Detection and Controlling of Grape Leaf Diseases using Image Processing and Embedded System

Neeraj Bhaskar Wadekar[#1] Prashant Kailash Sharma[#2] Nilesh Sanjay Sapkale[#3]

[#]*B.E (E & TC), Department of Electronics and Telecommunication Engineering*

STES's Smt. Kashibai Navale College of Engineering,Vadgaon(BK),Pune-411041,Maharashtra,India.

Savitribai Phule Pune University

Abstract *- Grape farming in India faces a serious threat from leaf diseases. The major diseases include downy mildew, powdery mildew and anthracnose, which causes every year an enormous economic losses to grape sector. Its effect will diminish the quantity & quality of Grape fruit, as it reduces the Photosynthesis process. To effectively grow a grape plant and increase its productivity, it is important to monitor the plant during its growth period till harvesting. The use of appropriate pesticide in right dose at right time holds the key for effective disease management. The system uses image processing as a tool to monitor three diseases of grape plant i.e. downy mildew, powdery mildew and anthracnose. Hence to manage these diseases, it is important to control it before it is completely developed, so as soon as the disease is detected the respective pesticide is sprayed automatically on infected leaves, which is implemented using ARM7 embedded systems .The resulting agricultural automation system will help & reduce the rigorous efforts taken by farmer to consistently monitor and manage the different grape leaf diseases.*

Keyword *- Image Processing, ARM 7, embedded system, Pesticide Spraying, Downey mildew, Powdery mildew, Anthracnose, humidity sensor, temperature sensor.*

I. INTRODUCTION

Traditionally the farmers need to go in the farm to check each and every grape plant leaf in the field. The farmer visually checks the leaves for the disease merely on the basis of observation and his past experience. On this basis if he founds the grape plant infected by the disease, then he applies pesticide spray manually.

Thus the traditional way is applicable only after the grape plant is infected with the disease. Also it can be said that the traditional way only cures the disease and it has no provision to prevent the various fungal disease. The methods used by the farmer is out-dated and based on the old methods instead on the scientific methods. Indiscriminate use of pesticides also adds to the cost of pesticide and damages the neighbouring soil and water.

The introduction of automation technology can have several good impacts on the traditional system. The farmer need not go in the grape farm to check for the infected leaves, thus rigorous efforts of the farmer is saved using the automation technology.

Also on the certain climate change, the robot system will automatically detect the change in the weather condition and will start pesticide spraying on the leaf in the right quantity. Thus prevention of the dangerous fungal diseases is possible using this system.

This will result in the healthy grape plants and fruits, as the photosynthesis of the grape plant are normal and this will result in improved quality of grape fruit production.

II. OBJECTIVE

To build an automatic system for diagnosis of grape leaf diseases using Image Processing and an automatic pesticide spraying mechanism using embedded system.

III. BLOCK DIAGRAM OF SYSTEM

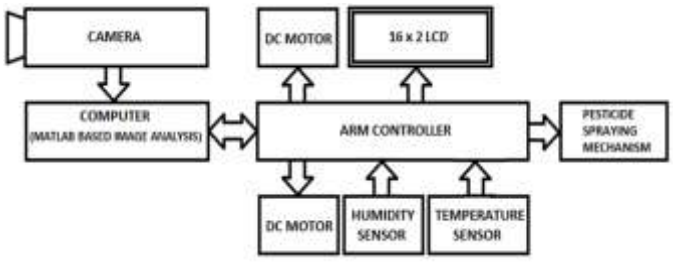

Fig 1: Block diagram of the Proposed System.

A. Camera

The camera is an image capturing device to acquire grape leaf images in real time and feeds to computer for further MATLAB analysis.

B. Computer (MATLAB based Image Analysis)

The MATLAB uses snapshot of the leaf samples as an input. Using HSV color extraction algorithm, it can perform the diagnosis on grape leaf images, that predicts the type of disease found. Depending upon the image processing result the disease severity is determined and the pesticides are sprayed accordingly.

C. ARM 7 Controller

The system use ARM7 for handling the operations such as DC motor direction control, to drive LCD display, opening and closing of pesticide spraying valve by receiving the controlling signals from computer.

D. DC Motors

Main purpose of DC motor in system is to direct the robotic vehicle in desired direction.

E. Spraying Valve

If any disease is detected, then valve i.e. water motor mounted on system, will start spraying the pesticide only on the infected grape leaves.

F. Humidity Sensor & Temperature Sensor

If the humidity acquisition from SY-HS-220 humidity sensor rises high then the spraying mechanism is initialized as it develops Downey mildew disease.

Temperature Sensor LM 35 is used to get temperature information for warm climate surrounding the grape plant. This warm temperature occurance signal is send to ARM for intializing of spraying system to get prevention over the disease.

IV. Detection of Grape Leaf Diseases

It is crucial to detect correctly that, is grape leaf been affected by one of the diseases. If the leaf is healthy i.e. completely green with no infection, will lead the control system to take no action, where else if the grape leaf is infected by disease then it will look like the images shown below in Figure 2, 3 & 4.

A. Downey Mildew infection:

Fig 2: Yellow portion detected below the grape leaf shows the infection of Downey Mildew disease.

B. Powdery Mildew infection:

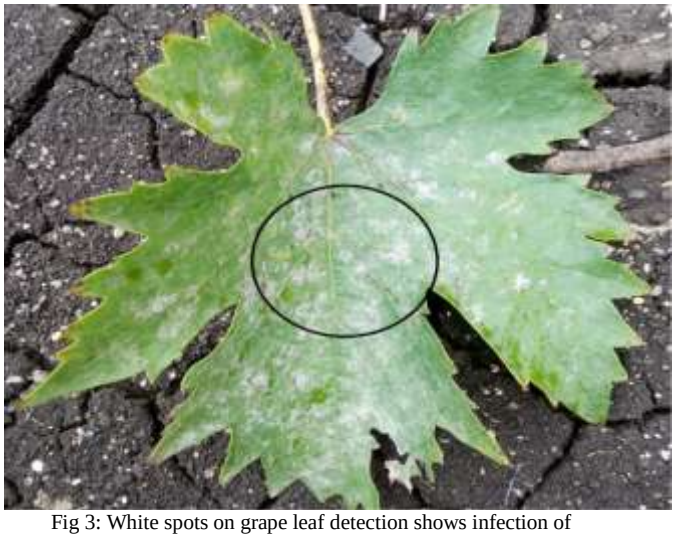

Fig 3: White spots on grape leaf detection shows infection of powdery mildew disease.

C. Anthracnose infection:

Fig 4: Dark red Spots on the grape leaf detection shows infection of Anthracnose disease.

V. Controlling Strategies

* Pesticide used for controlling of downy mildew will also control Anthracnose disease.

H: Humidity, T: Temperature.

Table 1: Pesticides and spraying condition.

Sr No	Management for Pesticide Spraying		
	Disease	Condition	Pesticide
1.	Downey Mildew (Plasmopara viticola)	*H: high* *T: 25-35 °C*	Trichoderma 2 to 5 ml/l. *
2.	Powdery Mildew (Uncinula necator)	*T: <35 °C*	Spray Sulphur 2g/l or Potassium bicarbonate 5g/l
3.	Anthracnose (Elsinoe ampelina)	*No Condition*	Trichoderma 2 to 5 ml/l. *

VI. Advantage of Proposed Pesticide Management

1) **For Downey Mildew & Anthracnose:**

1.1) The system will control infection done by fungal species i.e. *Alternaria* & *Cladosporium* on grape leaves to delay the leaf falls.

1.2) One or two spraying at 10 days gap is provided by system when high humidity occurs, especially for Downey mildew disease.

2) **For Powdery Mildew:**

2.1) The System will control Powdery mildew as the dense *canopy* (layer that spreads out and cover the leaf area) is developed during summer, especially after flood irrigation process.

2.2) The system will not spray Sulfur pesticide to avoid *phytotoxicity* (poisonous to plant) if temperature is very high around 35 to 40°C.

VII. Advantages

1) Real-time diagnosis of three major grape leaf diseases.
2) Automatic pesticide spraying mechanism on disease detection.
3) Cost-effective with long-time and continuous observation on grape field.

VIII. Future Scope

1) The system can be made more convenient to capture the image of grape leaves within the complex area of grape plant.
2) The system can be further developed to manage other grape disease infected due to pests and steam borer.

IX. Conclusion

With the help of cultural practices, the farmer can reduce the disease only up to some extent. Therefore a novel approach can be used to detect grape leaf diseases by using image processing and embedded system. It will perform autonomous spraying of pesticides on infected leaves, this will lead to reduce the delay caused by farmer to prevent diseases, in turn making the detection & control technology more reliable and accurate in agriculture automation.

References

[1] Dr.P.G.Adsule, Dr.Anuradha Upadhyay-"Package of practices for managing major diseases and insect pests on grapes" NRCG Pune, Technical Bulletin No. 8 ,March 2007.

[2] Vikramsinh Kadam, Mrudang Shukla, Amol Ubale – "Prevention of downey mildew disease in grape field", March 2014.

[3] Jhuria M, Kumar A, Borse R- "Image processing for smart farming: Detection of disease and fruit grading," Image Information Processing (ICIIP), 2013 IEEE Second International Conference on , vol., no., pp.521,526, 9-11 Dec. 2013

[4] Sarika Datir and Sanjeev Wagh – "Monitoring and Detection of Agricultural Disease using Wireless Sensor Network".

[5] Nikita Rishi, Jagbir Singh Gill –"An Overview on Detection and Classification of Plant Diseases in Image Processing", IJSER 5, May 2015.

[6] Cesare Gessler, Ilaria, Pertot & Michele Perazzolli – "Plasmopara Viticola".

About Authors

Neeraj Bhaskar Wadekar

He had Completed Diploma in E &TC and is currently a final year student of E&TC Engineering at SPPU University. His area of interest includes Image Processing, Embedded Systems, Computer Networks, Agricultural Automation Systems and Wireless Communication Systems.

Prashant Kailash Sharma

He had Completed Diploma in E &TC and is currently a final year student of E&TC Engineering at SPPU University. His area of interest includes Image Processing, Robotics, Embedded Systems, ARM 7 Interfacing, Data Acquisition Systems and Analog Communication Systems

Nilesh Sanjay Sapkale

He had Completed Diploma in E &TC and is currently a final year student of E&TC Engineering at SPPU University. His area of interest includes Image Processing, Circuit Designing, Arduino Programming, Agricultural Automation Systems, Short Distance Communication Systems and Sensor Technologies.