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Research paper

Pest identification in sugarcane crop using acoustic sensor

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Abstract

In the existing system, the disease in sugarcane crop is found manually. So there are more chances for loses to the farmers. Now a day's agriculture growth is reducing because of more pollution and pest in the environment. In India most of the farmers grow sugarcane but are not getting good yields due to bugs and larvae in sugarcane. To avoid this situation, the proposed design has been developed with acoustic sensor and MQ2 sensor. In this proposed design system used aurdino for monitoring the noise and ammonium gas. So finding the problem can be simplified and can be solved easily.

Keywords: *Acoustic Sensor; MQ2 Sensor; Aurdino Nano; ESP 8266.*

1. Introduction

Solar Sugar cane crop is also a major crop in India. Generally the canes are two types thick and thin. In agriculture, the sugarcane share is 10% of the total value of agriculture output. The sugarcane plant mainly consists of three important parts that are root, stalk and leafs. Sugarcane is a perennial grass in the family poacese. The sugarcane has a thick stem which produces sucrose. The stem is divided in to several nodes [1]. The shape of the leaves are tubular and blade type. The sugarcane can grow a height of 6m. The stalk will regrow allowing the plant to live for 8 to 12 years. The sheath is green with red blotches and the inflorescence of sugarcane generally called arrow.

The sugarcane crop is sensitive to atmospheric conditions. The temperature requirement of sugarcane in sprouting stage is 32° C to 38° C. If the temperature is above 38°C, it reduces the rate of photosynthesis and it may slow down when the temperature range is 25°C. In ripening stage, the desired temperature range is around 14°C.

Sugarcane crop may get diseases easily because of its sensitivity to atmospheric conditions. The productivity from the sugarcane crop gradually decreases due to various pests [2]. In order to improve the high yield from a sugarcane crop, it is necessary to investigate and control over various pests and diseases. In entire India, there is no uniform climatic condition for healthy sugarcane crop. So, the different insects and pests exists in the crop, management strategy should be adopted accordingly.

2. Diseases in sugarcane crop

2.1. Red rot



Fig. 1: Red Rot.

2.1.1. Disease symptoms

It is due to glomerella tucmanensis fungus and the symptoms are internal stalk reddening with transverse white patches and stalk death. In wet seasons, the red rot disease usually occurs and there is a chance of spread.

2.1.2. Favorable conditions

Red rot usually expandable to other areas of the crop through soil mostly and through air rarely.

2.2. Sugarcane yellow leaf disease



Fig. 2: Yellow Leaf.

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2.2.1. Disease symptoms

It is caused by acidovorax avenae subsp. Avenae bacteria and this is usually occurred in moist weather [3]. The yellowing of spindle leaves i.e, the 4-6 yellow spots on leaves of sugarcane plant is identified in the initial stage of disease. In the next few days, the leaves at mid rib may get yellowish, then the farmer can easily identified but the damage is not avoidable at this point.

2.2.2. Transmission

The disease is transmitted by small insects around the trip. The other chance of spreading of this disease is by infected seed cane [3].

2.2.3. Favorable conditions

The weather condition for this disease is to be dry. Generally from January to March is the favorable time period for this disease.

2.3. Smut



Fig. 3: Smut.

2.3.1. Disease symptoms

The whip is originated from the sugarcane plant in the early stage of its growth. It is due to listilago scitaminea fungus and the favorable condition for this bacteria is hot and dry conditions. The symptoms are terminal growth ending in a whip grassy growth.

2.3.2. Favorable conditions

Generally hot dry weather is suitable for the spread of smut disease. But, the high humid air is responsible for the origination of pathogens of smut [4].

3. Acoustic sensor in sugarcane

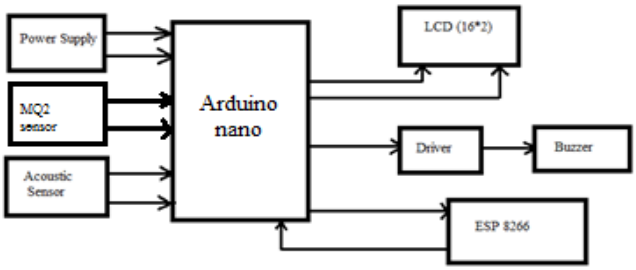


Fig. 4: Block Diagram of Pest Identification Method.

3.1. MQ2 sensor

It is evident that the emission of nitrogen gases from agriculture to the atmosphere represents a loss of 'N' to agriculture and also in environment. MQ2 sensor indicates the emission of 'N' gas in the crop field.
The use of MQ2 sensor is not only simply measuring 'N% ' of crop surroundings and also indirect indication of fertilizer requirement of crop.

3.2. Acoustic sensor

An acoustic wave sensor can measure sound level. When an acoustic wave travels through a certain material or along the surface of the material, it definitely changes the material properties. Any change in the travelling wave is only due to path effect i.e velocity or amplitude of the wave. These are converted into digital by a transducer. So, here we considered frequency as output parameter. The acoustic sensors are able to discriminate the pest sounds and other noises. We have tested this device in the crop field [5] [6][7].

Table 1: Frequency Classification

Source	Frequency	Time delay
Pests in sugarcane	5khz	2msec
Surrounding traffic	5khz	>1sec
Thunder	100hz (after 1km)	3 sec (in general)

3.3. Pest identification

We are proposing an efficient pest monitor system for sugarcane crop production [8]. The systems will be using an acoustic device sensor which will monitor the noise level of the pests with nearly 5khz frequency over 2ms of time period and whenever the noise crosses the threshold it will notify the farmer of the area where the infestation is occurring[9] [10].

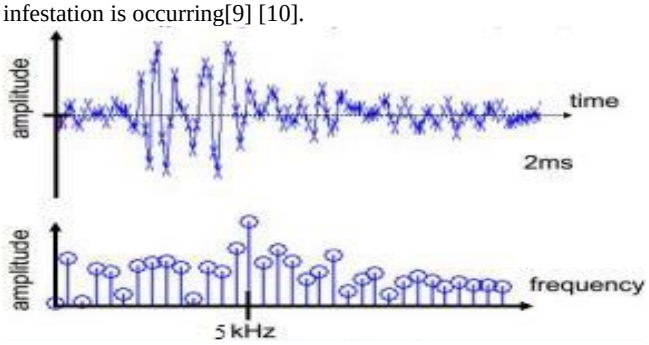


Fig. 5: Frequency of Pest Sound.

4. Results

The proposed method has superiority over manual inspection of sugar crop. The cost of the system increased only if we propose more number of sensors.Remote sensing with acoustic sensors and MQ2 sensors gives a cost effective technique to get the clear picture of the crop diseases. Pest monitoring system used the arduino micro controller, IoT with allthingstalk platform, audio sensor, WiFi module (ESP8266) and real time module. When it reached the threshold value, automatically the WiFi module will send notification to farmer's mobile. Then farmer will follow the the pest control action.

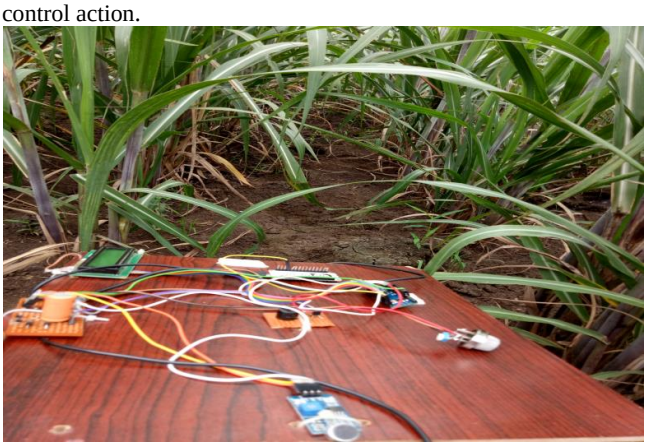


Fig. 6: Pest Identification in Sugarcane.

5. Conclusion

In the existing system, the disease in sugarcane crop is found manually by farmers. So there are more chances for crop and money loses to the farmers. Now a day's agriculture growth is reducing because of more pollution and pest in the environment. In India most of the farmers grow sugarcane but are not get good yields due to bugs and larvae in sugarcane. To avoid this situation, the proposed design has been developed with acoustic sensor and mq2 sensor (gas sensor) [8] [9]. In this proposed design, system used aurdino for monitoring the noise and ammonium gas in the crop. So finding the problem be the disease is wide spread in crop can be simplified and solved easily [10].

Since we are focusing on very limited pests like sugarcane borer and adult sugarcane moth diseases like red rot, yellow leaf and smut, these pests and diseases require similar pesticides in order to check their infestation so we can also have an automatic pest spraying mechanism that will automatically spray pesticides wherever the infestation is occurring. This will further automate farming to grow better and healthier crops. We have to use call back function while writing code for aurdino.

Acknowledgements

Not applicable

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