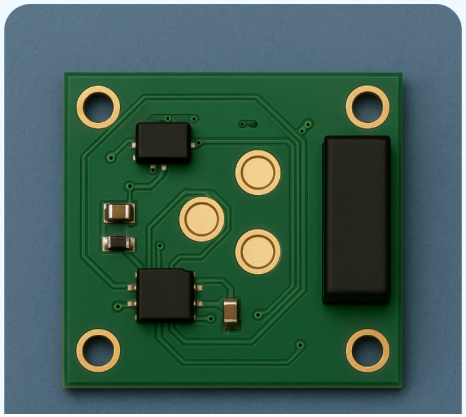
•Amplifiers, filters, and ADC (Analog to Digital Converter) to clean and digitize sensor signals.

Firmware / Algorithms-

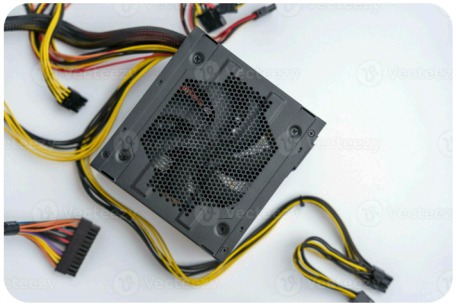
•Compares sensor readings to known patterns of plastic contamination.

•Could use AI/ML models if advanced detection is needed.

← BACK TO DEVICE



DEVICE-PARTS PAGE



3.POWER SUPPLY:

Rechargeable Battery (Li-ion / Li-Po)-

•Powers the device for portability.

Voltage Regulator-

•Ensures stable supply to sensitive sensors.

Charging Module-

•Example: TP4056 for Li-ion charging via USB.

4.DATA DISPLAY & COMMUNICATION:

On-Device Display-

•LCD or OLED screen to show plastic detection results (ppm, status).

LED Indicators-

•Simple green (safe), yellow (warning), red (plastic detected) indicators.

Wireless Communication-

•Bluetooth / WiFi for sending data to a smartphone or cloud for monitoring.

•Example: ESP32 with built-in WiFi + BLE..

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DEVICE-PARTS PAGE

CM-0070
CM-0071

5.ENCLOSURE & PROBE:

Waterproof Casing-

•Protects electronics, typically IP65/IP67 rated.

Immersible Probe-

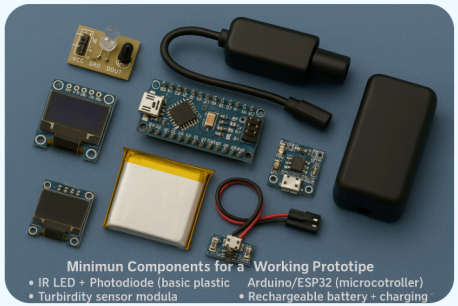
•Contains optical and conductivity sensors that go into the water.

Cable / Connector-

•Carries sensor signals from probe to main body..

🔷 MINIMUM COMPONENTS FOR A WORKING PROTOTYPE

- **IR LED + Photodiode (basic plastic scattering detection)**
- **Turbidity sensor module**
- **Arduino/ESP32 (microcontroller)**
- **Rechargeable battery + charging module**
- **Small OLED display (for result)**
- **Waterproof casing + probe.**



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DEVICE-PARTS PAGE

Plastic Detection in Water

Check whether Plastic is present in Water?

Upload or Capture Image

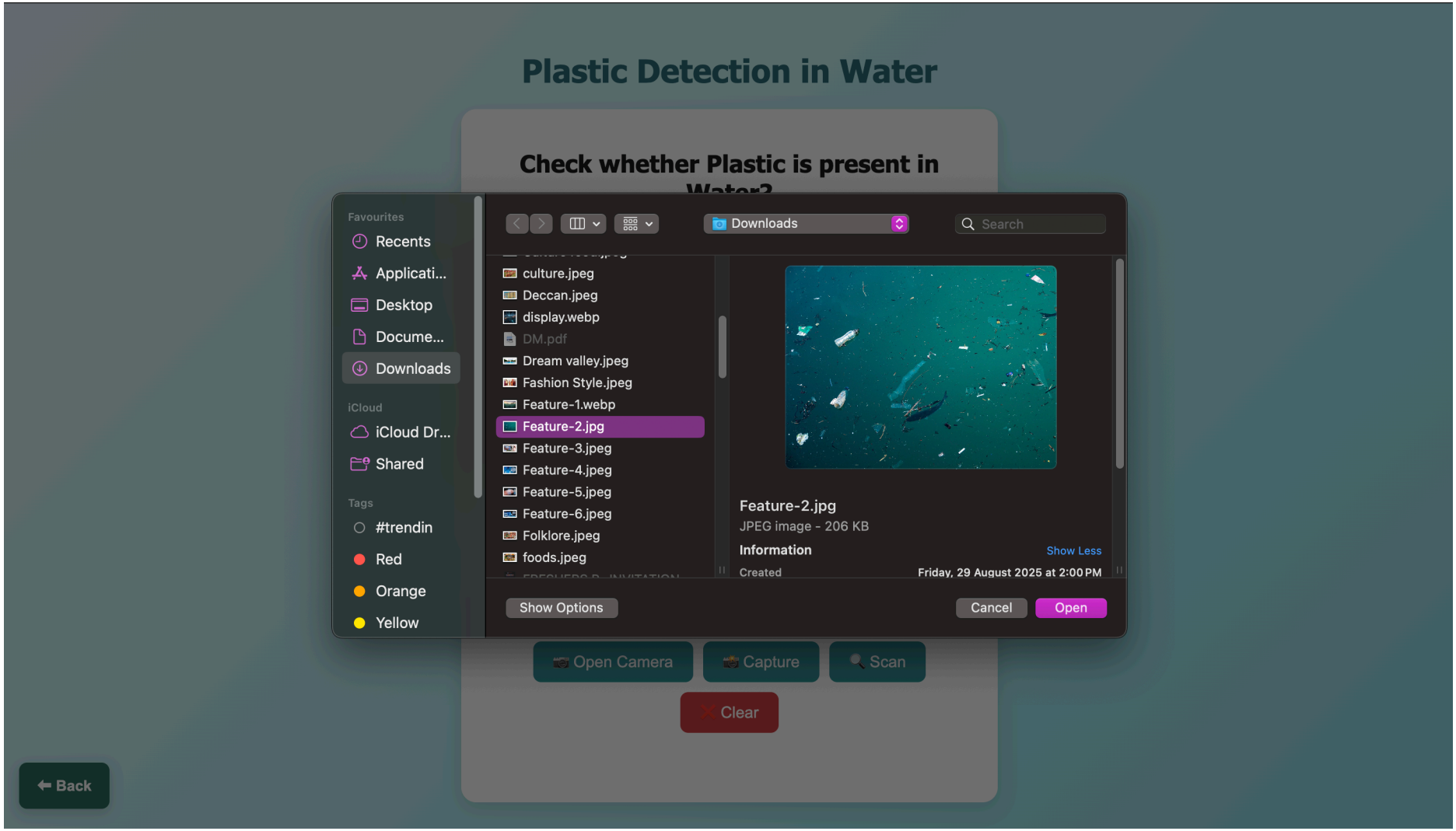
Choose file | No file chosen

📷 Open Camera | 📸 Capture | 🔍 Scan

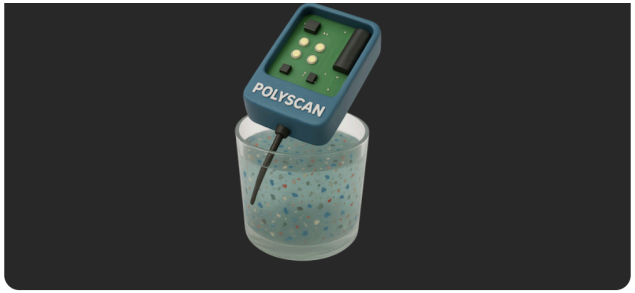
❌ Clear

⬅ Back

SCAN-IMAGE PAGE



SCAN-IMAGE PAGE



Upload or Capture Image

Choose file Feature-2.jpg

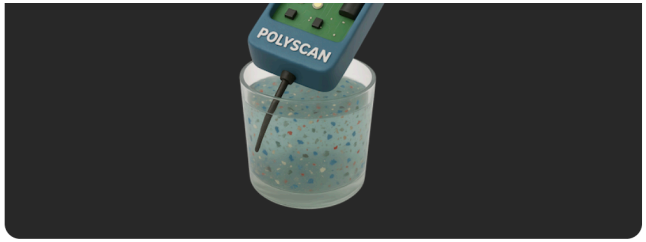
📷 Open Camera | 📸 Capture | 🔍 Scan

No file chosen

❌ Clear

← Back

SCAN-IMAGE PAGE



Upload or Capture Image

Choose file Feature-2.jpg

📷 Open Camera | 📸 Capture | 🔍 Scan

❌ Clear

⚠ Plastic Detected in Water!

Accuracy: 85.43%

⬅ Back

SCAN-IMAGE PAGE

POLYSCAN Device - Working Principle

Working Principle

- POLYSCAN is designed to detect **plastic contaminants** in water samples.
- The device uses **optical sensors** that emit light and analyze how it scatters when passing through the water sample.
- Plastic particles cause **unique light scattering patterns** compared to pure water or natural sediments.

WORKING-MECHANISM PAGE

Working Principle

- POLYSCAN is designed to detect **plastic contaminants** in water samples.
- The device uses **optical sensors** that emit light and analyze how it scatters when passing through the water sample.
- Plastic particles cause **unique light scattering patterns** compared to pure water or natural sediments.
- These patterns are processed by the device's **signal processor** and compared with trained data.
- The system uses **pattern recognition algorithms** to differentiate between plastics and harmless particles.
- A **confidence percentage** is displayed to show the likelihood of plastic presence.
- The device can detect both **visible plastic fragments** and **microplastics** that are invisible to the naked eye.
- POLYSCAN is portable and designed for **field use**, making it suitable for real-time monitoring of lakes, rivers, and lab samples.
- Results are fast, reliable, and can help in **environmental pollution tracking** and **water quality management**.

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WORKING-MECHANISM PAGE

CONCLUSION

The proposed system **AQUA-PLASTIC DETECT** provides a website-based simulation tool to identify plastic-like particles in water samples through image analysis. By allowing users to upload images and receive results with visual highlights, the system makes microplastic detection appear simple and user-friendly. The inclusion of a **3D Poly-Scan device** model further demonstrates how a real detection device could function in the future. While it does not perform real microplastic testing, the project effectively serves as an educational and awareness platform. It encourages students, researchers, and the public to understand the growing issue of plastic pollution in water. This simulation creates a foundation for future development of affordable, real-time detection devices.

Thank You