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Research paper

Insects identification in maize crop using WSN

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Abstract

In India, every year a large scale of agricultural crops are destroyed by these soil-dwelling pests and White Grubs have most significant damage among them. White Grubs are the larvae of scarab beetle that feeds on the rootlets of the plants. It is considered as the national importance pest of India. Several technologies are being adapted from the past few years in order to control White Grubs. Apparently, they serve as either slow methods or costly. A different framework is developed to sort out the problems faced by the earlier technologies. The use of Smart Greenhouse technology has aided in finding the location of grubs' larvae efficiently. The capability of EPNs nematode to locate White Grubs is taken as the fundamental methodology to develop a system for tracing the location of White Grubs.The proposed method is mainly invented to find the second instar and third instar of grubs as they are the most damaging stages in the grub lifecycle. MQ-135 is used in the developed hardware to detect the CO2 bursts emerged from the grubs.

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

1. Introduction

A large proportion of India's population is strictly dependent on agriculture. Therefore, agriculture is considered as the main occupation of our nation. Apparently, the mentioned occupation is being deteriorated by several factors. One of the most significant factors to harm the agriculture of our nation is the pests. Agricultural insects can be categorized into two types i.e.; beneficial insects and damaging insects.

However, it is seen that the insects in agriculture field are collaboratively famous for their damaging nature rather the beneficiary nature. Such is the kind of damaging pest is White Grub. It resides in soil and cause a huge damage to the fields' plantations. It is considered as the pest of national importance.

White grubs are present in all the corners of our country. The tremendous destruction caused by the grubs are quite dreadful [1]. Every year many experiments are carried out to reduce the damage caused by scarab beetles. Seed treatment technologies, soil treatment technology as well as the standing crop treatment procedure are some of the manual methodology that have been taken in use in order to dwindle the grubs' population. Indeed, it is noticed that the manual methods serve as a slow process. In addition to this, they also tends to destroy only the scarab beetles and first instar which are recognized to produce less damage. WSN technology can be used to control White Grubs efficiently.

WSN technique is trending in all sectors; however it has already attained its popularity-peak in agriculture sector. It's easy installation and low-cost has made it to utilize in agricultural fields. Some of the sectors of agronomy that are already using Wireless Sensor Networks technology are smart greenhouse monitoring, livestock monitoring, woods monitoring and field monitoring. In the recent researches, WSN has also intervened in the field of insect monitoring. A lot of sensors were developed to identify the movements, sounds and many more features exhibited by the insects.

2. Identification of white grub using WSN

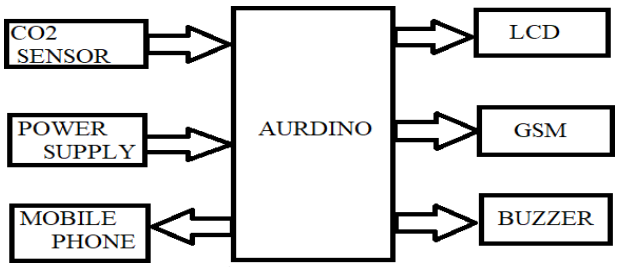


Fig. 1: Identification White Grub Using WSN.

The Fig.1 shows the block diagram of the project. CO2 (Carbon dioxide sensor) is sense the gas released by the white grub. LCD is used to display the value of the gas released. GSM is used to send the message to the farmer [2]. Buzzer is on when the gas is more than or equal to the threshold value given in the aurdino program.

The main parts in the proposed model are MQ135, Aurdino microcontroller, buzzer, GSM, LCD screen and mobile phone. Generally, White Grubs are appeared in rainy season. The maize crop usually consists longer growth period. So, many diseases are attracted by the crop and there is a reasonable reduction in the crop yield [5].

There are 200 plus insects that can affect the maize crop and around 20 insects will affect the crop severely. Based on the region and area, the different insects may attack the crop. Rust and Amp diseases are usually occurred near the earth equator line (tropic areas), above that region borer and stalk borers are dominantly effect the crop [6].

Earlier several methods are employed to reduce the effect of White Grubs. One of the methods is acoustic sensor approach for White Grubs identification but digging and scrapping sounds not properly recorded due to noise. In this paper, the proposed technique with MQ135 sensor is used to measure CO2. The grub usu-

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ally moving from one root to another root of the plant. In this process, it will release very high amount of CO2 then the MQ135 identifies the specified range of CO2 concentration in ppm. The sensor is buried in the soil. A group of sensors are located in the various places of the crop filed. The wireless sensors arrangement will give remote identification of the White Grubs in the crop field. Usually with the effect of White Grubs, the tunnelling is happened in the major roots. Because of this effect, the plant get infected and it leads to break off.

3. Testing and Analysis

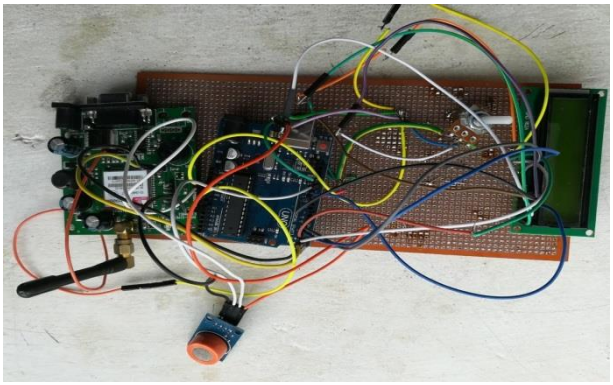


Fig. 2: Real Time Implementation.

Through acoustic detection technology there will be no need of the farmer to go to each and every part of the field and perform periodical surveys over widespread plantation.

This will help to reduce time and increase the productivity and help to grow better and healthier sugarcanes. The collection of the noise levels will be done using a number of wireless sensor nodes spread over an area. The MQ135 gas sensor consists of SnO_2 and there are two measuring electrodes. The top portion of the sensor holds the connection terminal. Based on the CO2 gas, the resistance of the circuit decreases. The resistance change is converted in to voltage by external load resistor circuit. There are different varieties of gas sensors are available and they are compatible with Arduino microcontrollers. The design considerations are main important because the performance depends on it. The hardware and the selected networks plays a vital role in the quality of the sensor output.

The kit is place in the crop under the soil near to the roots. The white grub can damage in the roots of the plant. When the grub comes out from root and go to another root it releases sudden CO2 of an average of 620-650 ppm range [9]. MQ135 is the gas sensor which senses that sudden CO2 and compares the threshold values which was given in the Aurdino program. When the value is greater or equal to the threshold it enables the gsm module. The GSM sends the message to the farmers mobile [10].

4. Results

The manual inspection is usually done in the maize crop for prevention of diseases. But, the accuracy depends on the human experience. So, it requires more man power and cost also. There are other limitations like only sample check can be done in small areas. The manual methods cannot prevent the damage of the crop because it only identified at the last stage.

Remote measurement by MQ135 provides good solution for grubs identification by measuring CO2. The entire crop field consists of 4 or 6 node points for 1 hectare crop field. Pest monitoring system using to the arduino micro controller, GSM module. When the level of value more than are equal to treshhold automatically GSM module send notification to farmer's mobile. Then farmer will be do the pest control action.

5. Conclusion

In the existing system, the disease in maize crop is found manually by farmers. so there is 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 and mq135 sensor (gas sensor). In this proposed design, system used arduino for monitoring the Carbondioxide in the crop. So finding the problem be the disease is wide spread in crop can be simplified and solved easily.

6. Further work

Since we are focusing only on white grub CO2 monitoring in maize crop have- aphid and diseases like 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. Now agriculture field is with Internet of Things technology. It can also implement this proposed model with IoT . But implementation with IoT is complex and cost effective.

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Not applicable

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