Development of a Low-Cost Optical System for Monitoring Plastics in Irrigation System Grids

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INTRODUCTION
INTRODUCTION

Plastics

Problem for the irrigation system

Accumulation of plastics in the gratings of agricultural irrigation canals

Causes runoff

Reducing the irrigation flow
INTRODUCTION

Commonly used method → Satellite method

We propose → Sensor for detecting the presence of plastics in the irrigation grids

Plastic bags
Bottles
Other plastic waste
RELATED WORK
## RELATED WORK

<table>
<thead>
<tr>
<th>DETECT PLASTICS IN THE OCEAN</th>
<th>• Using equipment mounted on a C-130 aircraft, which captured swir red, green, and blue (RGB) and hyperspectral images. <em>Karaba et al.</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>DETECTION OF MACROPLASTICS</td>
<td>• Using the sentinel-2 satellites of the European Space Agency (ESA) <em>Biermann et al.</em></td>
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<tr>
<td>OPTICAL SYSTEM CAPABLE OF DETECTING MICROPLASTICS IN WATER</td>
<td>• Developed sensor is based on a low-cost system based on a spectrophotometer <em>Iri et al.</em></td>
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<tr>
<td>METHOD FOR THE DETECTION OF PLASTICS</td>
<td>• This system is based on an automated system monitoring that detects said contamination <em>Van Lieshout et al.</em></td>
</tr>
</tbody>
</table>
PROPOSAL
TEST BENCH
TEST BENCH

- Rectangular glass fish tank:
  With dimensions of 24.5 cm high, 26 cm wide, and 50 cm long were used.
- White plastic:
  Grid 23 cm high and 25 cm wide.
- Soil with a composition:
  4.3% sand, 67.3% silt, and 28.4% clay was used as a turbidity-enhancing compound.
- Camera
TEST BENCH

1. The first is based on the experiment itself, where the necessary images are taken.

2. The second is the processing and analysis of these images in order to obtain the different histograms of these images and to be able to differentiate between the grid and the plastic bag in different conditions.

Function [Hist_RED, Hist_GREEN, Hist_BLUE,] = Read_Comp_Image
[Comp_RE, Comp_GR, Comp_BL, Col, Row]
//Calcule Histogram Red
Repeat
    vector_RE [i]=0     // Create_vector_RED
Up to (i=256)
Repeat 
    Repeat
        Read Value= Comp_RE
        vector_RE [i]= Value
        Comp_RE++
        Up to (Column == end)
    Up to (Row == end)
//Calcule Histogram Green
Repeat
    vector_GR [i]=0     // Create_vector_GREEN
Up to (i=256)
Repeat
    Repeat
        Read Value= Comp_GR
        vector_GR [i]= Value
        Comp_GR++
        Up to (Column == end)
    Up to (Row == end)
TEST BENCH
RESULTS
RESULTS

- The most representative graph is c) where we can find the presence of grid between pixel values from 1 to 90 and from 91 to 190 for the presence of pockets.
- The maximum pixel percentage for grids is 4 % and 5.3 % for the bag.
RESULTS

- Best section is the b) with the green band. We can observe that parts of grids 2 and 3 can be distinguished from the presence of bags.
- The presence of the grid is located between the values 55 to 105, with a maximum pixel percentage of 3%.
- The results show that the system is able to differentiate some pieces of bag.
RESULTS

- The best section is the b) with the green band.
- We can observe that parts of grids 2 and 3 can be distinguished from the presence of bags.
- The presence of the grid is located between the values 109 to 163, with a maximum pixel percentage of 12.5%.
VERIFICATION

- Section a) represents the values taken in the experiment.
- A maximum pixel % of 74.8% in grid 2, and a maximum pixel % of bags of 0.02%.
- Pixels above the 5% limit are considered part of the grid and below the bag. In addition.
- Section b) represents the verification performed, taking other different pieces of grid and bag.
- A maximum pixel % of 84.08% in grid 2 and a maximum pixel % of bags of 0.09%.
CONCLUSIONS AND FUTURE WORK
CONCLUSIONS AND FUTURE WORK

• We propose a system to monitor the presence of plastics in the gratings used in irrigation channels for agriculture.
• It is possible to differentiate between bags and the grid up to 5g of added soil.
• The proposed system is based on the application of artificial intelligence, being of great help, in this case, to be able to differentiate and learn about the presence or absence of plastics in the grid.
• In future work:
  o Test at different distances.
  o Extend the number of objects to be detected.
THANK YOU FOR YOUR ATTENTION

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