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AUTOMATIC FIELD IRRIGATION SETUP USING MATLAB

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***Abstract* -- Irrigation refers to the watering of land to make it ready for agriculture. The Irrigation refers to the process of supply of water through artificial means such as pipes, ditches, sprinklers, etc. An automated irrigation system refers to the operation of the system with no or just a minimum of manual intervention behind the surveillance. An automated irrigation system was developed to make use of water efficiently for agricultural crops. The idea behind this project is to optimize the use of water effectively and the motor will be pumped on and off based upon the texture of the leaf. The healthy leaf image will be already stored in the PIC16f877a microcontroller in the SD card. The captured leaf image from the camera is sent via Zigbee through signal conditioning processor to the microcontroller. When comparing both the images, if the captured image mismatches with the stored image in the microcontroller, automatically command will be sent from the controller to turn on the motor and thus irrigates the field. Also, the project aids in giving information about the suitable soil for cultivating the Plants such as Banana, Paddy, Wheat, etc.**

***IndexTerms*-- Zigbee; Irrigation; PIC microcontroller; camera.**

I.INTRODUCTION

India is mainly an agricultural country. In India, agriculture contributes about sixteen percent (16%) of total GDP and ten percent (10%) of total exports. Manual irrigation systems are very simple, but it would be one of the useful methods for making irrigation of water to the crops. Manual irrigation systems are handled easily and there is no need for technical equipment set-up. But it is important that they are built correctly to avoid loss of water and crop shortfall. The systems help the farmers in terms of high self-help compatibility and have reduced initial capital costs. There are many disadvantages found in manual irrigation system. It includes very basic and creates a lot of work on large fields.Labour intensive, farmers need very basic training to install and use the proper and effective method. If the pumping water is not properly refined out and the equipment used is not properly maintained, it can result in clogging.

Automatic land irrigation system overcomes these limitations. Zigbee modules are used to transmit and receive all parameters such as motor ON/OFF, water level etc. long distance. The motor can be controlled using microcontroller.

There are many different technologies suitable for wireless communications that are used in applications related to irrigation in farm field. The main aim of this project is to design Automatized Field Irrigation Setup by MATLAB Process.

The objective of this project is to provide automatized irrigation system to reduce the human intervention in the field and to irrigate the field based on the information obtained from the camera fixed in the field to know the condition of the leaf in addition to the sensor values obtained from the microcontroller.And also, the camera captures the image of the soil and process using MATLAB and deliver the information about the type of soil.Eg.Red soil which is suitable for Cultivating Banana Plant.

II. SYSTEM DESIGN AND ANALYSIS

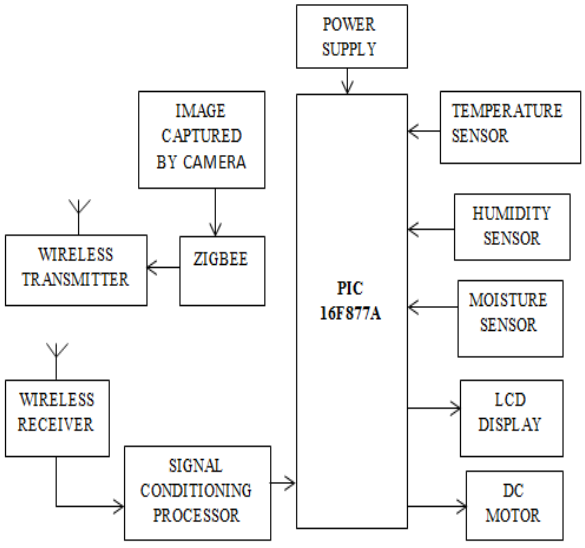

Figure: 1. Block diagram of Automatic Field Irrigation Setup Using MATLAB.

The methodology of the proposed system is that the camera captures the image of the plant and the information will be transferred via Zigbee to microcontroller. The proposed system adopted the image processing technique and the image will be processed by the MATLAB software. MATLAB process the edge detection Technique based upon the adaptive K-Means Filtering and Gabor Filtering.

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A combination of K-means clustering, and Gabor wavelet method are used to accomplish edge detection and

image segmentation tasks. An initial segmentation attained which is created on K-means clustering technique and wavelet technique with Gabor filter used to detect their boundaries. Gabor wavelets are used at this point to detect edges, corners and blobs. The output obtained from Zigbee is given to signal processor which triggers the PIC Microcontroller.

Digital Signal Processor compares the obtained image with the original image. The length of the leaves is calculated. If the ratio of the obtained image to the original image is greater than 0.25, then the condition is found abnormal. This information will be sent to PIC16f877a which in turn passes the message via zigbee to turn on the motor.

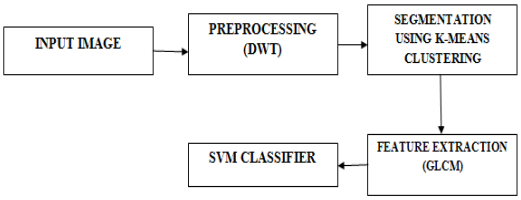

Figure: 2. Steps for Processing the Soil Image.

Soil image can be Pre-processed using discrete wavelet transform. After that segmentation is achieved by using means clustering, color and texture features are extracted using Gray-Level Co-Occurrence Matrix (GLCM).Then soils are classified using support vector machine.

A. ADAPTIVE K-MEANS CLUSTERING ALGORITHM

It adapts itself according to the image based on colour based clustering. The numbers of clusters using the colour features are calculated based upon analysis of histogram in gray format. The highest peak of the histogram is the main source point of computation of number of colours in the image and based on the same, the image data that are grouped.

B. GABOR TEXTURE FILTERING

It is a linear filter used for edge detection. Frequency and orientation model of Gabor filters are exactly identical to those of the human visual system, identified to be particularly applicable for representation of texture and inequity. Its impulse response is defined by a product of sinusoidal wave and the Gaussian function. By multiplication-convolution property, the Fourier transform of a Gabor filter impulse response function is the convolution of the Fourier transform of the Gaussian function, the Fourier transform of the harmonic function. The filter yields a real component and an imaginary component representing orthogonal directions. These components may be formed into a complex number or used individually.

C. SUPPORT VECTOR MACHINE

SVMs refers to collection of related supervised learning methods used for classification and regression.The important property of SVM is that SVM can simultaneously reduce the empirical classification error and maximize the geometric margin. Therefore, SVM is also known as Maximum Margin Classifiers.

D. GLCM

A statistical method of investigating the texture that considers the spatial relationship of pixels is the gray-level co-occurrence matrix (GLCM).Their function characterize the texture of an image by simply calculating how often pairs of pixel with specific values and in a specified spatial relationship appear in an image, yielding a GLCM, and then extracting statistical measures from this matrix.

III. DESCRIPTION

*A. LIQUID CRYSTAL DISPLAY (16*2 DISPLAY)*

LCD displays the temperature level, moisture level, humidity level of the plant and the status of the motor whether is displayed such as ON/OFF condition.PIC compares the image result and if the image matches with the stored image it turns off the motor and the motor status will be displayed on LCD and also displays the type of soil suitable for plant cultivation.

B. ZIGBEE MODULE IEEE 802.15.4

In this project the ZIGBEE module obtains the image from the camera and convert into suitable signal and it is transmitted through wireless transmitter which then given to the signal conditioning processor through wireless receiver. The captured image information is given to the microcontroller.

C. MATLAB

In this project, MATLAB software tool is used for analysis of images mainly used for edge detection. It makes use of commands to detect the plant region and find out the texture of the image and finally edges of the plant region have been found out by various algorithms. The language, tools, and built-in math functions allow to explore multiple search outs and attain the solution at a rapid rate than with excel sheets or with the traditional programming languages, such as C/C++ or Java.

DSP System Toolbox produces executable algorithms for the design and reproducing signal processing systems. These functionalities are utilized as MATLAB functions, MATLAB System objects, and Simulink blocks. The system toolbox comprises of design methods for specialized FIR and IIR filters, FFTs, MultiMate processing, and DSP techniques for streaming data processing and producing the real-time prototypes. Design an adaptive and MultiMate filters, implement filters using computationally high efficient architectures, and exaggerate floating-point digital filters. Signal input and output for tools that are obtained from files and spectral analysis, signal generation of devices, and interactive visualization enable users to analyze system behaviour and performance. For both rapid archetype and

embedded system design, the system toolbox aids fixed-point arithmetic and C or HDL code generation.

IV. A. EXPERIMENTAL RESULTS

When the dried leaf image is found, the result obtained is normal and hence it does not turn on the motor.

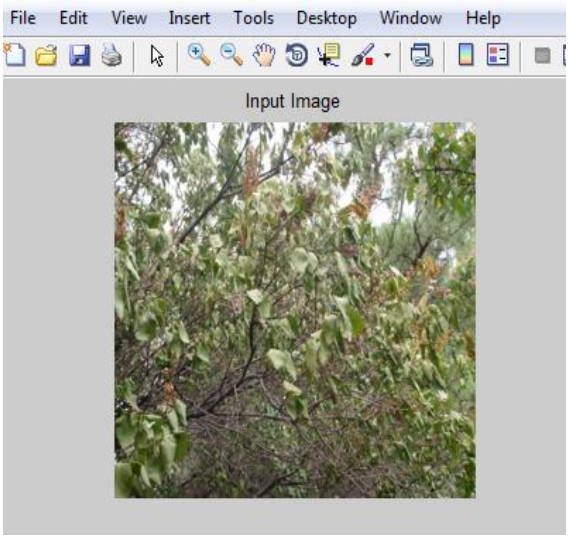

Figure: 3. Input Image

The detected plant region of an input image is analyzed by Adaptive k-Means Clustering Algorithm.

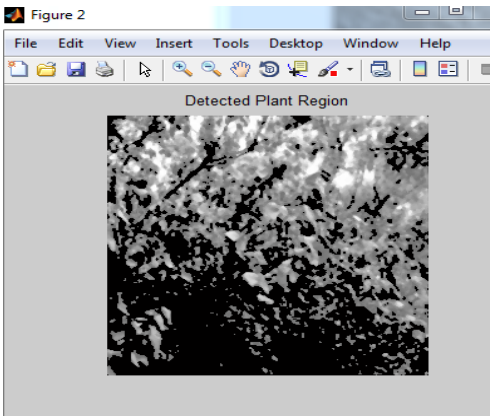

Figure: 4. Detected Plant Region

The Texture of the leaf is found using Gabor Texture filter such that the original texture of the leaf is obtained.

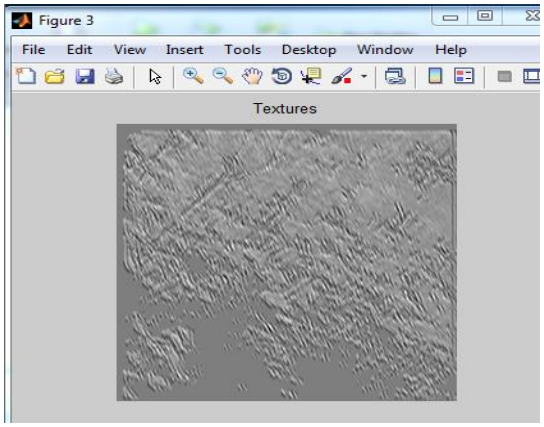

Figure: 5. Texture of the image

The Edges of the leaf is calculated using thresholding Algorithm.

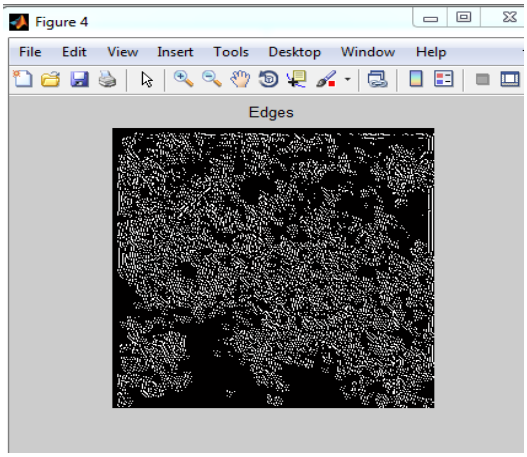

Figure: 6. Edges Detected in the Plant Region

When the input image mismatches with the already stored healthy leaf image, then the result shown will be abnormal.

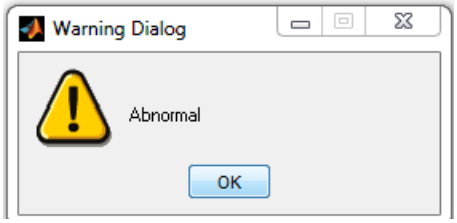

Figure: 7. Result

B. EXPERIMENTAL RESULTS FOR PLANT CULTIVATION.

As soon as the input image is given,it is preprocessed using discrete wavelet transform.

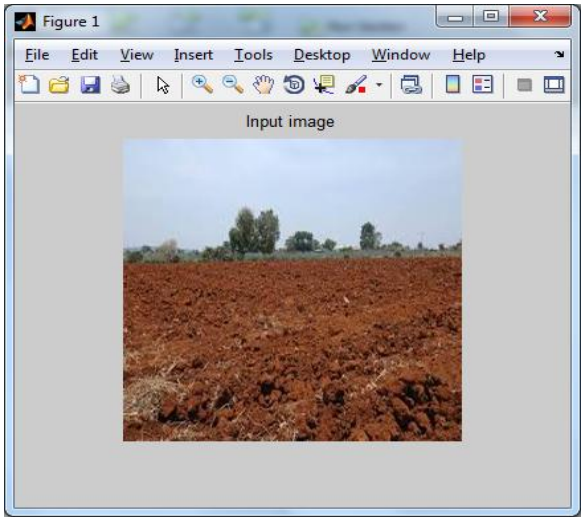

Figure: 8. Input Image.

After that segmentation is achieved by using means clustering, color and texture features are extracted using Gray-Level Co-Occurrence Matrix (GLCM).Then soils are classified using support vector machine .

Figure: 9. Enhanced Image.

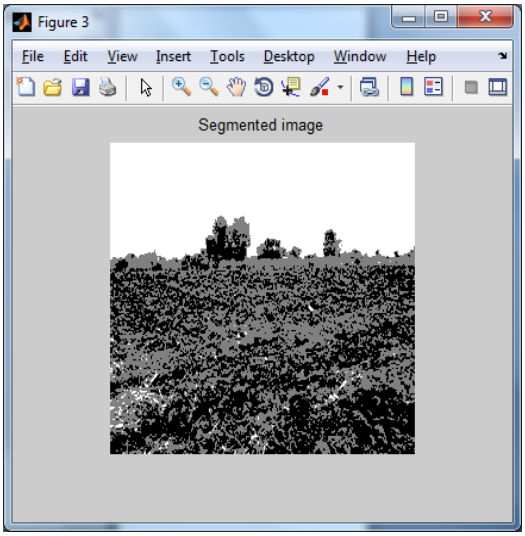

Figure: 10. Segmented Image.

Figure: 11. Result.

V. CONCLUSION AND FUTURE WORK

The automated irrigation system developed is found to be possible and cost effective for utilizing the water resources for agricultural production and also helps in biomass production. This irrigation system permits harvesting and cultivation in places with water insufficiency thereby improving viability. The system is found to be useful since it facilitates the automatic irrigation system and turn on the motor if the leaves are found dry and also provides information about type of soil for cultivating suitable crops.

The future work of the project also extends in providing the information in finding out the calorie of the plant which also serves the user the user to turn on or off the motor.

VI. REFERENCES

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