

Smart Crop Cultivation with Disease Monitoring and Control System



T.Rajeshwari, P.A.Harsha Vardhini

Abstract— Agriculture plays a vital role in economic growth of every nation. In our nation major population - directly or indirectly depends on this sector. Technology growth introduced many automatic and intelligent systems that lead to smart agriculture. This paper presents high yield crop cultivation technique that monitors and also helps for the detection of germination of the disease and also to control the water supply to the plant. Various sensors are interfaced to the cultivation system for detecting the environmental conditions i.e., humidity, moisture, temperature across the farm. Wireless module is needed to transmit sensed data from Arduino to central unit (website) where data is stored, and analyzed. Arduino checks the present sensed data with disease condition (environmental) and soil condition, if the condition matches the sensed data, information is sent to the farmer and appropriate prevention methods will be implemented according to the condition of crop.

Index Terms— Crop Cultivation, Arduino, Disease control, high yield.

I. INTRODUCTION

Agriculture plays a major role for the economic growth of various countries. In our nation major population - directly or indirectly depends on this sector. Technology growth introduced many automatic and intelligent systems that lead to smart agriculture. High yield cultivation procedures are required to meet the nation needs. But at many places traditional farming practices, less usage of technology, poor infrastructure, low water supply, low soil fertility, climate change or diseases, dependence on the monsoon led to low yield. Out of these, low water supply and diseases based on climate change are the main factors which will decide the yield rate. Efficient cultivation is mostly needed to be implemented to maintain the soil moisture correctly and also to save water from the sources. Fungi, bacteria, and viruses, can be controlled by taking proper actions like applying proper pesticides which can kill insects at the beginning stage of parasite itself. Increase in yield rate can be acquired using smart crop cultivation system and controlling the crop disease by continuously monitoring them.

II. SMART CROP CULTIVATION

High crop yielding in cultivation is a challenging role. The advancement of technology will help the farmers to increase the crop gain. Demand of the agricultural products increase as there is rapid increase in population. The diseases in crops results in decrease of yield rate. So, large production rate can be perfectly achieved if a smart crop cultivation technique can be implemented with disease monitoring and controlling system.

Disease Epidemiology

Survey performed on different crops and their diseases with environmental conditions which are responsible for those particular diseases. The below Table.I shows disease epidemiology for 3 crops; Citrus, Groundnut, Cotton. The system proposed helps to predict the start of germination of the crop disease and also monitors the cultivation. System consists of sensing unit, GSM module, Arduino, WiFi Centrino module and Galileo gen2. Sensing unit read the different atmospheric and soil conditions.

Table I. Disease Epidemiology

S.No	Crop	Disease	Epidemiology	Pest Management
1	Citrus	Gummosis	Temperature 28° to 32°C and 65% soil moisture over a 15 days with high humidity	Spray Bordeaux. Mixture 1% alone or with tin sulphate (or) difolatan 0.3% or Metaloxyl Mencozeb 0.2%
2	Groundnut	Cercospora Leaf	Relative humidity exceeds 90 % and temperatures range between 20° to 29°C for six to seven days	Single spray at critical stage with carbendazim 0.1% + mancozeb (0.2%)
3	Cotton	Alternaria Blight	The mean temperature of 29°C with continuous drizzling rains and high relative humidity	Spray Dithane M- 48, Dithane Z-78, copper oxychloride (0.1%) or difolatan (0.2%) at 20 days interval for effective control.

The readings are given to Arduino and Galileo gen2. These readings display on Serial Monitor of Arduino Uno and Galileo gen2. Galileo gen2 transmits these sensor readings through WiFi centrino module to thingspeak website and also monitor the cultivation based on soil moisture sensor reading.

III. RESULTS

Proposed cultivation method is a reliable system that takes over the task of monitoring the irrigation and controlling the disease very accurately. Fig.1 depicts the interfacing of modules. Modules are Temperature Sensor, Humidity Sensor, Soil Moisture Sensor, Wireless module and MCU. Temperature and Humidity Sensor modules are giving analog input to Microcontroller unit through P0.28 (AD0.1) and P0.29 (AD0.2).



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* Correspondence Author

T.Rajeshwari*, Assistant Professor, Department of ECE, Vignan Institute of Technology and Science, Deshmukhi, Telangana, India.

P.A.Harsha Vardhini, Professor, Department of ECE, Vignan Institute of Technology and Science, Deshmukhi, Telangana, India.

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Soil Moisture Sensor is a digital input to MCU and a LED is connected to P1.23 to indicate soil condition (dried or wet).

The digital data of Temperature and Humidity and disease condition (reached or not) will be transmitted character by

character to CU (GUI) through wireless module. The MATLAB GUI at CU will display the received data to the farmer

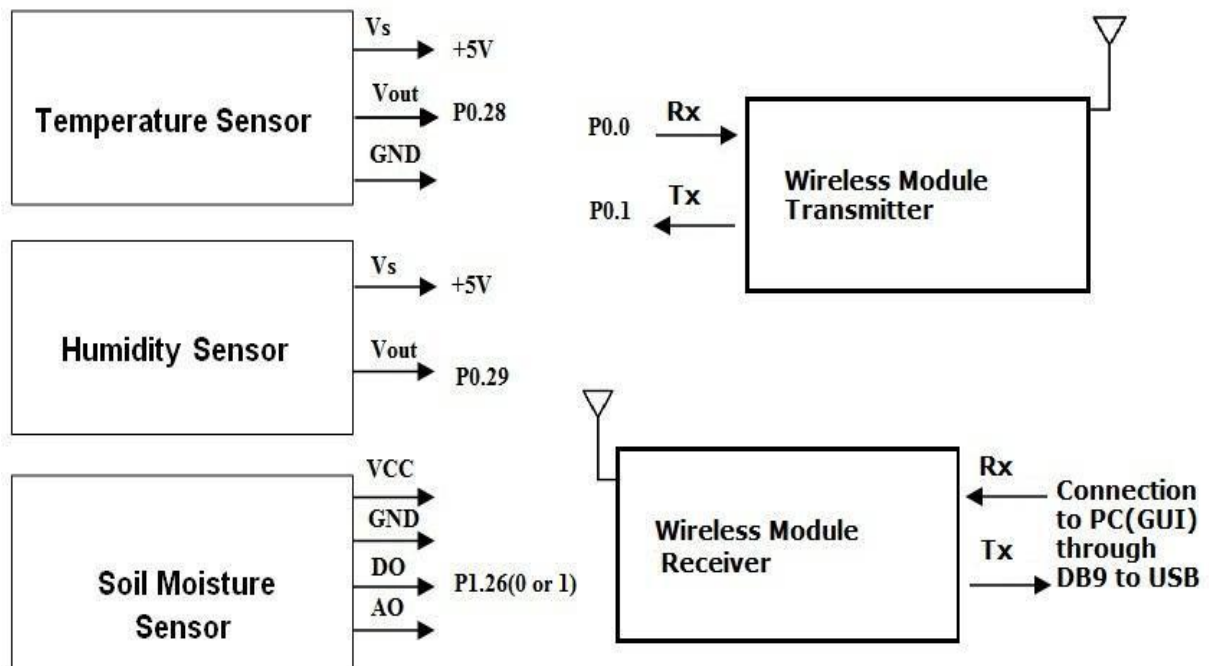


Fig. 1. Sensors and Wireless module Connections

Fig.2, Fig.3 and Fig.4 illustrates the screenshots of the procedure & selection of COM port.

Step1: Open Matlab GUI window



Fig.2. Matlab GUI window



Fig.3. selecting COM port

Step2: Selecting COM port

Step3: COM port selected



Fig.4. Screenshot showing the selection of COM port

Step4: Click on capture tool - get the sensor readings



Fig.5. Sensor reading

Fig. 5 depicts the onscreen presentation of the parameters read by the sensors placed or located at various places on the field. Fig.6 represents the indication of the crop condition and whether proper pesticide is needed for crop or not.

Results are by considering disease condition at temperature range 20⁰C to 30⁰C and relative humidity range 50% to 80%. If this condition is reached, Irrigation motor will be off and a warning message will be displayed with pesticides.

Step 5: Disease condition- pesticide indication



Fig.6 Disease condition- Pesticide indication



Fig.7. Indication of no disease condition

Fig.8 depicts the prototype implemented that operates at various environmental conditions. Temperature, Humidity and the moisture content of the soil are being detected. Parameters sensed and read by the sensors ie., the data recorded is transferred to the receiver section. In the open fields or in the green house structures, the proposed system not only monitors the environmental conditions but also detects the start of the disease in the crop. With the noted readings and continuous monitoring of the crop, corresponding pesticides can be given and decrease the effect of disease on the crop.

This helps for high yield using smart cultivation technique. Wireless module helps us to locate and relocate the sensors in the field. With the data monitored by the sensors, supply of water to different parts of the fields as per the requirement will be done.

This is an added advantage as it overcomes water scarcity problem. Proposed work with continuous monitoring can control the percentage of crop affected by the change of weather by proper application of pesticides based on the region and crop condition. Smart cultivation system with crop disease detection can be implemented by farmers for high yield with minimum resources.

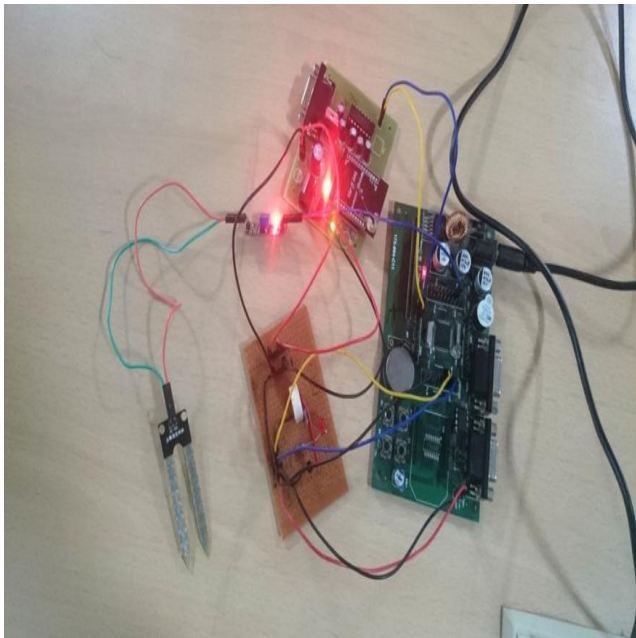


Fig. 8. Crop Protection system

IV. CONCLUSION

Crop cultivation system to detect the start of germination of the disease and also to control the water supply to the plant is implemented with arduino suitable for various environmental conditions. Solar energy can be used to provide power supply to each sensor module in the field throughout the season. Real Time Clock and all the ADC channels of LPC2148 can be used to increase the accuracy in predicting the disease. Disease condition can be sent to the farmer using GSM module and different types of unknown diseases can be analyzed by the researchers with the help of data acquired by this proposed system.

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