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WSN application: Insect Monitoring through their behaviour

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Abstract: The major part of population is involved in agriculture but the production is not sufficient to fulfil their needs, taking in concern to this issue, the paper includes the monitoring of insects through their behaviour and as well as amount of the insects, that are proved harmful for crops is also monitored through the image processing toolbox of Matlab. In a result the amount of fertilizer is advised and at the same time various parameters of greenhouse are also taken in concern so that proper growth with minimum labor can be possible in intelligent greenhouse, these all parameters are measured wirelessly. This whole process led to the increase in the productivity that was cleared through results taken by us on the real field.

Keywords: *fertilizer; image processing toolbox; intelligent greenhouse, insect monitoring.*

I. WSN APPLICATION

Now days the large part of population is suffering from water problems, the main cause behind this is the irrigation practices. If the water will be irrigated properly in the crops than the water level up to 70% can be improved **[1].** These practices are keep on changing as in earlier decades the farms were irrigated through the surface irrigation, drip irrigation and then by sprinkler irrigation but these methods were alone not proved beneficial so the technology was introduced in the form of sensors for the all parameters that play essential part at the earlier stage of crops**[2]** The needs at early stage of crops is water, sunlight, fertilized soil etc, these all are provided through the sensors such as temperature sensor, soil moisture sensor, light sensor , humidity sensor and water level sensor.

As in the first stage we introduced the concept of micro-irrigation which in result provide better management of water through sensors, this was experimentally checked in RARI (Rajasthan agriculture research institute) proved beneficial for crops as type of soil is checked and the water is poured to the crops through sensors, according to the type of soil and needs of crop measured through the recorded data of several areas and whenever the soil is enriched with essential needs the buzzer rings up than the motor is automatically switched off. This whole process helps to improve the water conditions in India but this technology was only not sufficient for the crop growth and accuracy of each and every parameter to use in farms so, we further proceed our work with the measurement of different parameters in the greenhouse, as we have measured the temperature at the instant of time then if it is higher or lower than threshold it is instantly measured and then maintained as per the available data provided in the records for each and every crop, the humidity is also maintained according to the need of crop, the light is provided as much needed for the proper process of photosynthesis, the moisture of soil and as well as the insects are monitored according to their behavior**[3].**

The insects are being trapped and kept under observation for few days and then the sensors are implemented on their back so that they can be easily tracked and then they are again sent back to their hives or groups, as this sensor help researchers to provide the data of tracked position and their day to day behaviour is being tracked with the help of which they can predict the weather condition **[4]** and the other way is to measure the frequency of insects well as the frequency of each and every insect can be also measured easily. The total data of the measured parameters will be sent to the farmer, one who will play role as a user on sending a single password that can be only accessed by the farmer. The best opportunity that is provided by the model is that the data can be also accessed after every second without any delay and always the threshold levels will be marked, that is not possible with the manual method and in next morning the farmer can also provide the temperature conditions or humidity as it needs to increase the level that was fallen last night. The software on which we are performing insects work is through Matlab by that images can be taken and number of insects can be seen lively [5] and it also provides the live video of each and every place of the farms very closely, so that farmers are not forced to stay on fields for all the time and as well the labor will be reduced.

II. INTELLIGENT GREENHOUSE

The environment climatic conditions nower days doesn't allow the crops to grow at greater level so to cope with these difficulties, the solutions in the form of sensors is presented for the greenhouse so that we can make it "**intelligent**

greenhouse", it is a closed room covered with glass where unseasonal crops can be also grown by maintaining its temperature, humidity, water level, moisture in soil, light etc.

This project also favour the farmers those who believe in predictions till now and imply the solutions according to this predictions ,the result we get is loss in the crops production. To overcome such consequences we introduced a model which will help to improve these turnouts. The each and every parameter will work automatically as sensor based model is prepared on its ability of senses it will work. The temperature and humidity is controlled through coolers and fan, soil moisture and water level is controlled through motors and the light needs are fulfilled through bulb as these all are connected to the control circuit with this procedure the all parameters work for the requirements of greenhouse.

First of all the data for all crops that are to be planted in the greenhouse, is been taken manually that is essential to grow it and then this data is initialised into the module if the present conditions matched the stored value for the crop then there is no change in the external suppliers as cooler, fan, motor and light but in case there will be any change in the value that is stored and the present value than the critical condition occurs and buzzer gets started. This data will sent as information to the farmer through a sms at every second they want to check it which is not possible with the manual method that is why this method is more beneficial for the farmers rather than the manual method. It also proves greater accuracy than to the initial methods. The components used to complete this procedure are ATMEGA 16 module, LM324 IC for light sensor, LM35 for temperature sensor, HSM 20G humidity sensor, water level sensor and a probe with ldr sensor to make soil moisture sensor. The diagram given below shows the circuit diagram and the simulation of the project through proteus software:-

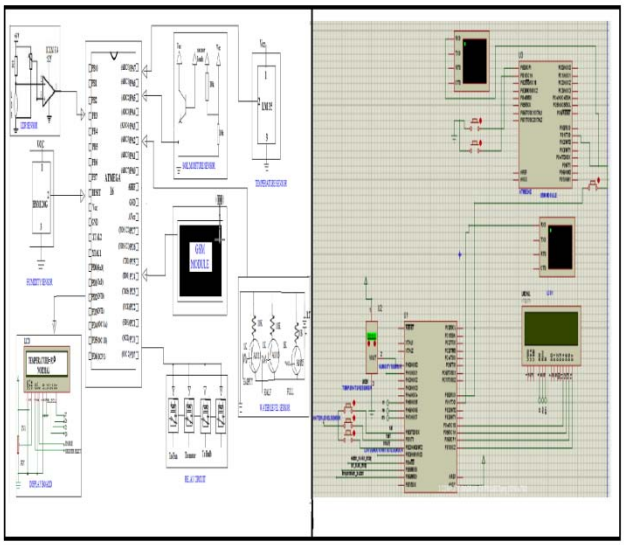

Figure1 :- circuit diagram with its simulation

This project led to several changes in the yield of crops it support the productivity of crops and as well the major criterion of temperature is also get controlled by this model. The temperature also led to severe damage to the crops as much as the plants are infected by insects the same quantity of crops is damage due to unfavourable temperature conditions. The crops in summer if get the temperature more that the efficiency of the fruit then the fruit starts to overripe or rotten and then insects start developing in that fruit. In this model we have provided a column in that temperature values are stored that are provided after our experiment of values by the manual method as well as wsn method, the wsn method was proved more beneficent than that to the manual method as it provides more accuracy and reliability. This stored values in the model works as a threshold value and automatically maintain the temperature which is not possible with manual method and as a result it also provides the motor facility for the crops automatically.

III. INSECTS MONITORED WITH THE HELP OF VIDEO AND MATLAB:-

(A) VIDEO PROCEDURE:-

Figure 2:- Robot for insect monitoring and its circuit diagram in dip trace.

The above project deal with the video processing in which it is shown that it deals with live video and as well with the images of insects from everywhere we want, it is a robot it can move anywhere according to the program burned in the controller as the program suggests numbering 1,2,3,4. If the user will press 1, the robot will move towards right and so on. The same is with camera position we can change it according to our specifications and the camera is made compatible through TV tuner which is attached to the laptop/pc at the receiver end. As there is no limit to catch

the video from distance we can take the clip as from far distance we want but for that we have to change the antenna according to the distance and the PCB designing of this project is made in dip trace through it we can have circuit diagram and we can have the pcb designing. For decoding the tone MT8870 decoder is used as it will receive the tone decodes it in binary number for example if we press the key 3 than the output that will be generated is "00000011". As a result it will built output for each and every input that is generated by the user through cell phone.

(B) MATLAB WORK:-

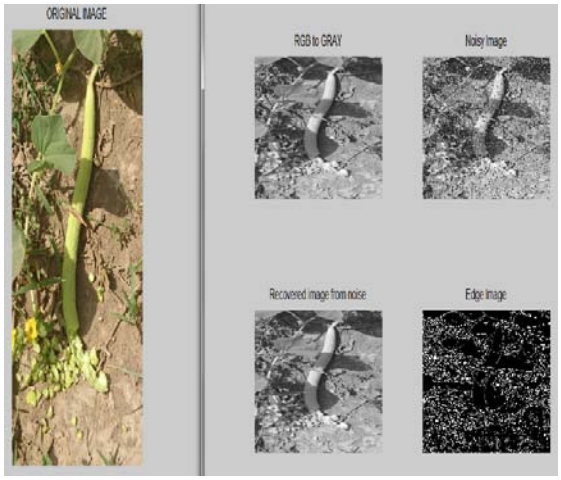

Figure 3:-Result showed for insect infected crop through image processing.

The above image is shown through the software known as Matlab by using image processing toolbox. This image shows how the infected crop can be captured and through Matlab it is sent to the user so that it can be monitored for its remedy such as pesticides etc. the Matlab only reads the grey image it does not generate output for coloured image so first the image is read and then it is converted into grey and as a result we get its noise and edge image **[6].** Below shown is the program that shows

Program:-

```
close all; clc; clear;

% READ THE ORIGINAL IMAGE

image1 = imread ('cucumber1.jpg');
figure (1)
imshow (image1)
title ('ORIGINAL IMAGE');

%//////////Convert into gray Image\\\\\\\\\\%

image1 = rgb2gray (image1);
image1 = imresize (image1,[300 500]);
%Displaying and storing the rbg2gray image
figure (2)
subplot (2, 2,1);
imshow(image1)
%a=size(image1)
title('RGB to GRAY');
imwrite(image1,'R2G.bmp');

%//////////Define Noise\\\\\\\\\\%
 %We may define noise to be any degradation in the image signal, caused by external disturbance.
image2 = imnoise (image1,'salt & pepper',0.1);
%image2= imnoise(image1,'speckle',0.05);
%image2 = imnoise(image1,'poisson')
%Displaying and storing the noised image
subplot(2,2,2);
imshow(image2);
title('Noisy Image')
imwrite(image2,'noisy.bmp');

%//////////Denoising\\\\\\\\\%

noise1 = double(image2) - double(image1);%  noise
image3 = double(image2) - double(noise1); % recovered image
image3 = uint8(image3);
%Displaying and storing the denoised image
subplot(2,2,3);
imshow(image3)
title('Recovered image from noise');
imwrite(image3,'denoise.

bmp');

%////////Edge Detection\\\\\\\\\\%

image4 = edge(image1,'prewitt',0.06);
%Displaying and storing the edged image
subplot(2,2,4);
imshow(image4);
title('Edge Image');
imwrite (image4,'edge.bmp');
```

The work done above is that the image of infected prone area is captured and then it is sent to user so that they can easily check the live condition of the fruits and vegetables and they don't need to come to the field every second and as a result the human labor is also reduced and the crop efficiency is increased.

This work alone in Matlab was not enough to control the insects then further we implied the technology that would help to recognise the insects with different frequencies, as each and every species of insects have different frequency so according to each and every type of insects the frequency will be calculated and then it will further stored to controller to process the work on the controlling the insects through the adequate amount of fertilizers. This all was explained in the graph below that how the procedure is continued. As through this easily the insects can be verified and treated according to the solution.

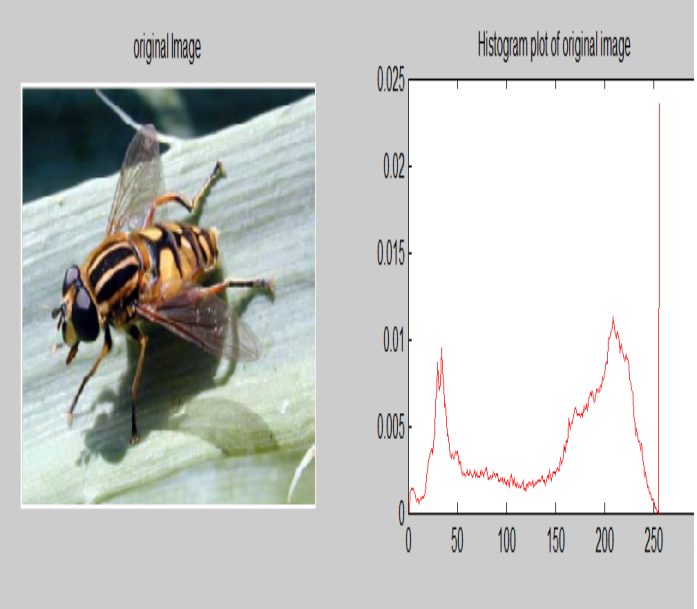

Figure4: -honey bee and its measured frequency

The frequency of the insect sound is measured above and then it is installed in the module, whenever the same frequency will be noticed because of the insects present in the field with the frequency that is stored before than the two frequencies will be matched and alert will be on then according to the needs of the quantity of insects the amount of the fertilizers/pesticides will be suggested as well.

```
clc; close all; clear all;
% read the image that is used for frequency.

I1 = imread ('bee.png');
 Im1 = im2double (I1);
 %   convert RGB to grayscale
Ima1 = rgb2gray (Im1);
 hm1 = imhist (Ima1)./numel(Ima1);
 figure
 subplot (2,2,1);
 imshow(I1)
 title('original Image')
 subplot(2,2,2);
 plot(hm1,'r')
 title('Histogram plot of original image')
 % Histogram Error
```

The above program in Matlab can be used to find the frequency of sound of various insects; the program explains that first the image captured is read out. As the insect will enter in the greenhouse it will have its unique sound frequency that will be tracked and if it will match with the existing frequency the buzzer will indicate that this is not the beneficial insect for the crop and as a result the pesticide with proper amount will be showered on the crops so that they can be saved at early stage of its growth.

IV. FUTURE WORK

As each and every insect have its unique odour and to measure that odour the sensors are available by this we can further elaborate this work in this direction and as well as sound can also measured through this sensors.

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Mr. Rashid Hussain, Rashid Hussain Tech, MBA pursuing PhD on topic "Application of WSN in Rural Development. Area of research is WSN application from rural as well as urban area. Paper published on 1.WSN application in Health monitoring.2.WSN application in intelligent traffic monitoring 3.WSN application in agriculture as well as water management etc.Member of Institute of Engineer, Members of extended Board of management.

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