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Implementation Of Smart Farming Using Data Analysis Based On Iot And Machine Learning

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ABSTRACT

Agriculture plays a vital role in the development of our country. In India about 70% of population depends on farming and one third of the nation‘s capital comes from farming. Issues concerning agriculture have been always hindering the development of the country. The only solution to this problem is agriculture by modernizing the current traditional methods of farming. Hence this project aims at monitoring the temperature and moisture sensor using the necessary sensors. Measurement of these factors using these sensors in agriculture can be referred to as smart agriculture. Therefore this modern agriculture can positively impact the planet in immeasurable ways. It improves the yield of crops of all kinds, decreasing the dependence on pesticides, reducing operational costs, optimizing water usage, and ensuring better land management and crop rotation. To ensure better farming method and to get maximum yield with less resources using Communication technology we can monitor live field condition to take corrective action. Hence as advancement in this field, the project presents about the image processing techniques and various sensors for the development and yield of crops

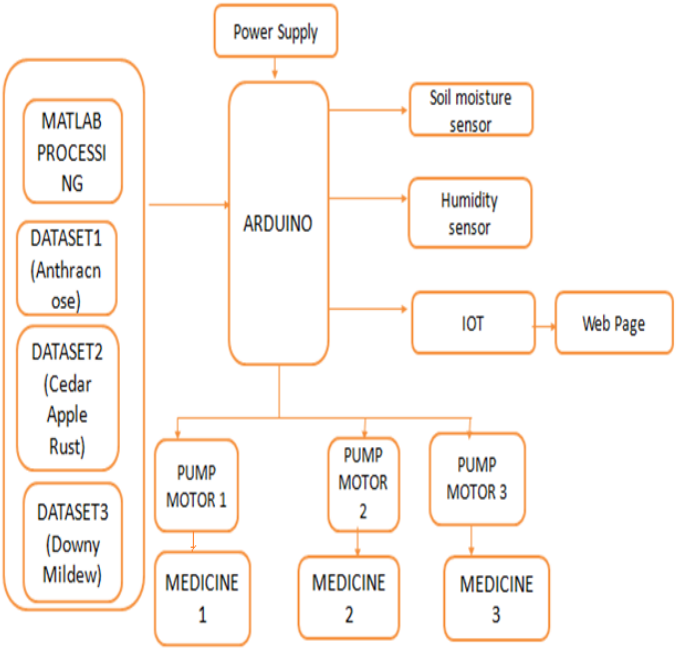
INTRODUCTION

Farming in India is done using the mundane ways. The fact that most of our farmers lack proper knowledge makes it even more erratic. portion of farming and agricultural activities are based on the predictions, which at times fail. Farmers have to bear huge losses and at times they end up committing suicide. Since we know the benefits of proper soil moisture and its quality, air quality and irrigation, in the growth of crops, such parameters cannot be ignored.

We, therefore, have come up with a new idea of crop monitoring and smart farming using IOT. We believe that our concept will be a benchmark in the agribusiness due to its reliability and remote monitoring. Our idea tries to digitalize farming and agricultural activities so that the farmers can

check on the requirements of the crops and accurately predict their growth.This concept will surely accelerate their business to reach new heights and also be more profitable. The implementation of our project largely depends upon the awareness among farmers, which, we believe will be easily created due to its numerous advantages. It aims in using various sensors like moisture, humidity and temperature sensor for determining climatic factors linked to the processor Arduino UNO and storing the data in UART module for future use.

Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with AC-to-DC adapter or battery to get started. You can tinker with your UNO without caring too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in Italian and was chosen to mark the release of Arduino Software(IDE) 1.0. This will avoid consumption of more time and also helps in high yielding of crops. Detection of pests in the paddy fields is a major challenge in the field of agriculture. Therefore effective measures should be developed to fight the infestation while minimizing the use of pesticides.



The techniques of image analysis are extensively applied to agricultural science, and it provides maximum protection to crops, which can ultimately lead to better crop management and production. Monitoring of pests infestation relies on manpower, however automatic monitoring has been advancing in order to minimize human efforts and errors. India is a cultivated country and about 70% of the population depends on agriculture. Farmers have large range of diversity for selecting various suitable crops and finding the suitable pesticides for plant.

DETAILED DESCRIPTION

In our proposed system image processing techniques are used to detect and remove noises in each and every pixel thus making the filtration process effective and used for feature extraction. More formally, a support vector machine constructs a hyperplane or set of hyperplanes in a high- or infinite-dimensional space, which can be used for classification, regression, or other tasks. Intuitively, a good separation is achieved by the hyperplane that has the largest distance to the nearest training-data point of any class (socalled functional margin), since in general the larger the margin the lower the generalization error of the classifier.

Fig 1: Block diagram of the project

Whereas the original problem may be stated in a finite dimensional space, it often happens that the sets to discriminate are not linearly separable in that space. For this reason, it was proposed that the original finite-dimensional space be mapped into a much higher-dimensional space, presumably making the separation easier in that space.

To keep the computational load reasonable, the mappings used by SVM schemes are designed to ensure that dot products may be computed easily in terms of the variables in the original space, by defining them in terms of a kernel function k (x , y) selected to suit the problem. The hyper planes in the higher-dimensional space are defined as the set of points whose dot product with a vector in that space is constant. .the block diagram is shown above fig1.

SOFTWARE DESIGN

MATLAB

MATLAB is a high-level technical computing language and interactive environment for algorithm development, data visualization, data analysis, and numerical computation. Using MATLAB, you can solve technical computing problems faster than with traditional programming languages, such as C, C++, and Fortran. Its standard data type is the matrix all data are considered to be matrices of some sort. Images, of course, are matrices whose elements are the grey values (or possibly the RGB values) of its pixels. Single values are considered by MATLAB to be matrices, while a string is merely a matrix of characters; being the string's length.

When working with images in MATLAB, there are many things to keep in mind such as loading an image, using the right format, saving the data as different data types, how to display an image, conversion between different image formats.Image Processing Toolbox provides a comprehensive set of reference- standard algorithms and graphical tools for image processing, analysis, visualization, and algorithm development. Image enhancement, image deblurring, feature detection, noise reduction, image segmentation, spatial transformations, and image registration can be performed. Many functions in the toolbox are multithreaded to take advantage of multicore and multiprocessor computers.

IMAGE PROCESSING

- An image is an array or a matrix of square pixels (picture elements) arranged in columns and rows.
- An image (from Latin: imago) is an artifact, for example a two-dimensional
- Image processing is a subset of the electronic domain where in the image is converted to an array of small integers, called pixels
- Pixels transform into inches through what is called “resolution,” -- the number of pixels per square inch on a computer.

- Resolution allows you to transform pixels into inches and back again.

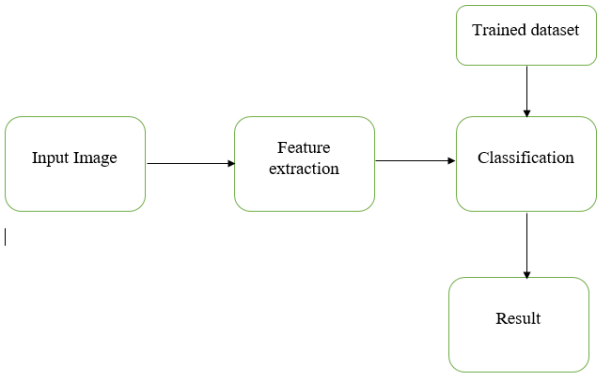


Fig 2:Block Diagram of Image Processing

RGB TO GRAY SCALE CONVERSION

- Conversion of a color image to grayscale is not unique; different weighting of the color channels effectively represent the effect of shooting black-and-white film with different-colored photographic filters on the cameras.
- To convert a color from a color space based on an RGB color model to a grayscale representation of its luminance, weighted sums must be calculated in a linear RGB space, that is, after the gamma compression function has been removed first via gamma expansion.
- I = rgb2gray (RGB) converts the true color image RGB to the grayscale intensity image I. The rgb2gray function converts RGB images to grayscale by eliminating the hue and saturation information while retaining the luminance**.**

PRE-PROCESSING STAGE

- The image sequence obtained for different d values (noise density) of noise added to the image LG confirms, in all cases, the necessity and reasonableness. The next step of image pre-processing is normalization.
- Images LG coming from different human populations obtained under various conditions are characterized by various parameters relating to brightness.
- In general, these images have a histogram shifted towards the darker pixels.
- Therefore, it is necessary to carry out normalization. Image normalization can be carried out in two different ways:
  - Normalization of the entire image to the range of brightness values from 0 to 1.
  - Normalization of individual columns or rows to a range of brightness values from 0 to 1.

Fig3 shows that the preprocessing will eliminate errors caused during taking the image and to reduce brightness effects on the image. The original images are resized from 150*130 to 256*256

to use in CVIP tools. Images in green bands show fundus structures most reliably.So, the green band was extracted.

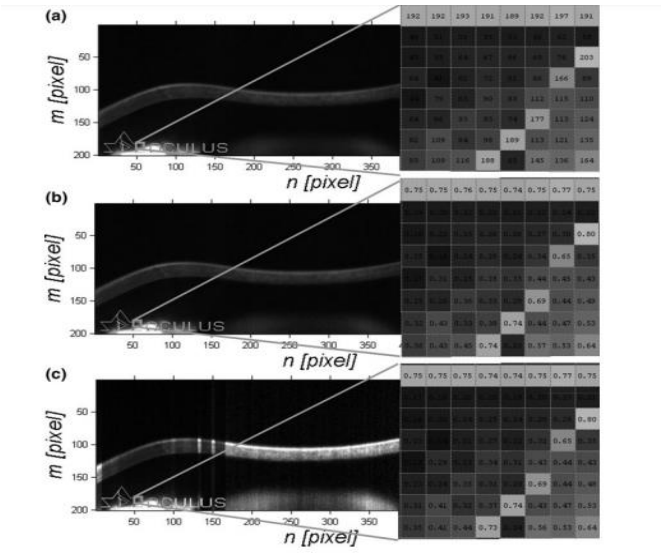


Fig 3:Preprocessing Image

FEATURE EXTRACTION

Feature extraction is done for dimensionality reduction process in which raw data is divided and reduced to more manageable groups.

Feature extraction is a part of the dimensionality reduction process, in which, an initial set of the raw data is divided and reduced to more manageable groups. So when you want to process it will be easier. The most important characteristic of these large data sets is that they have a large number of variables. These variables require a lot of computing resources to process them. So Feature extraction helps to get the best feature from those big data sets by select and combine variables into features, thus, effectively reducing the amount of data. These features are easy to process, but still able to describe the actual data set with the accuracy and originality.

The technique of extracting the features is useful when you have a large data set and need to reduce the number of resources without losing any important or relevant information. Feature extraction helps to reduce the amount of redundant data from the data set.

In the end, the reduction of the data helps to build the model with less machine's efforts and also increase the speed of learning and generalization steps in the machine learning process.

CLASSIFICATION

Support Vector Machine (SVM) classifier used for classification.The general framework to measure the accuracy of a SVM on a given database is composed of the following stages:

- Preprocessing of the images in the database
- Separation of the database in training and test sets
- Choice of the representation of the input data

- Choice of the way of training, which includes:
    - Method of multi-class training
    - Value of the penalty term C
    - Choice of the kernel
- Training
- Test and evaluation of the performance

Support Vector Machine or SVM is one of the most popular Supervised Learning algorithms, which is used for Classification as well as Regression problems. However, primarily, it is used for Classification problems in Machine Learning.

The goal of the SVM algorithm is to create the best line or decision boundary that can segregate n-dimensional space into classes so that we can easily put the new data point in the correct category in the future. This best decision boundary is called a hyperplane.

SVM chooses the extreme points/vectors that help in creating the hyperplane. These extreme cases are called as support vectors, and hence algorithm is termed as Support Vector Machine.

HARDWARE DESIGN

COMPONENTS

i. PUMP MOTORS

A DC motor is used to drive a mechanical load. In this , a separately excited DC generator provides the load. The load on the motor is adjusted by varying the generator field current.

By increasing the field current of the DC generator, the load on the DC motor increases and thus the armature current increases.

ii. RELAY

A Relay Is A Electromagnetic Switch. It Is Used In Application To Turn On And Of A Circuit By Low Power Signal 24v, Or Several Circuits Must Be Controlled By One Signal.

iii. POWER SUPPLY UNIT

DC is usually somewhere between 12 and 30 volts, depending on the source - far too low voltage to power appliance designed to run from outlets. To increase the voltage, a DC to AC converter uses a component called a step-up transformer. In a transformer, AC electricity flows through a coil of wire

iv. UART RS232 CABLE

An RS-232 Serial Port Was Once A Standard Feature Of A Personal Computer, Used For Connections To Modems, Printers, Mice, Data Storage, Uninterruptible Power Supplies, And Other Peripheral Devices.

v. DRIVER UNIT

A small motor can be started by simply connecting it to power. A larger motor requires a specialized switching unit called a motor starter or motor contactor. When energized, a direct on

line (DOL) starter immediately connects the motor terminals directly to the power supply. In smaller sizes a motor starter is a manually operated switch; larger motors, or those requiring remote or automatic control, use magnetic contactors. Very large motors running on medium voltage power supplies (thousands of volts) may use power circuit breakers as switching elements.

vi. SENSORS

a) PIR SENSOR

When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors. When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a positive differential change between the two halves.

b) MOISTURE SENSOR

This sensor intimates us about the moisture content in the soil.it has two electrodes placed in the soil .depending upon the moisture content present in the soil the conductivity between the two electrods varies.the change in the conductivity is is reflected in the output .

c) TEMPERATURE SENSOR

Temperature is the most often-measured environmental quantity.

vii. ARDUINO AND ITS PROGRAMMING

Arduino is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board. fig 4 is the Arduino used in our project. Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can communicate with software running on your computer. The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free.

The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.

Arduino Uno:

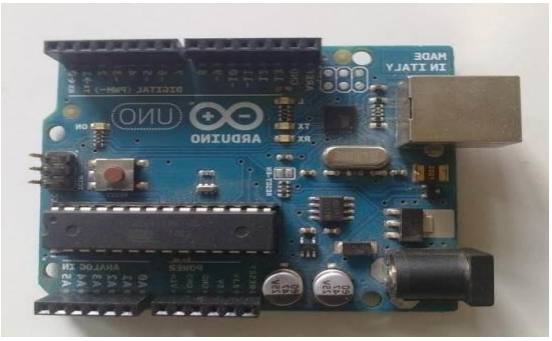


Fig 4:Arduino Microcontroller

PROPOSED MODEL

The Principle of operation is quite simple.Fig 5 shows the detailed process done in the project. First, the captured image is given as the input . Preprocessing will eliminate errors caused during taking the image and to reduce brightness effects on the image.

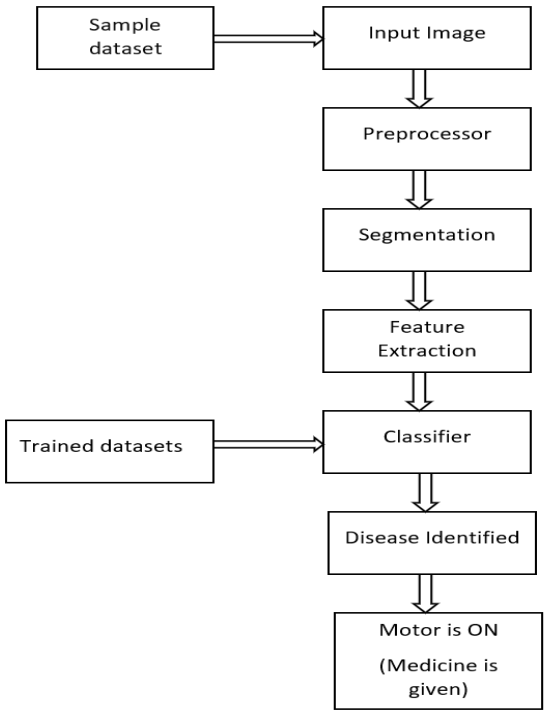


Fig 5: Work Flow of the Project

Feature extraction is used for dimensionality reduction process. Classification will be executed after feature extraction Fig 6 shows the input image is compared with trained dataset and the disease is identified.. Respective motor will be turned on to supply themedicine based on the disease identified

Fig 6:identified disease

Temperature is identified with the help of temperature sensor. Moisture content in the soil is identified using the Humidity sensor.

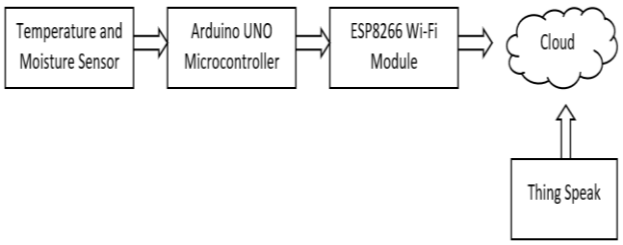


Fig 7: The values are compared with the already set values and it is indicated in the IOT Webpage shown in fig 8 .

```
TEMP =     38.09

MOISTURE =    1023

TEMP =     82.03

MOISTURE =    1023

TEMP =     38.09
```

Fig 8:Temp and Moisture Values

Conclusion

Agriculture plays a vital role in the development of our country. Issues concerning agriculture have been always hindering the development of the country. The only solution to this problem is agriculture by modernizing the current traditional methods of farming. Hence this project aims at monitoring the temperature and moisture sensor using the necessary sensors. Measurement of these factors using these sensors in agriculture can be referred to as smart agriculture. Therefore this modern agriculture can positively impact the planet in immeasurable ways. It improves the yield of crops of all kinds, decreasing the dependence on pesticides, reducing operational costs, optimizing water usage, and ensuring better land management and crop rotation. To ensure better farming method and to get maximum yield with less resources using Communication technology we can monitor live field condition to take corrective action. Hence as advancement in this field, the project presents about the image processing techniques and various sensors for the development and yield of crops

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