|| Volume 5 || Issue 1 || January 2020 || ISSN (Online) 2456-0774
INTERNATIONAL JOURNAL OF ADVANCE SCIENTIFIC RESEARCH
AND ENGINEERING TRENDS

STEM BORER AND NPK DETECTION

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Abstract- Grapes is an important cash crop of Nashik, India plays important role in the economy of the country. In India grapes is grown on 2.6 million acres. Its annual production is 54741.6 tons and average yield is 37-50 tons. The average yield of grape in India is low as compared to the Nashik. Among the different reasons responsible for low yield of grapes in India, insect pests are the most important one. About 100+ insects are associated with grapes. Among all insect pests, grapes stem borer is one of the serious problems in reducing he yield of grapes crop. Its caterpillars destroy about 20% of the young shoots annually. The stem, after hatching reach the plant base, bore into the shoot and feed there. In years of severe infestation, it reduces the grapes yield from 30-70%. The caterpillars feed in the stem and cut off the growing point (central whorl of the leave) causing the later to wilt and dry. The central dead shoot is also called "dead-heart". Such plants never grow further but the dormant buds sprout and produce side-shoots.

Annual production of grapes may vary due to duplicate & low quality fertilizers. Low quality fertilizers does not maintain proper NPK ratio & it may affect grapes yield .To overcome above problems we are designing system for Stem Borer Detection using sound sensors & NPK analysis using LED &Photo- diode.

Keywords - *Grape, stem borer, Sound detector, buzzer, Optical transducer, NPK Fertilizer, LED, photodiode, Arduino.*

I INTRODUCTION

The wood boring insects are currently the main cause of damage in the grapes production. The most dangerous species of insects destroy the stem by dwelling inside it for many generations, causing its total destruction. The most dangerous insects are stem borer. Species exist in the wide areas of grape land, dwelling in various types of trees, which facilitates their aggressive expansion. The most important is the sound, as the larvae activity is high only within the specific range, which should be maintained during the experiments. It was proven in that each insect behaves differently and generates specific sounds, depending on both the thickness of wood and structure of the feeding apparatus. To grow crop yield fertilizers containing predominantly Nitrate (N), Phosphate (P), & Potassium (K) are imperative.

Quality of NPK is dependent on crop type & on plant growth status. How much quality of fertilizer to be used in further dependent on present contents of NPK nutrients in fertilizer Also nutrients required are in macro & major amount so a precise control is must which must be maintained throughout the crop duration, which is only the solution to obtain high yield & quality at par. Researchers in agriculture are looking for ways to optimize plant yield while minimizing the consumption of fertilizer. Since these macro-nutrients vary even on a small scale throughout a cultivated field.

However, the initial procedure used to clamp the accelerometer to a stem was difficult to perform and sometimes compressed weak stems .An improved, non destructive clamping device was developed and tested in studies that compared sounds produced by C.cinctus in wheat stems with sounds produced by much larger, Metamasiuscallizona (Chevrolat) (Coleoptera: Curculionidae) stem hidden inside meristematic tissue of Tillandsiautriculata (L.),an endangered species of bromeliad. Temporal and frequency patterns of sound pulses generated by the stem were compared in relation to insect size and differences in the structural properties of the substrate. Stem of both species produce brief,1 kHz sounds, loud enough tobe detected by an acoustic sensor in moderate background noise without using an insulated room or anechoic chamber. As expected, the larger (300–400 mg)M. callizona generated louder sounds than the 3–8 mg C. cinctus. The improved accelerometer/clamp system can be a useful tool for detecting the movement and feeding activity of C. cinctus, M. callizona, and other insects that are difficult to observe inside plant tissue .Keywords sound, feeding and movement behavior, hidden infestations Cephuscinctus Norton (Hymenoptera: Cephidae) stem feed and pupate inside wheat stems, hidden from predation and behavioral observation. Larval activity can be detected acoustically by attaching an accelerometer to the base of an infested stem. However, the initial procedure used to clamp the accelerometer to a stem was difficult to perform and sometimes compressed weak stems. An improved,

nondestructive clamping device was developed and tested in studies that compared sounds produced by C. cinctus in wheat stems with sounds produced by much larger, Metamasiu scallizona (Chevrolat) (Coleoptera: Curculionidae) stem hidden inside meristematic tissue of Till and siautriculata (L.), an endangered species of bromeliad. Temporal and frequency patterns of sound pulses generated by the stem were compared in relation to insect size and differences in the structural properties of the substrate. Stem of both species produce brief, >1 kHz sounds, loud enough to be detected by an acoustic sensor in moderate background noise without using an insulated room or anechoic chamber. As expected, the larger (300–400 mg) M. callizona generated louder sounds than the 3–8 mg C. cinctus. The improved accelerometer/clamp system can be a useful tool for detecting the movement and feeding activity of C. cinctus, M. callizona, and other insects that are difficult to observe inside plant tissue. An optical transducer is developed to measure and to detect the presence of Nitrogen (N), Phosphorus (P) and Potassium (K) of Fertilizer. Such transducer is needed to decide how much extra contents of these nutrients are to be added to the Fertilizer to increase Fertilizer fertility. This can improve the quality of Fertilizer and reduces the undesired use of fertilizers to be added to the Fertilizer. The N, P, and K value of the sample are determined by absorption light of each nutrient. The optical transducer is implemented as a detection sensor which consists of three LEDs as light source and a photodiode as a light detector. The wavelength of LEDs is chosen to fit the absorption band of each nutrient. The nutrient absorbs the light from LED and the photodiode convert the remaining light that is reflected by reflector to current. The system utilizes an Arduino microcontroller for data acquisition therefore the output from the transducer is converted into a digital display reading. Testing on various samples of Fertilizers, showed that the optical transducer can evaluate the amounts of NPK Fertilizer content as High, Medium and Low.

II METHOD

The wood boring insects are currently the main cause of damage in the grapes production. The most dangerous species of insects destroy the steam by dwelling inside it for many generations, causing its total destruction. The most dangerous insects are steam borer. Species exist in the wide areas of grape land, dwelling in various types of trees, which facilitates their aggressive expansion. The most important is the sound, as the larvae activity is high only within the specific range, which should be maintained during the experiments. It was proven in that each insect behaves differently and generates specific sounds, depending on both the thickness of wood and structure of the feeding apparatus.

The presented task is difficult, as the sounds made by the larvae are of relatively low amplitude and the background noise caused by people, electrical appliances or other sources may significantly degrade the accuracy of detection. The first one is the initial assessment of the created system where the background sounds are selected randomly. The second stage involves selecting the background sounds as close to the originated as possible. After detecting the sound bore steam borer the buzzer will be buzzed and get alert. Finally, Boring Insects are Based on the Acoustic Signal Analysis. The sounds of borer species and the larvae of steam boring insects should be checked. In the presented research the first step is verified. Although detection of the insects in the isolated environment is relatively simple (as long as the insect makes sounds while boring in the wood), its identification may be difficult.

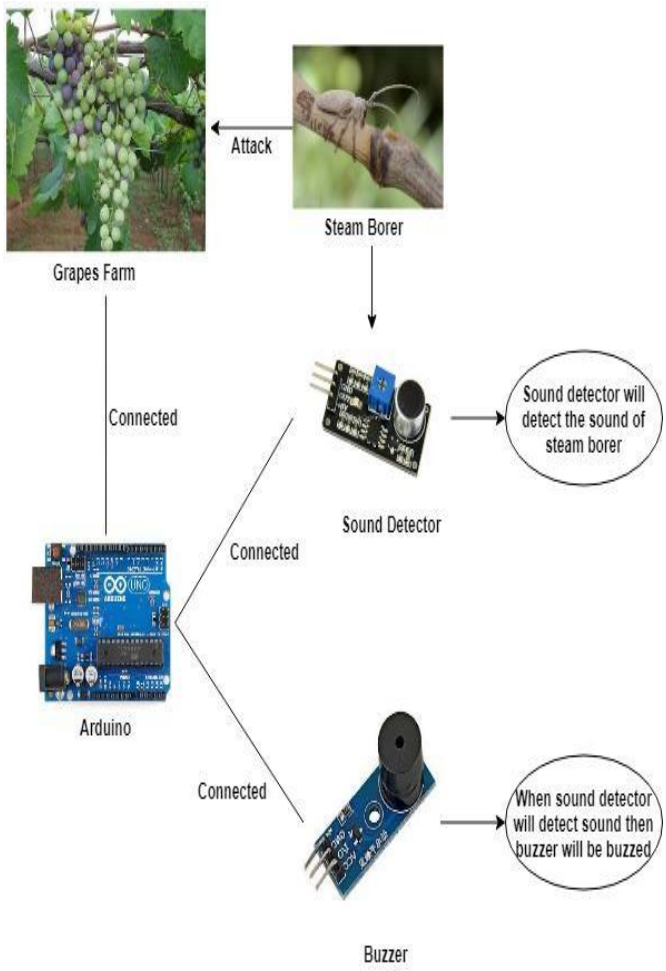

Figure 1. Schematic diagram of the experimental setup for Stem Borer

The overview of optical transducer for NPK Fertilizers detection illustrated in Fig. 1. The optical transducer was formed by the integration of light transmission system and light detection system. The Arduino microcontroller was used to operate the light source in a transmission system. Apart from that, it was also used as a data acquisition from the light detection system and provides liquid crystal display (LCD) control functions to operate the display.

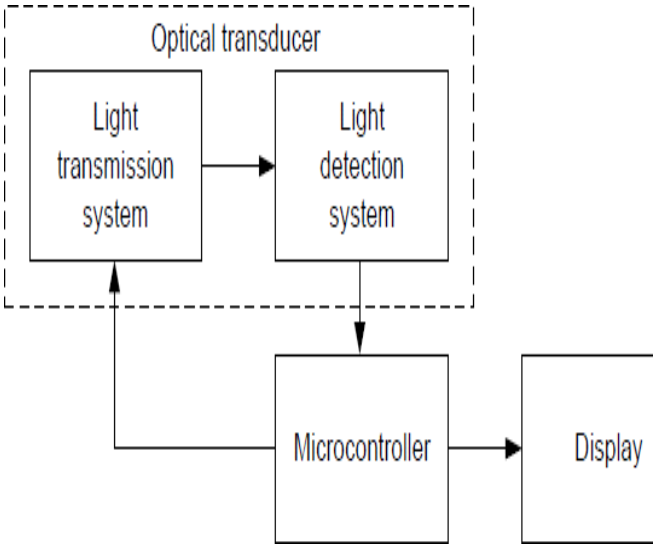

Figure 2. Schematic diagram of the experimental setup for measuring Fertilizer sample

Photodiode received the light reflected from the Fertilizer where the Fertilizer received the light from the LED. The light was converted into current by the photodiode and the data was sent to the Arduino controller for further analysis such as digital conversion and display. Reflection and transmission of light waves occur because the frequencies of the light waves do not match the natural frequencies of vibration of the objects. When light waves of these frequencies strike an object, the electrons in the atoms of the object begin vibrating. But instead of vibrating in resonance at a large amplitude, the electrons vibrate for brief periods of time with small amplitudes of vibration; then the energy is reemitted as a light wave.. Such frequencies of light waves are said to be transmitted. If the object is opaque, then the vibrations of the electrons are not passed from atom to atom through the bulk of the material. Rather the electrons of atoms on the material's surface vibrate for short periods of time and then reemit the energy as a reflected light wave.Such frequencies of light are said to be reflected. Microcontrollers are embedded inside devices to control the actions and features of a product. Hence, they can also be referred to as embedded controllers. They run one specific program and are dedicated to a single task. They are low power devices with dedicated input devices and small LED or LCD display outputs. Microcontrollers can take inputs from the device they controlling and retain control by sending the device signals to different parts of the device. A good example is a TV's microcontroller. It takes input from a remote control and delivers its output on the TV screen. Arduino can interact with LEDs, buttons, the Internet and even smart gadgets like phones and TV screensThe overall optical transducer with microcontroller is shown in Fig. 1 and the schematicdiagram is in Figure 2.

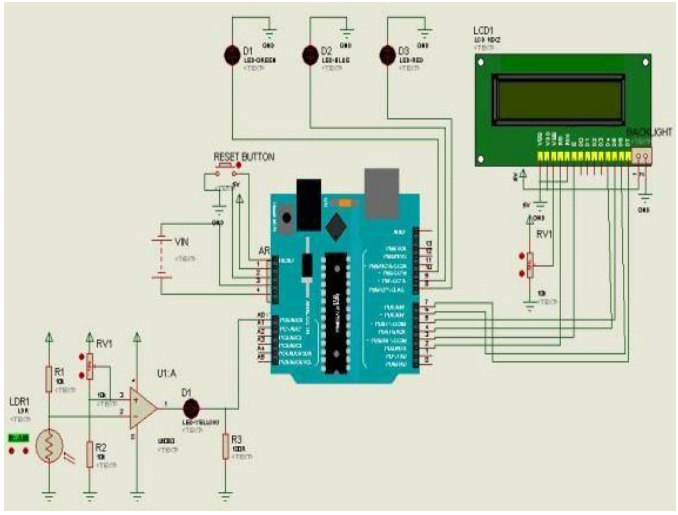

Figure 3. Schematic diagram for overall optical transducer integrated withArduino microcontroller

The overview of optical transducer for NPK Fertilizer detection is illustrated in Fig. 1. The optical transducer was formed by the integration of light transmission system and light detection system. The Arduino microcontroller was used to operate the light source in a transmission system. Apart from that, it was also used as a data acquisition from the light detection system and provides liquid crystal display (LCD) control functions to operate the display.

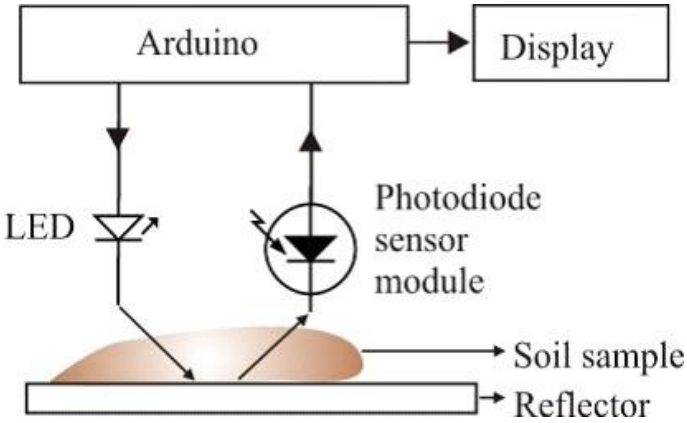

Figure 4. Schematic diagram of the experimental setup for measuring Fertilizer sample

Sample	Nitrogen (N)	Phosphorus (P)	Potassium (K)
1	High	Medium	Low
2	Low	High	Low
3	Low	Low	High
4	Low	Low	Low
5	Low	Low	Low
6	Low	Low	Low

TABLE 1. THE NUTRIENT CONTENT LEVEL IN ALL SAMPLES

III CONCLUSIONS

The sound detector and buzzer with Arduino microcontroller as an alternative method of determination of the stem borer in the grape plant. This project can reduce the problems in determining the stem borer with a cheaper cost with other technology.

The optical transducer; LEDs and photodiode with Arduino microcontroller as an alternative method of determination of the deficiency N, P or K in the fertilizer. This project can reduce the problems in determining the amount of nutrients in Fertilizer with a cheaper cost with other technology. It can also reduce the undesired use of fertilizers to be added to the Fertilizer which can cause dead plants and reduce plant quality and quantity. This can be determined through to the light absorption of nutrients by the optical transducer and developed threshold values for each nutrient which decide the level of nutrients into three levels: Low, Medium and High in the display.

Fertilizer sample	Nutrient content
Sample 1	High Nitrogen
Sample 2	High Phosphorus
Sample 3	High Potassium
Sample 4	Low nutrient
Sample 5	Low nutrient
Sample 6	Low nutrient

TABLE 2. FERTILIZER SAMPLE

IV ACKNOWLEDGMENT

We take immense pleasure in expressing our humble note of gratitude to our project guide Prof. R. R. Tajanpure of Information Technology Engineering for his remarkable guidance in doing our project.

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