

The background features a large, light blue hexagon with a thick blue border. Inside the hexagon, there are several blue circles of varying sizes and thin blue lines. A large, stylized blue 'V' shape is formed by two thick lines meeting at the bottom center. A horizontal blue bar with rounded ends is positioned across the middle of the 'V' shape.

Portable system for detecting plant stress and Image Processing



Supervisor

Dr. Navneet kumar
Mechanical Engineering Dept.
Indian Institute of Technology,
Jammu

Team :

1. Nageshwar kumar
(2022uee0138@iitjammu.ac.in)
2. Saurav Kumar
(2022uee0150@iitjammu.ac.in)
3. Jejariya Ajay Bhai
(2022uee0133@iitjammu.ac.in)
4. Aashish kumar Singh
(2022uee0116@iitjammu.ac.in)
5. Saurabh Kumar Rao
(2022uee0149@iitjammu.ac.in)



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Portable System for Detecting Plant Stress



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Advantages



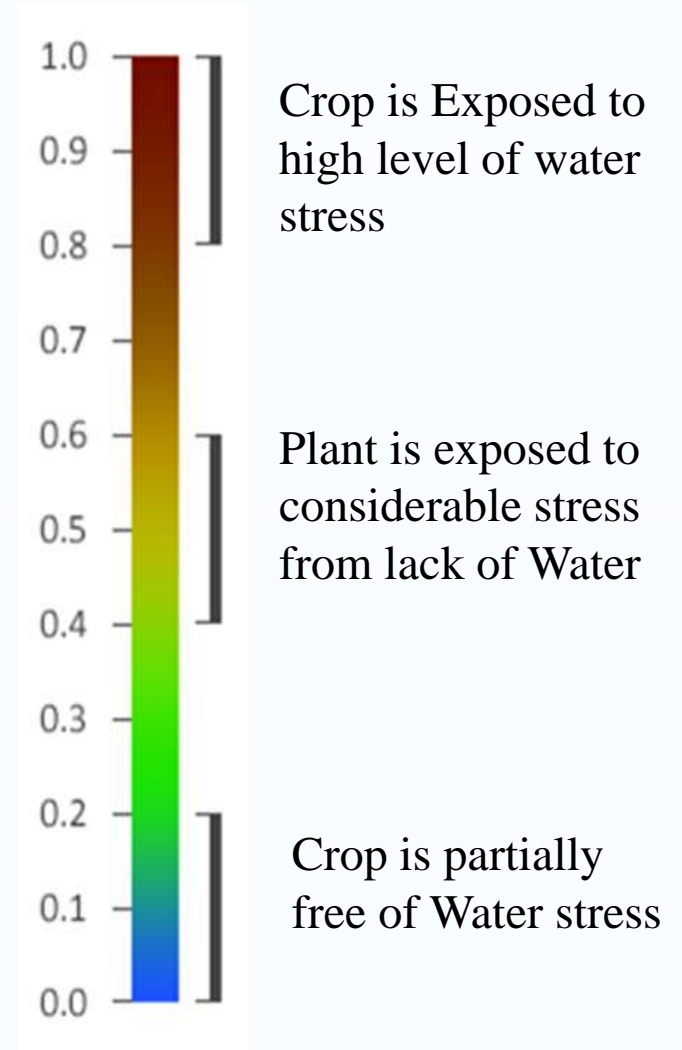
Background

- Real Time **Crop health Monitoring** for better yield and quality
- For Decades **plant temperature has been proven to be a convincing parameter** for predicting crop health



Objectives

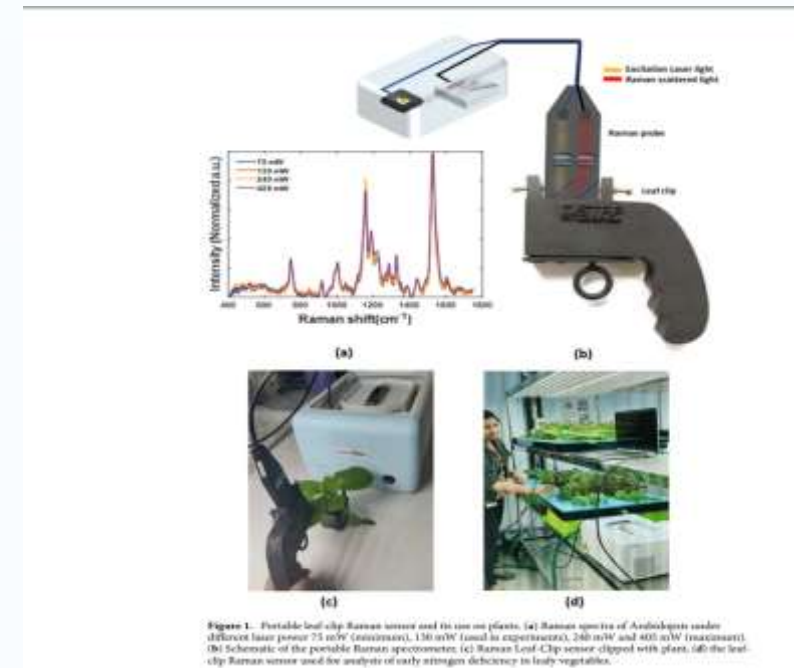
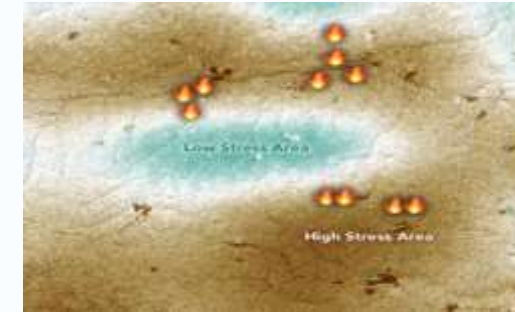
- Develop a device capable of calculating the crop water Stress index (**CWSI**) based on Leaf temperature measurements
- Implement a leaf health scale that correlates with leaf temperature data, providing a practical tool for assessing plant health
- $$CWSI = \frac{T_L - T_w}{T_D - T_w}$$
- T_L : Leaf Temperature
- T_w : Wet Reference Temperature
- T_D : Dry Reference Temperature





Available Solutions

- **Satellite Imagery:** It uses machine learning algorithms to predict CWSI values by analyzing historical data.
- **Portable Raman Leaf Clip Centre :** studies molecular vibrations to detect the status of plant leaves



<https://earthobservatory.nasa.gov/images/145823/detecting-invisible-plant-stress>

<https://www.nature.com/articles/s41598-020-76485-5>

Experimental Procedure

- **Experimental Setup**



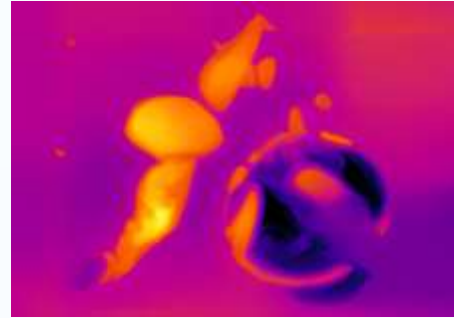


Experimental Procedure

- Optical and IR Images :

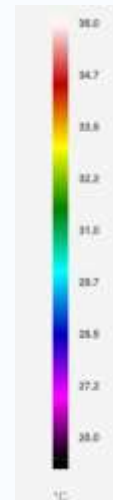
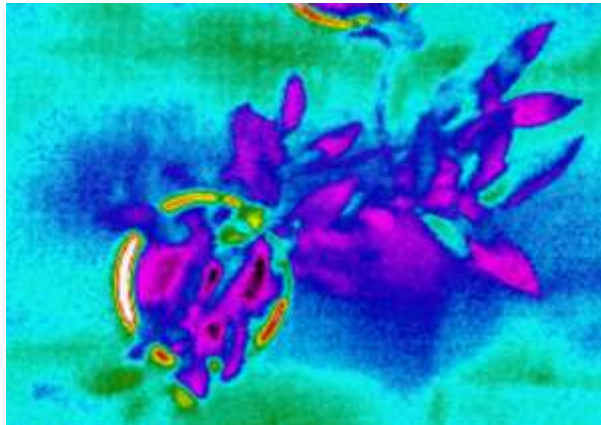


Optical Image



IR Image

- IR Temperature Scale :

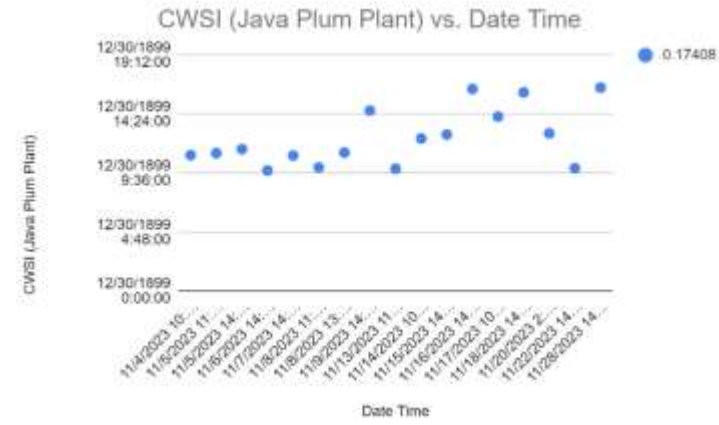
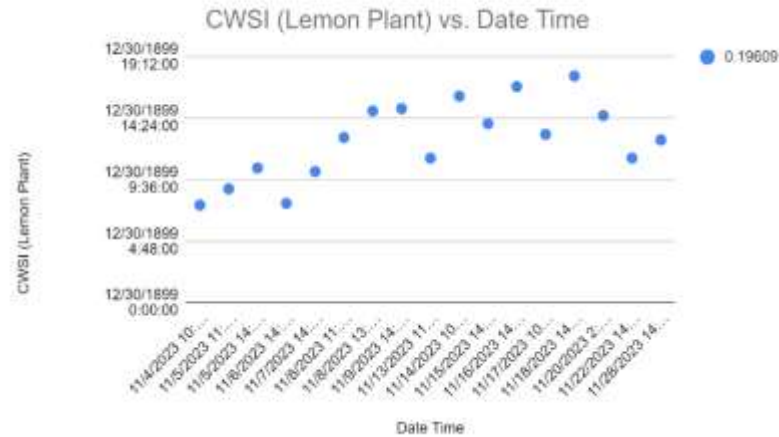
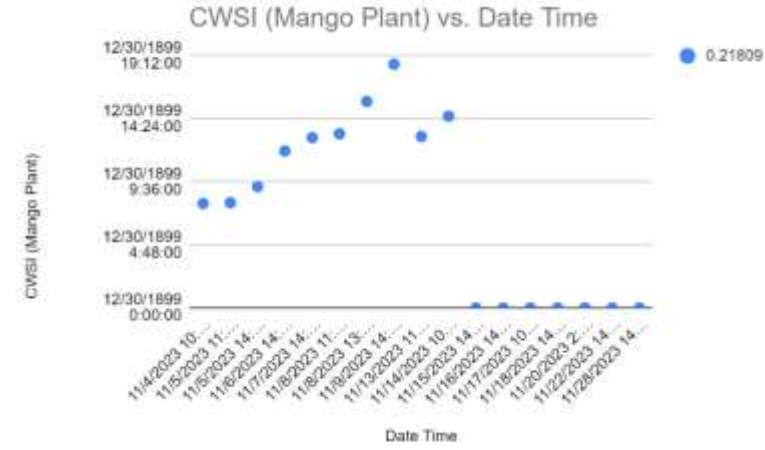
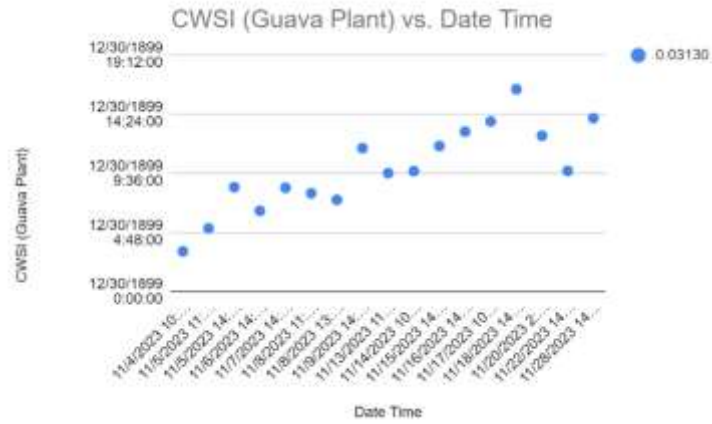


Java Plum Plant



Experimental Procedure

Variation of CWSI



https://docs.google.com/spreadsheets/d/1v4vwyYS-CgRQhTB_QnavkTkGthdox7yO/edit?usp=sharing&ouid=104655483092176756320&rtpof=true&sd=true



Our Product

Measurement resolution	0.02°C
Sensing Temperature	-70°C ~ 380°C (IR)
Accuracy - Highest (Lowest)	±0.5°C (±4°C)





Advantages of Our Product

- Portable
- Cost effective
- Easy to use
- Time saving
- Easy to assemble



The background is a light blue gradient with various abstract shapes. There are several circles of different sizes and shades of blue. A large, thick blue arch is positioned behind the text. Below the text, there is a blue rectangular block with a horizontal line extending from its left side. At the bottom, there are two sets of horizontal lines that resemble a staircase or a series of steps, one on the left and one on the right.

Image Processing of Pebbles



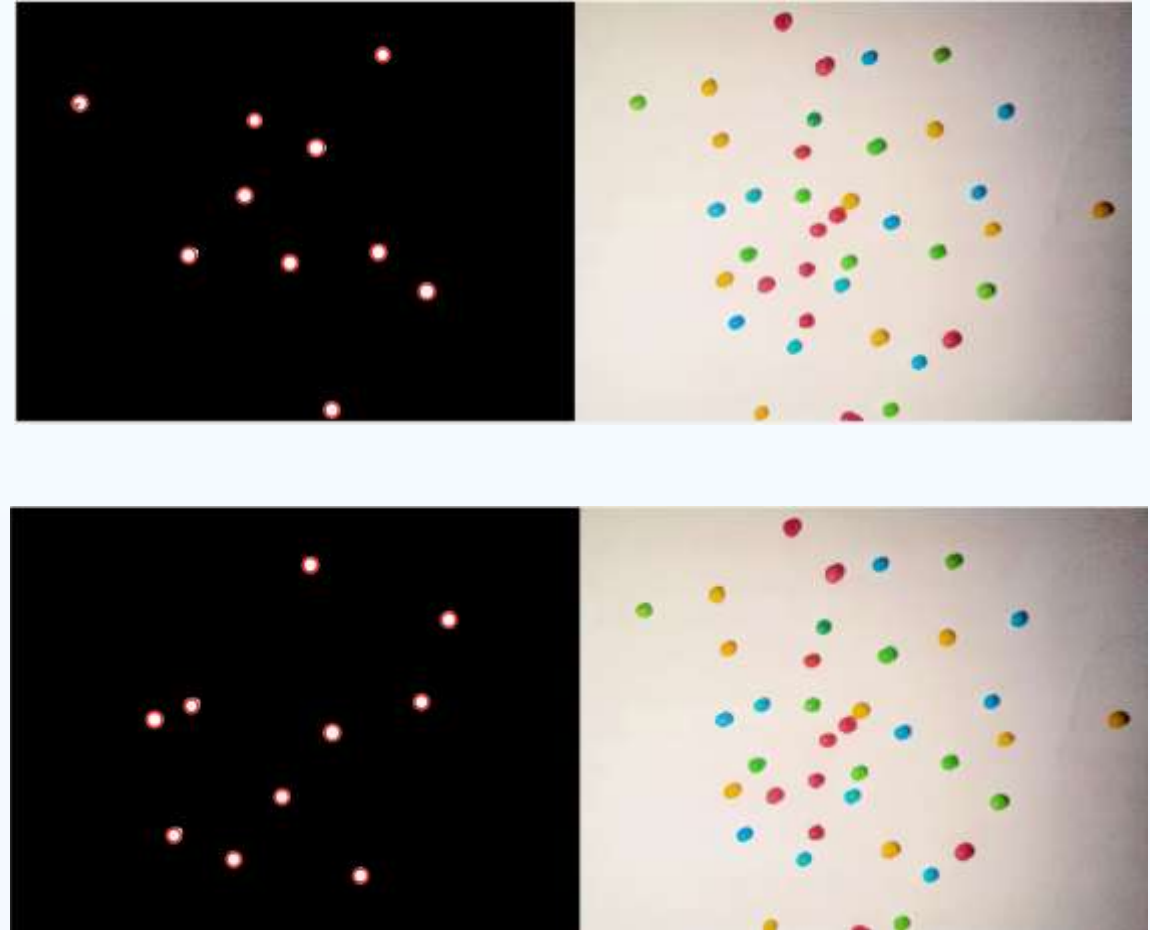
Motivation and Practical Relevance

- **Particles** : Soil, Rice Mill, etc.
 - **Soil** : Mixture of particle sizes (Clay $< 2\mu m$; **0.05 mm** $<$ **Sand** $<$ **2mm**)
 - Rice : Shape detection (qualitative assessment)
 - Use Case : Sarveshwar Foods, Jammu – **Basmati** Rice Producer
 - Detect and separate **unwanted** contaminant
- Particle **Sorting** : Size-based sorting (target range : $\sim 100\mu m$ to a few 'mm')
- Particle Size **Distribution**
- Fractional Occupancy
- **How to tackle multi-layer problem** : **REMOVE Background** ?



Segmentation on the basis of colours

- Here we have done **image segmentation** and **edge detection** for spherical balls.
- In the first and second images we have segmented the images based on Green and blue colours.
- Here the **fractional occupancy** of green balls is **0.2215 %** and the fractional occupancy of blue balls is **0.2068%.**





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Progress

Edge detection on the basis of size:

- In this image coins are detected on the basis of size.

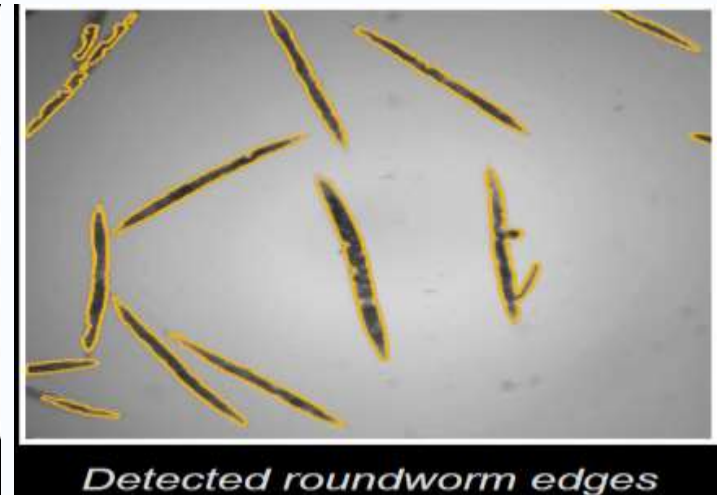


Edge detection on the dead worms:

- Here we have detected the edges of random shapes.



Dead worms

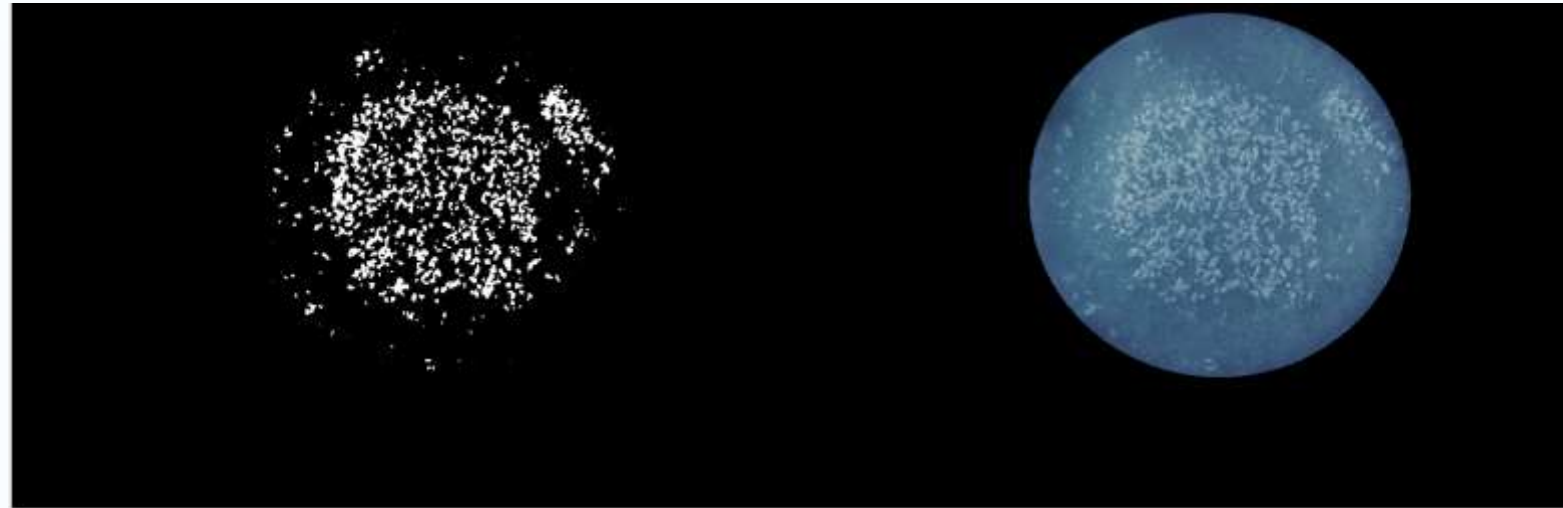


Detected roundworm edges

Image segmentation of the salt particles

With the help of image segmentation we can also process the fine particle of salt

All it's need a good image and we can calculate the area of the salt covered .

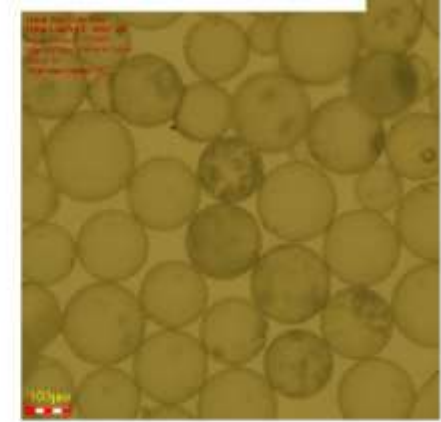
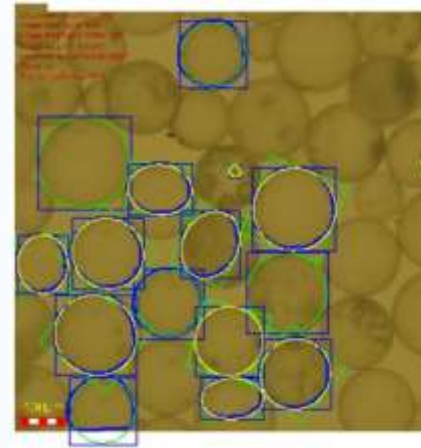




Currently available methods for particle size analysing

- Currently **Malvern Panalytical** makes machinery to measure particle sizes. Eg :

1. Mastersizer 3000+
2. Spraytec
3. Nanosight pro



- This image is from **Biovis** where we can see sphericity of micro size particle.



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Contributions

- **Yuvraj Chugh**
- **Shivani Chauhan**



THANK YOU