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Smart Irrigation and Pesticides Management Using Worm Detection System

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***Abstract* - Agriculture is one of the most important factors for economic growth for any country. Agriculture plays a very crucial role in increasing the economy of many developing countries. India, being one of the major countries in the world for producing vast amounts of different crops, still uses traditional techniques in the field of agriculture. Farmers not only face problems in coping with the changing climatic conditions but also need to meet up the rising demands of higher food production with good quality. As a matter of fact, Farmers need to be aware of the changing climatic conditions in order for them to yield quality crops. Smart Irrigation would not only help farmers monitor their crops in real time but also would help in recommendations regarding crops and fertilizers. For Worm Detection, we have used image processing using openCV. This paper focuses on proposing Smart Irrigation and Pesticides Management using Worm Detection System, which would help farmers, get recommendations based on various factors like humidity, temperature, and moisture.**

Keywords: Agriculture, Worm Detection, Image Processing, OpenCV, Smart Irrigation, etc.

I. INTRODUCTION

The development and usage of Smart Agriculture systems is changing the field of agriculture sector by not only improving the crop production but also making it cost effective. The agriculture sector has gone through a constructional transformation in recent years, demonstrated by hikes in prices and guided by population growth and urbanization. There is no hesitation that the government needs to invest in the agriculture sector in order for it to bloom. The world seems to be making advancements in the field of technology and it is necessary to make reasonable advancements in the field of agriculture as well. According to the World Bank, the food consumption would increase by 50% by 2050 if the global population continues to rise at its current pace.

As a matter of fact, the effects of drastic changes in climatic conditions have seen crops yield falling by more than a quarter. There needs to be a focus on the implementation of smart technologies in the field of agriculture to yield quality and bulk production of crops. The Machine Learning can certainly help in lowering the cost and also help in increasing the scale of production through the collection of time series data from sensors. There are certain factors, which play a vital role in the production of crops. Nearly 51% of the crop yield is dependent on the influence of these factors. These factors include precipitation, temperature, humidity, and moisture.

In order to avoid this problem for poor irrigation and worm affection in plants in this project work is to implement the automatic irrigation and worm detection in the field using a PC with open computer vision application software. First step is image acquisition. The web camera can be placed in the particular field to capture the dry and worm infected plants in the field. Image captured by web camera can be uploaded in software. Then the image will go for next stage Preprocessing. Pre-processing typically includes operations like image de-noising, image content enhancement, and segmentation. These can be applied in parallel or individually, and they may be performed several times until the quality of the image is satisfactory. Feature extraction refers to taking measurements, geometric or otherwise, of possibly segmented, meaningful regions in the image. Features are described by a set of numbers that characterize some property of the plant or the plant's organs captured in the images (aka descriptors). In the classification step, all extracted features are concatenated into a feature vector, which is then being classified. The main objectives of this paper are reviewing research done in the field of automated plant species identification using computer vision techniques, to highlight challenges of research, and to motivate greater efforts for solving a range of important, timely, and practical problems.

II. LITERATURE REVIEW

If climatic condition is hot, dry, sunny, windy then there is need of high amount of water for crops and if these factors

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are like cold, humid, cloudy, little wind then we need less water for the crops. Earlier study model conceptualized a system that consist of six parts that are monitoring, management, planning, Information Distribution, decision support and control action. And above study model does data analysis for better decision support [1].

In [2], a GSM based smart farming system was proposed for doing automation of several farming tasks. Automation is proposed by smart irrigator that moves on mechanical bridge slider arrangement. The smart irrigator receives signal from smart farm sensing system through GSM module. Then sensed data is transfer towards central database from which all crop details are analysed and transferred to irrigator system to perform automatic actions.

IoT based smart Agriculture [3] gives information about irrigation having facilities like smart control and making intelligent decision depending upon real time data from fields. All these operations will be controlled through any smart device placed remotely and the interfacing sensors are used to perform operations along with Wi-Fi, actuators and other hardware devices. The whole system was developed using infield sensors which collects data from farm and using GPS data is sent to the base station where necessary actions are determined to control irrigation according to database available with the system. Researcher's measure soil related parameters such as humidity and moisture important for the growth of any crop.

Auto mode and Manual mode are the two modes of operation of the system. System takes its own decisions and controls the installed devices and user can control the operations of system using android app or commands in auto and manual mode respectively. Internet of Things is proven to be a cost effective and reliable technology to implement smart systems [5]. In smart village system advance rural connectivity is enabled through web service and measuring different environmental factors real time.

System proposed in [6] suggests use of IoT in almost all phases like growing, harvesting, packaging, transportation. Real time data provided by sensors, RFID tags in all the above phases of cultivation of crop will help farmers and all the stake holders to have complete view of the product right from the production to sales.

Automated farming system proposed in [7] turns on the motor on/off depending on the moisture values from the moisture sensor and turn the lights in the green house on or off based on the light sensors. Actuators are used to control the motor. Automated system definitely helps farmer in increasing the yield of crops.

Paper [8] produces an agricultural model in IoT environment which is human centric. It incorporates IoT and cloud computing ubiquitously to remove the inefficiency and lack of management, which are the root of problems in agriculture.

III. METHODOLOGY

The working of project is in two phase:

Software Phase

- First, the real time images of various leaves are acquired using a camera.
- Through OpenCV the features of the image are extracted and the output is given to program.
- Then various image-processing methods are applied to the acquired images to getting useful features that are important for next analysis process.
- Pre-processing will also be consisting of conversion of RGB to grey, as grey scale image gives perfect accuracy to worm detection.
- Feature extraction process will consist actual worm detection from an image by comparing the image with non-defected images.
- After that, many analytical techniques or methods are carried out to classify the images according to the particular problem at hand.
- The proposed working process is worm identification using automation.

Hardware Phase

- The Arduino integrated development environment (IDE) is used for the Processing programming language and the Wiring projects. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation. Arduino version is used here for interfacing purpose. It is also capable of compiling and uploading programs to the board with a single click. Arduino programs are written in C or C++. The board is equipped with 6 analog inputs and 14 digital input output pins. It acts as a communication interface which can include USB interface used for programming. It consists of power jack, reset button, flash memory of 32 kb, SRAM and EEPROM, clockspeed (16MHz) and it operates on 7 to 12 V.

IV. SOFTWARE DESIGN

In this project we are design the irrigation system and worm hole identification using opencv here:

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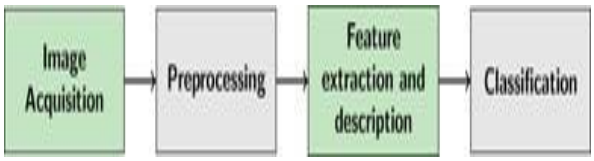

Figure 1: System Architecture

Image acquisition:

The purpose of this step is to obtain the image of a whole plant or its organs so that analysis towards classification can be performed.

Pre-processing:

The aim of image pre-processing is enhancing image data so that undesired distortions are suppressed and image features that are relevant for further processing are emphasized. The pre-processing sub-process receives an image as input and generates a modified image as output, suitable for the next step, the feature extraction. Pre-processing typically includes operations like image de-noising, image content enhancement, and segmentation. These can be applied in parallel or individually, and they may be performed several times until the quality of the image is satisfactory.

Feature extraction:

Feature extraction refers to taking measurements, geometric or otherwise, of possibly segmented, meaningful regions in the image. Features are described by a set of numbers that characterize some property of the plant or the plant's organs captured in the images (aka descriptors).

Classification:

In the classification step, all extracted features are concatenated into a feature vector, which is then being classified. The main objectives of this paper are reviewing research done in the field of automated plant species identification using computer vision techniques, to highlight challenges of research, and to motivate greater efforts for solving a range of important, timely, and practical problems. More specifically, we focus on the Image Acquisition and the Feature Extraction and Description step of the discussed process since these are highly influenced by the object type to be classified, i.e., plant species. A detailed analysis of the pre-processing and the Classification steps is beyond the possibilities of this review. Furthermore, the applied methods within these steps are more generic and mostly independent of the classified object type.

V. HARDWARE DESIGN

- The block diagram consists of Atmega 328 smd controller, Soil Moisture Sensor, Water Level Sensor, Temperature Humidity Sensor, LCD Display, Relay Module, Water Pump, Buzzer and Power Adapter, etc.

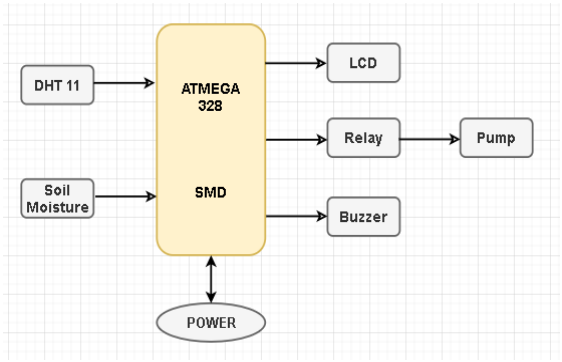

Figure 2: Block Diagram

- Atmega 328 is the central part of the proposed system. It has given 12V 1.3A Power Supply using Power Adapter.
- There will be a low-level hardware device that will measure different variables of the surroundings like temperature, humidity, soil moisture sensor.
- The measured values will then be transferred to microcontroller for further processing.
- Atmega328p smd will check the threshold value of sensor and if below threshold value detected then it will on relay to start the pump.
- If value of sensor is below threshold, then it will give buzzer.
- It will also display it on LCD Display. LCD Display will also display the project name
- Following figure shows the flowchart of the system:

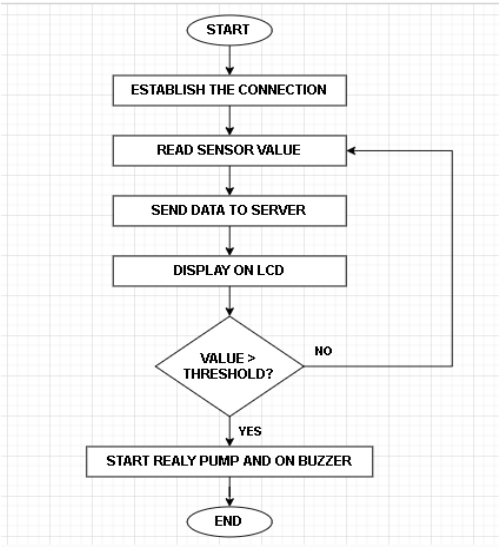

Figure 2: Flowchart of the System

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VI. RESULT AND DISCUSSIONS

A) Smart Irrigation

Irrigation System is used to generate decisions regarding irrigation using real time data.

System is implemented in three phases.

1. Sensing
2. Processing
3. Information distribution.

In sensing phase, various sensors like temperature, moisture, humidity are attached to the Arduino board to sense the soil, air and water characteristics of the field. They sense the real time environmental values and transfer it to controller.

In Processing phase, this sensed values are processed to the Arduino for further process. Arduino will check the threshold value of each input.

In information Distribution phase, processed value of sensors are displayed on LCD.

The Hardware Setup of the system is as follows:

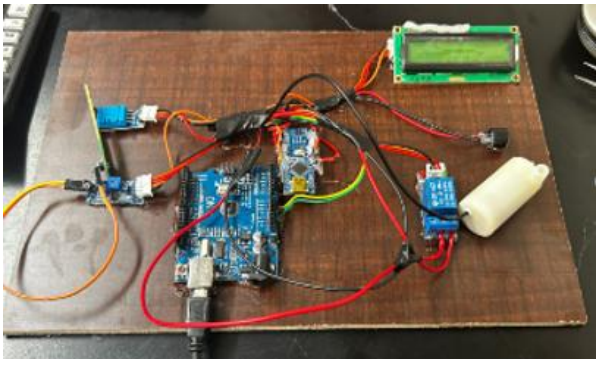

Figure 4: Hardware Setup

B) Worm Detection

- In this work, a system is developed to determine to the quality of the crop. The proposed method uses the image processing to detect the condition of the crop, which are then compared with the dataset to check whether the collected values falls in to the range specified in the dataset.
- The proposed model can be used in different areas by farmers, industrialists, botanists, food engineers and physicians.
- Here we can build an automated system so that it is useful for the large scale production and also helps in early detection of the worms that helps the clients for the better performance and enhances the crop yield.
- The proposed system is limited to only detect whether the crop under consideration is healthy or wormed.
- This can be further carried out for even recognizing the kind of worms in the soil and classification of those worms.

Figure 5: Result 1

Figure 6: Result 2

Figure 7: Result 3

VII. CONCLUSION

Agriculture is one of the major sectors for the economic development of India. The traditional agricultural sector, which include farmers, seem to suffer from various problems like inadequate crop growth and inadequate climate conditions.

Irrigation System is proved to be very helpful for farmers since over also shows that less irrigation is not good for farming. Threshold values for climatic conditions like humidity, temperature, moisture can be fixed based on the environmental conditions of that particular region. This system generates irrigation schedule based on the sensed real

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time data from field. This system recommends farmer whether or not, is there a need for irrigation.

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The proposed model can be used in different areas by farmers, industrialists, botanists, food engineers and physicians.

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