IoT BASED CROP GROWTH DETECTION AND IRRIGATION SYSTEM USING RASPBERRY PI

[1]Mukesh Kumar .N, [2]M. Vengatramana Karthikeyan, [3]B. Vishal, [4]N. Vidhyalakshmi

[1,2,3] B.E – ECE department , Easwari Engineering College, TamilNadu, India
[4] Assistant Professor, ECE department, Easwari Engineering College, TamilNadu, India

---

Abstract - *Humans have the ability to estimate the size of the objects, in this project we take the visual perception as the principle to calculate the growth of the crops by finding the Euclidean distance. Picture of the crops is taken with the Raspberry Pi camera, the OpenCV running on the Raspberry Pi 3b serves as the digital image-processing tool to find the precise dimensions of the crops, which is then compare with a reference image to find the growth. The obtained result is shared with the user through the means of IoT, the result is uploaded on-to the Firebase and the result is viewable on the web or using the Android app. The system we propose also provides fully controllable irrigation facility to the user, the water quantity and the timings to initialize the irrigation are given to the system, once it is set the system takes care of the rest, otherwise the soil moisture can be determined with the help of soil moisture sensor. The moisture content is analyzed and if it is less than the threshold the watering to the plantation will be begin automatically.*

***Key Words*: OpenCV, size-detection, Raspberry PI, SSIM.**

1. INTRODUCTION

With increase amount of crop wastage, there is an increase in demand for that particular crop. One of the reasons for crop wastage and reduction in quality of any fruit is the inability to realise when is the right time for harvest.

Harvesting is paramount for farmers irrespective of any kind plantation. The livelihood and providing for demand are all strictly depending on harvesting. Intuition and instincts are the existing parameters farmers have been dependent on for centuries, but the skill set is not always passed along to generations ahead. The proposed system is a tool to determine the size of the crop using a camera. The size of the crop is enough for farmers to determine and harvest when the crop is fully-grown. It gives them the ability to actively monitor and objectively decide when to harvest.

By doing so, the farmers can increase the yieldability and thus providing for on-going demand in the market. As the result of increasing human population and decreasing agriculture, there's an active exponential increasing demand for crops, vegetables, fruits, etc. There is a demand for system that does not promote artificial doping to boost the yieldability but a guiding system that helps farmers to provide more and gain more.

2. PROPOSED HARDWARE SYSTEM

The proposed system detects the size of the crop. Pictures of crop will be taken with the help of PI cam. The proposed system is classified into three parts,

a) Taking picture of the crop.
b) Processing the image.
c) Irrigation system.

There are few challenges when it comes to the first part. In order to obtain the precise data from the system the plant or crop has to be in an adequately lit environment evenly throughout the subject. The camera focusing mechanism and the processing is based on the technological term called edge detection. It detects the edges based on the contrast difference which is mainly visibly in well-lit condition. It is important to have the condition.

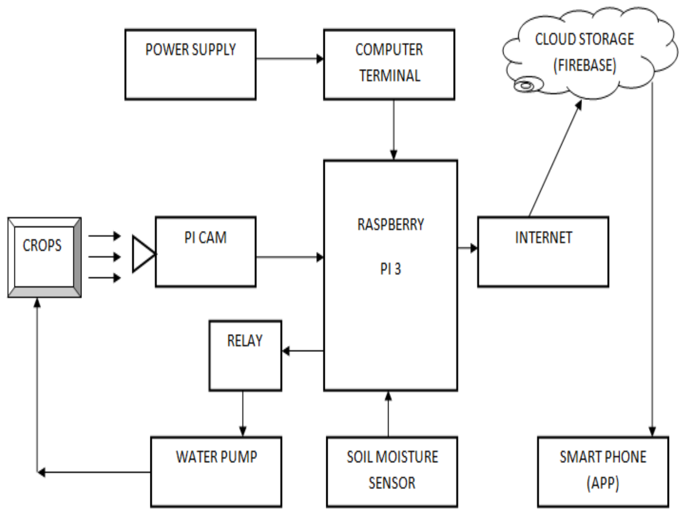


Fig -1: Block diagram of proposed system.

As depicted in this picture, the system is assembled. The picture of the crop is taken by the camera. The camera is interfaced with the Raspberry Pi. Then the image is compared with the reference image for growth dimensions. Once the dimensions are obtained the result is displayed on the terminal and as well as the app that is the second part.

The third part of the system is the irrigation system. The system is equipped with pump and soil moisture level. This irrigation can be taken control manually by giving the routine water level and timing and it can automatically water the plant based on the reading from the moisture sensor.

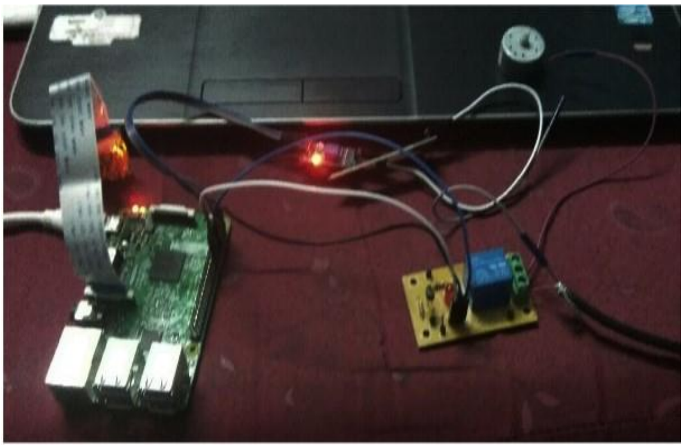


Fig -2: Proposed system with soil moisture and water pump for the irrigation system.

3. SOFTWARE IMPLEMENTATION

The latter part is purely software-based image processing which is supported and running on the hardware known as Raspberry PI. The digital image-processing algorithm called OpenCV runs the image to determine the size of the crop in any instance.

Once the image is captured, it is pre-processing with reference image. In this order

1. Grayscaling.
2. Gaussian blur.
3. Structural similarity (SSIM) index.
4. Contour detection.
5. Dilation.

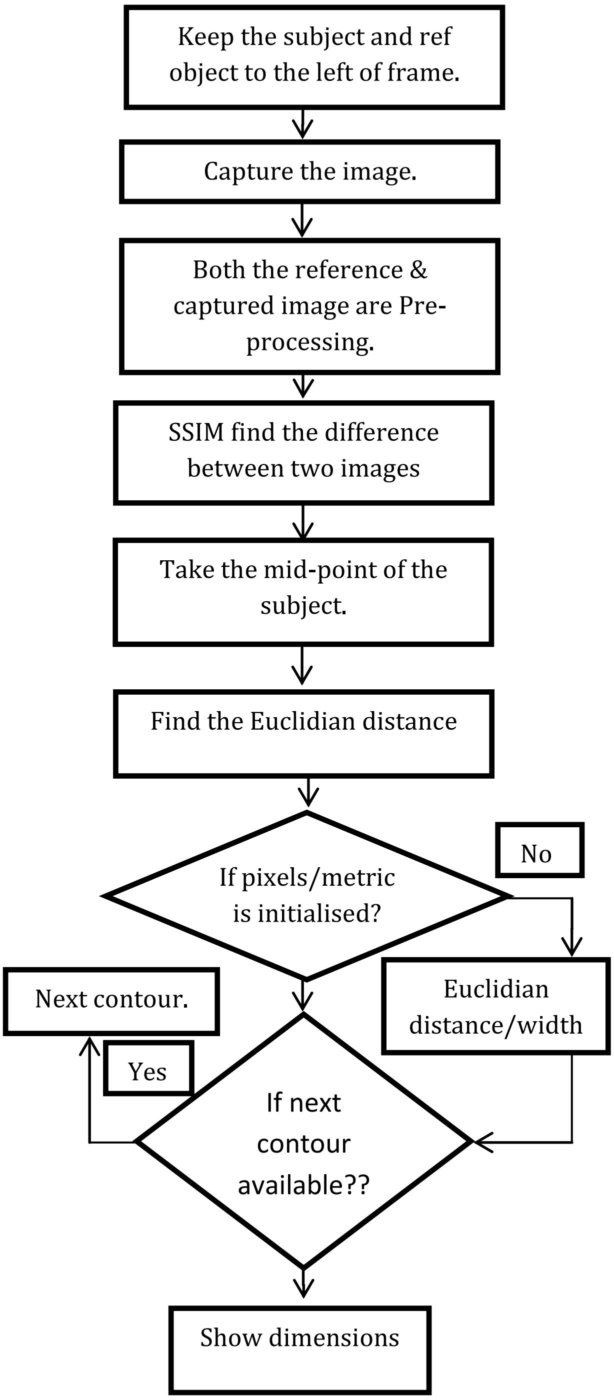
The images are initially grayscale converted. Because analysing an image with three parameters (RGB) rather than two (black and white) is less complex and more efficient. Next, Gaussian blur is initialized. The objective of this step is to reduce the noise. The Gaussian blur act as a de-noising mechanism.

Then, SSIM compares the similarity between two images and returns the image difference and SSIM score to the terminal by threshold values.

Contour detection, that is, the edges of the every object within the frame or image is detected. This helps in measuring or detecting the exact measurement of the crop. This also helps to differentiate the subject from reference.

Dilation, the step enlarges the images to its maximum image dimension to undergo the actual image processing

4. FLOW CHART



5. PROCEDURE

- Place the reference object in the frame at the left most side, because the system scans from left to right.
- Give dimensions of the reference crop as the input.
- The crop is placed in front the camera, the crop should be illuminated well for the camera.
- Camera is initialized; the photo is taken.
- The photo is fed to the Raspberry PI.

- The board takes care of the software implementation and procedures

    1. Pre-processing both reference and captured image (grayscale, edge-detection, erosion, dilation, Gaussian blur and mid-point finder.)
    2. Compares the both the reference and captured images using SSIM.
    3. Measurement(Contour data and Euclidian distance)

- The output is superimposed on the image, and the dimensions are printed on the terminal.
- The output is readily available in the monitor.
- Once the output is realized the raspberry pi also uploads the data into the cloud, in this case it is Firebase.
- The cloud is synchronized with the Android app (apk).
- The output is available on the phone.

Both the water pump and soil moisture sensor is controlled by phone terminal through flask server.

6. RESULT

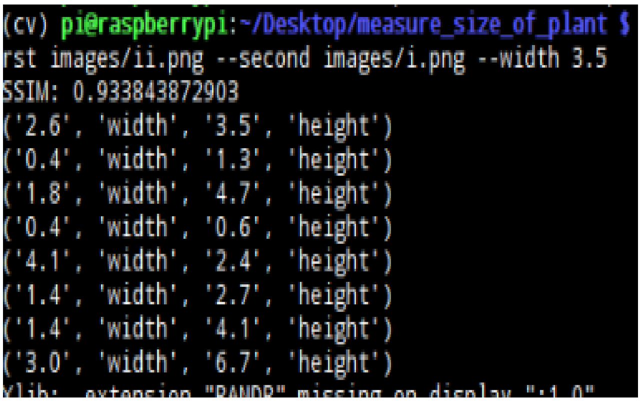


Fig- 3*:* Output data representing the dimensions of the crop growth and SSIM value.

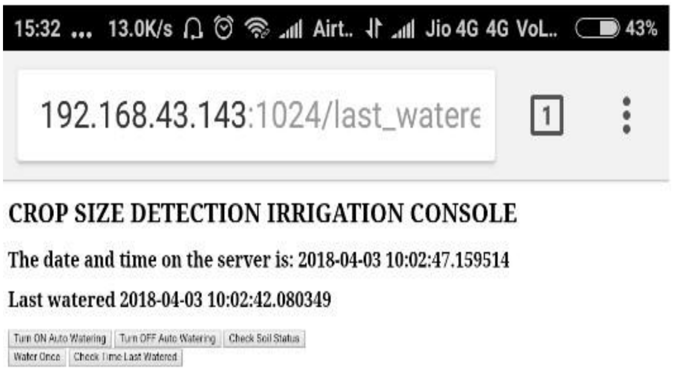


Fig- 4: Control panel for the irrigation system.

Fig- 5: Reference image for comparing with captured image

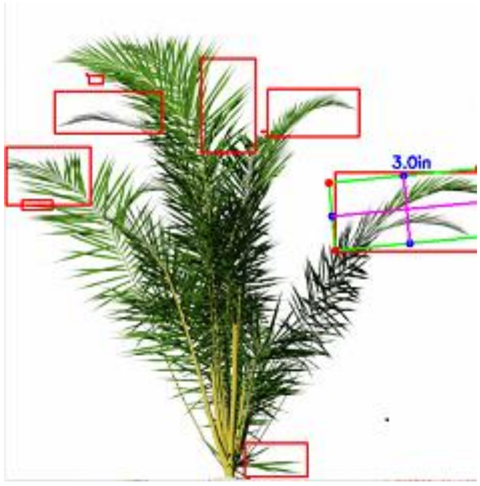


Fig- 6: Output image representing the dimensions of the crop growth.

7. CONCLUSION AND FUTURE WORK

This system hopes to bring out the best in agriculture in terms of quantity obtained during harvesting. It aims to increase the quantity of crops.

There can me many types of implementation that can be carried out. The entire computing operation can be carried out on cloud, by doing so; it improves the speed and efficiency.

The software can be modified to recognize and learn what type of crop or fruit it is. Even crop diseases can be find by image analysis and machine learning.

8. REFERENCES

[1] Khushboo Khurana and Reetu Awasthi,"Techniques for Object Recognition in Images and Multi-Object Detection",(IJARCET), ISSN:2278-1323,4th, April 2013.

[2] Nidhi, "Image Processing and Object Detection", Dept. of Computer Applications, NIT, Kurukshetra, Haryana, 1(9): 396-399, 2015.

[3] R. Hussin, M. RizonJuhari, Ng Wei Kang, R.C.Ismail, A.Kamarudin, "Digital Image Processing Techniques for Object Detection from Complex Background Image, "Perlis, Malaysia: School of Microelectronic Engineering, University Malaysia Perlis, 2012.

[4] S.Bindu, S.Prudhvi, G.Hemalatha, Mr.N.RajaSekhar, Mr. V.Nanchariah,"Object Detection from Complex Background Image using Circular Hough Transform", IJERA,ISSN: 2248-9622, Vol. 4, Issue 4(Version 1), April 2014, pp.23-28.

[5] Shijian Tang and Ye Yuan, "Object Detection based on Conventional Neural Network".