Predictive Crop Cultivation and Crop Defect Detection

Barshasree Ajum[1], Gargi Kumari[2], Kritika Surya[3], Asst. Prof. Y. R. Dhumal[4]
[1, 2, 3] E&TC, University of Pune, Maharashtra, India
[4] E&TC, BVCOEW, India

Abstract- The major problem faced by farmers today is low productivity and poor quality of crops. Most of the time, the farmers are unaware about which crop is to be grown at a particular season. To overcome this problem, we are proposing a system that would predict which crop is to be cultivated on the basis of analysis of parameters of soil and the environment such as temperature, humidity, colour, and moisture. For this each farmer will be provided a unique RFID tag in which all the information regarding the soil and the crops will be stored. If the farmer cultivates the particular crop that has been predicted then he will be provided subsidiary by the government if any mishap occurs. Our second step is to increase the quality of the crop. For this, we are using images of the crops to determine the percentage of defected crops after they have grown up to a certain height, through image processing. We are also introducing a control system that would notify the farmer about the present situation of his crops through GSM.

Key words- RFID reader, GSM, image processing

I.   INTRODUCTION

PREDICTIVE METHOD: Predictive crop cultivation means estimation of the crop that is best suited to that particular season which would yield maximum output. To reach this goal, we are analyzing the basic statistical parameters of the soil and the environment, that is, humidity, moisture, water level, colour and temperature using an ARM7 microcontroller.

IMAGE PROCESSING: Prior to the cultivation, images of the ground will be taken. Based on the analysis of the image and the values of the parameters of the soil, an optimum crop to be cultivated will be estimated. This estimation is done after comparing the values with the standard database that is stored in the PC. To determine the percentage of defected crops, we will be taking regular images of the crops. Through analysis and comparison of the images and the standard database stored in the PC, we will check the defected crops. This result will be notified to the farmer via an SMS.

GOVERNMENT AUTHENTICATION: Each farmer is provided with a unique RFID tag which will be registered with the government. After receiving the message about the defects in the crops, a notification will be sent to the government server about the farmer's loss. In accordance with the percentage of defected crop the farmer would be provided subsidiary which would eliminate any possibility of falsehood from the farmer's side.

II.   DESIGN OF THE SYSTEM
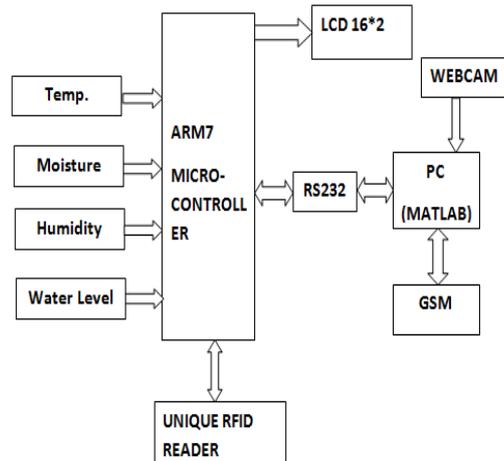
Work flow of the system:
- Each farmer will be provided with a unique RFID reader. All the details about the soil parameters and its related predicted crop will be stored.
- If the farmer cultivates the crop that has been predicted then he will be provided subsidiary as and when required.
- The webcam is basically used to take the images of the soil to analyze the color of the soil.

- Parameters of the soil such as temperature, moisture, water level of the particular area is being sensed via the sensors and given to the microcontroller
- The data from the microcontroller and the image from the webcam are compared with the standard database prepared.
- In accordance with the change in the data received, the particular crop to be cultivated is estimated.
- After the crop grows till a certain height, the regular images of the crops are taken. These images are then analyzed for any defects or color change.
- This result is notified to the farmer as an SMS alert via GSM

III.   HARDWARE DESCRIPTION

1. **LIQUID CRYSTAL DISPLAY:** LCD is used in a project to visualize the output of the application. We have used 16x2 LCD which indicates 16 columns and 2 rows. So, we can write 16 characters in each line. So, total 32 characters we can display on 16x2 LCD.


2. **RS 232:** RS 232 IC is a driver IC to convert the µC TTL logic (0-5) to the RS232 logic (+-9v).Many device today work on RS 232 logic such as PC, GSM modem , GPS etc. so in order to communicate with such devices we have to bring the logic levels to the 232 logic (+/-9v).

3. **ARM7 MICROCONTROLLER:** The microcontroller used is LPC 2138 which is based on a 16/32-bit ARM7TDMI-SCPU with real-time emulation and embedded trace support, that combine the microcontroller with 32 kB, 64 kB, 128 kB, 256 kB and 512 kB of embedded high-speed flash memory. The sensors used for sensing parameters like temperature, moisture, humidity and water level are given as input to the microcontroller. The data from the microcontroller are compared with the standard database prepared.

4. **TEMPERATURE SENSOR:** Temperature sensor is used to sense the temperature. We have used a Temperature sensor called LM35. This temperature sensor can sense the temperature of the atmosphere around it or the temperature of any machine to which it is connected or even can give the temperature of the human body in case if used. The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature.
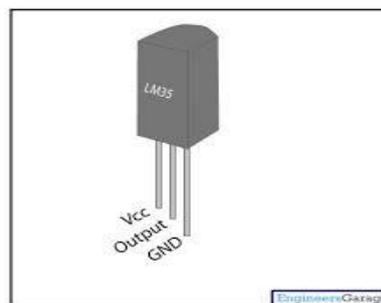
5. **HUMIDITY SENSOR:** Humidity sensor is an analog sensor and gives the output into form of analog signal. This signal is feed to ADC which will convert it into digital form. Once converted into analog form, the microcontroller can process the digital humidity signal as per the application. This sensor gives the value of change in humidity in the atmosphere as per the application.

6. **MOISTURE SENSOR:** Here we are connecting a moisture based Electrode sensor. As soon as the water dries up then the electrode voltage rises to 5v which is applied to the non inverting terminal and the output of the amplifier is 0v which will in turn, turn on the AC motor.

7. **GSM MODEM:** GSM (Global System for Mobile communication) is a digital mobile telephony system. With the help of GSM module interfaced, we can send short text messages to the required authorities as per the application. GSM module is provided by SIM uses the mobile service provider and send SMS to the respective authorities as per programmed.

8. **RFID:** The RFID reader interfaced with the microcontroller is used for authentication through the government to provide subsidiary to the farmer as per his loss in crops. This would eliminate any extra usage of pesticides etc and also any falsehood from the farmer's side.

IV.   SOFTWARE DESCRIPTION

Predictive crop cultivation
1. Start
2. Initialize LCD "A"
3. Select Channel 1, read ADC and store and display Temperature on LCD
4. Select Channel 2, read ADC and store and display Humidity on LCD
5. Select Channel 3, read ADC and store and display Soil Moisture on LCD
6. Is Serial Interrupt detected? If no then return to "A"
7. If yes then Select crop 1, go to "A"
8. If no then, check interrupt? If yes then select crop 2 go to "A"
9. If no then, check interrupt? If yes then select crop 3 go to "A"
10. If no then, select crop 4 go to "A"
11. Update the RFID reader according to the data received by the hardware.

Crop defect detection
1. Start
2. Clear screen &all parameters
3. Initialize Camera
4. Initialize Serial Port Baud rate 9600
5. Take Picture from Camera
6. Adjust resolution (Reduce resolution)
7. Use HSV function to determine the color and texture
8. Compare with the standard database
9. Send indication to hardware via serial port
10. Update the RFID reader according to the data received by the hardware
11. Send message via GSM module to the device

V.   ADVANTAGES
- Increases the productivity of the land by predicting the optimum crop to be grown
- Early detection of the defected crops is possible so that the farmer incurs less loss
- Proper and accurate subsidiary from the government is ensured to the farmer

VI.   DISADVANTAGES
- We need to frequently update the database required to study the crops and soil
- Need of high skills to study the defected crops

VII.   APPLICATIONS
- This project is especially designed for use in the agricultural sector. The farmers can use this to predict the optimum crop to be grown in that particular season based on the analysis of soil and its parameters.
- This project also identifies the amount of defected crops in the field by taking photos of the crops. The farmers are notified and updated regularly to avoid any kind of loss. Also government subsidiary can be claimed based on the analysis.

VIII.   CONCLUSION
This project allows a very good method for crop cultivation and monitoring of crop grown, by detecting the defects in the crop which will be very much helpful in optimum growth of plants and solve the issues related with subsidiary.

REFERENCES
[1]   Bus, Jvfang Jin and Baoqiang Wang: "Design of Automatic Meteorological Data Acquisition System Based on ARM and CAN" . 978-0-7695-3962-1/10 $26.00 © 2010 IEEE.

[2]   Gracon H. E. L. de Lima, Lenardo C. e Silva, Pedro F. R.Neto WSN as a Tool for Supporting Agriculture in the Precision Irrigation" 2010 Sixth International Conference on Networking and Services.

[3]   *Dr.K.Thangadurai , K.Padmavat* " Computer Vision image Enhancement For Plant Leaves Disease Detection" 2014 World Congress on Computing and Communication Technologies.

[4]   Andrew J. Phillips, Nathaniel K. Newlands, Steve H.L. Liang, Benjamin H. Ellert, 2014 Crown Copyright and Elsevier B.V. Published by Elsevier B.V. "Integrated sensing of soil moisture at the field-scale: Measuring, modeling and sharing for improved agricultural decision support"

[5]   Anup Vibhute and S K Bodhe, "Applications of Image Processing in Agriculture: A Survey", International Journal of Computer Applications (0975 – 8887) Volume 52– No.2, August 2012