Development of a System for Estimation of NPK and pH in Soil and Disease Detection in plants

[*]Madhu Shree N[1], Prasanna Kumar M[2]
[1]*Dept of E&IE, Dr. Ambedkar Institute of Technology, Bangalore, India.*
[2]*Dept of E&IE, Dr. Ambedkar Institute of Technology, Bangalore, India.*
Corresponding Author: Madhu Shree N

Abstract : *Agriculture is the basis of livelihood for the farmers through the production of food and important raw materials. Agriculture faces various challenges, hence becoming harder to attain its primary objective of feeding the growing population every year. Long lasting solutions would require rethinking of rural development by technology penetration and taking agricultural practices towards structural transformations that embodies the smarter methods and profits the farmers. Here in this paper we are determining the diseases that are caused to tomato plant and classification of each diseases through SVM classifier and development of a system to check the NPK and pH values in soil which are the vital nutrients for a plant to grow and we make use of Internet of things(IOT) to report any changes in field to the farmer. This will be very much help full fro the farmer to know all the recent updates in the field.*
Keywords: *LPC2148 Microcontroller, Internet of things (IOT), Nitrogen prosperous potassium(NPK), Pouvoir hydrogen(pH sensor), Support vector mechanism,*

I.   Introduction

Traditionally, farmers apply a consistent amount of fertilizer at a constant rate across the entire field. The rate at which fertilizer is applied is usually based on grid soil sampling or previous year's yield maps. Factors such as moisture and temperature, which can cause leaching or de-nitrification, are often not taken into account when calculating this year's fertilizer application rate. This work hence proposes a system which combines all the factors like nutrient requirement monitoring, ph content monitoring and crop disease detection methods which can be alerted to farmers for the necessary actions. Here in this paper we need to under go two levels and they are
1)   Estimation of Nutrient level.
2)   Disease detection module.

The soil sample is tested using the Rapidest kit and the corresponding indications through colour patterns are processed through a image processing unit .The image processing unit depicts the different pH levels associated with different colour patterns and the levels of macronutrients N, P, K in the soil sample. The information from the IP unit is passed to the controller which is interfaced with LCD for displaying the pH levels and the quantified value of the important macronutrients present in the soil.
Digital cameras are integrated to capture particular patterns on the plant body surface arising out of any disease the crop might have got effected from and again the information is processed though the IP unit ,feeding the identified information to the controller, which is then displayed in the LCD regarding the disease present and its phase. All the identified data and the suitable actions need to be taken is sent as alert to the centralised cloud for storage and the farmer's Smartphone for necessary response

II.   Literature survey

Existing methods

Prior papers are depicting to recognize predominantly bugs like aphids, whiteflies, thrips, and so forth utilizing different methodologies recommending the different usage courses as represented and talked about beneath. Proposed a psychological vision framework that consolidates picture preparing, learning and information based systems. They just recognize develop phase of white fly and tally the quantity of flies on single pamphlet. They utilized 180 pictures as test dataset .among this pictures they tried 162 pictures and each picture having 0 to 5 whitefly bother. They compute false negative rate (FNR) and false positive rate (FPR) for test pictures without any whiteflies (class 1), no less than one white fly (class 2) and for entire test set. Expand usage of the picture handling calculations and systems to identify bugs in controlled condition like nursery.

Three sorts of regular elements including size, morphological element (state of limit), and shading segments were considered and examined to recognize the three sorts of grown-up bugs, whiteflies, aphids and thrips. Advance early irritation discovery in green houses in view of video examination. Their objective was to characterize a choice emotionally supportive network which handles a camcorder information. They actualized calculations for recognition of just two bioaggressors name as white flies and aphids. The framework could distinguish low pervasion arranges by identifying eggs of white flies accordingly breaking down conduct of white flies. Proposed bother location framework including four stages name as shading transformation, division, decrease in clamor and tallying whiteflies. An unmistakable calculation name as relative contrast in pixel powers (RDI) was proposed for distinguishing bug named as white fly influencing different clears out. The calculation works for nursery based harvests as well as farming based yields too. The calculation was tried more than 100 pictures of white fly bug with an exactness of 96%. Proposed another technique for irritation recognition and situating in view of binocular stereo to get the area data of vermin, which was utilized for directing the robot to shower the pesticides naturally. Presented relevant parameter tuning for versatile picture division that permits to proficiently tune calculation parameters as for varieties in leaf shading and differentiation. Presents a programmed strategy for order of the principle operators that make harms soybean leaflets i.e., creepy crawlies and caterpillars utilizing SVM classifier. The proposed system is explained in detailed below

III. Design and Implementation

The design of the system and its implementation is by start with image capture or load image then we need to improve image quality by image enhancement. Image segmentation is done then we need to extract the feature from the loaded image then comparing with the database. The representation of input and output is done then sending a message of type of disease like this the procedure goes. The proposed algorithm flow is shown below.
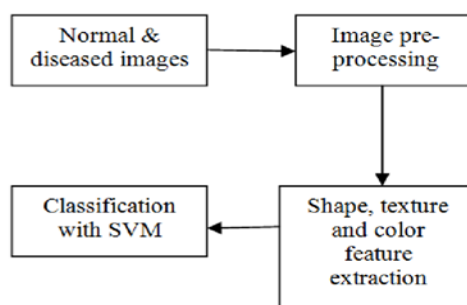

Figure 1: Proposed algorithm flow for leaf disease detection

3.1 SUPPORT VECTOR MACHINE

Training sample in support vector machine is severable by a hyper plane. This hyper plane is computed in step with the choice perform f(x) = sign (w.x) + b, wherever w could be a weight vector and b could be a threshold cut-off.

To maximize the margin, w $\in$ f and b got to be decreased to:

$$Xi.w + b \geq +1 \, for \, yi = +1$$
$$Xi.w + b \leq -1 \, for \, yi = -1$$
$$Yi \, (xi.w + b) - 1 \geq 0$$

Additional slack variables ought to be additional to stop over fitting.

$$Xi.w + b \geq +1 - \xi \, for \, yi = +1$$
$$Xi.w + b \leq \left|-1 + \xi \, for \, yi = -1\right.$$
$$Yi \, (xi.w + b) - 1 + \xi \geq 0$$

SVMs (Support Vector Machines) area unit a helpful technique for knowledge classification. Classification task sometimes involves separating knowledge into coaching and testing sets. every instance within the coaching set contains one \target value" (i.e. the category labels) and a number of other attributes" (i.e. the options or ascertained variables). The goal of SVM is to provide a model (based on the coaching knowledge) that predicts the target values of the check knowledge given solely the check data attributes.
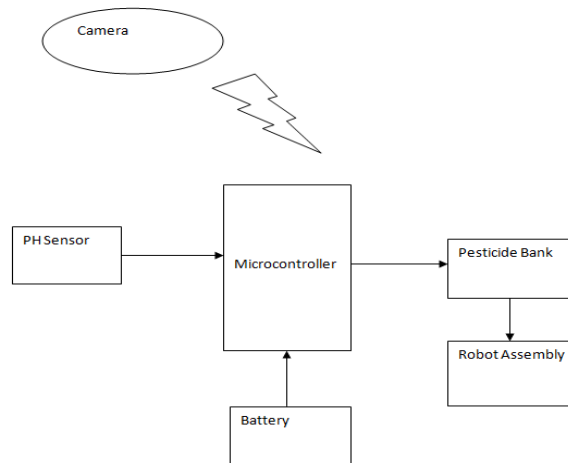
Figure 2: Robotic section

3.2 ROBOT

A ROBOT may be a virtual or mechanical simulated specialist much speaking, it's generally Associate in Nursing electro-mechanical machine that is radio-controlled by laptop or electronic programming, and is during this approach able to do assignments on their own .Another normal trademark is that by its appearance or developments, a robot frequently passes on a feeling that it has goal or office of its own.
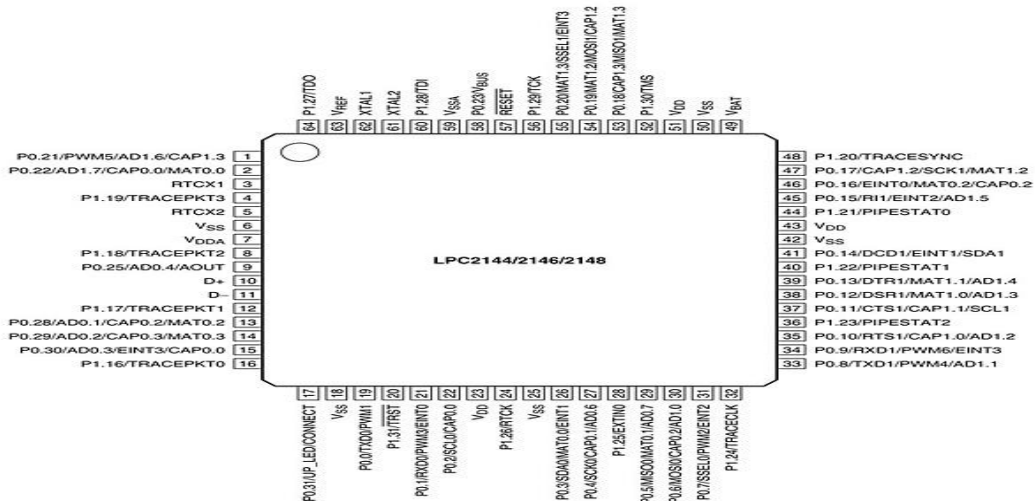
3.3 LPC2148

Figure 3: Pin diagram of LPC2148

ARM may be a cluster of direction set styles for computer processors in lightweight of a weakened guideline set registering (RISC) engineering created by British organization ARM Holdings. A RISC-based computer configuration approach implies ARM processors need altogether less transistors than run of the mill processors in traditional PCs. This approach decreases prices, heat and power utilize. These square measure enticing attributes for lightweight, compact, battery-fueled gadgets—including cell phones, moveable PCs, pill and scratch pad PCs), and alternative put in frameworks. A less advanced set up encourages simpler multi-center CPUs and better center checks at lower value, giving higher handling power and increased vitality productivity for servers and supercomputers. LPC2148 is that the typically utilized IC from ARM-7 family. It's created by Philips and it's pre-stacked with various built-in peripherals creating it additional productive and a solid different for the learners and additionally prime of the road application designer.

3.4 ZIGBEE

Zigbee is a remote innovation, which conveys on the rule of IEEE 802.15.4 standard. IEEE 802.15.4 is a standard that expresses the subtle elements for the lower layers of the correspondence. This standard concentrates on the ease and low power correspondence. On account of Zigbee's minimal effort, low power utilization and capacity to interface in a work organize, it is ending up noticeably more ideal answer for observing and control applications.

3.5 PH SENSOR

A standout amongst the most generally utilized water estimations, pH is a measure of acridity and alkalinity, or acidic and base, individually, of an answer. It is communicated commonly on a numeric size of 0-14. An estimation of 7 speaks to impartiality. Bring down numbers demonstrate expanding acridity and higher numbers expanding alkalinity. Every unit of progress speaks to a ten times change in corrosiveness or alkalinity which compares to the negative logarithm of the hydrogen-particle fixation or hydrogen-particle action.
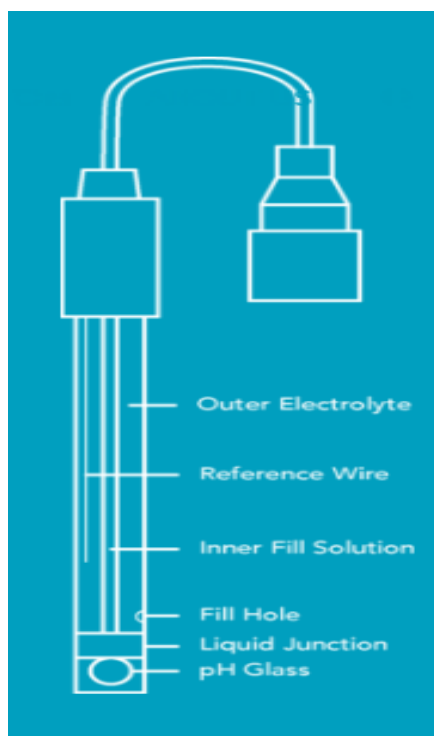

Figure 4: pH sensor

3.5 DC MOTORS AND RELAYS

A motor is an electrical machine that converts electrical current energy into mechanical energy. DC means Direct current. Usually DC motors have six parts.

Working principle of a motor:

An electric motor is concerning magnets and attraction: Associate in nursing motor utilizes magnets to create movement. Within the event that you just have ever contended with magnets you think that concerning the principal law of all magnets: Opposites pull in and likes repulse. Therefore within the event that you just have 2 bar magnets with their closures checked "north" and "south," then the north finish of 1 magnet can attract the south finish of the opposite. Then again, the north finish of 1 magnet can repulse the north finish of the opposite (and relatively, south can repulse south). Within an electrical motor, these drawing in and repulsing powers build motility movement. The relays we are using this for the controlling of pumps A RELAY is an electrically worked switch. Current moving through the curl of the transfer makes an attractive field which draws in a lever and changes the switch contacts. The loop current can be on or off so transfers have two switch positions and they are twofold toss (changeover) switches.
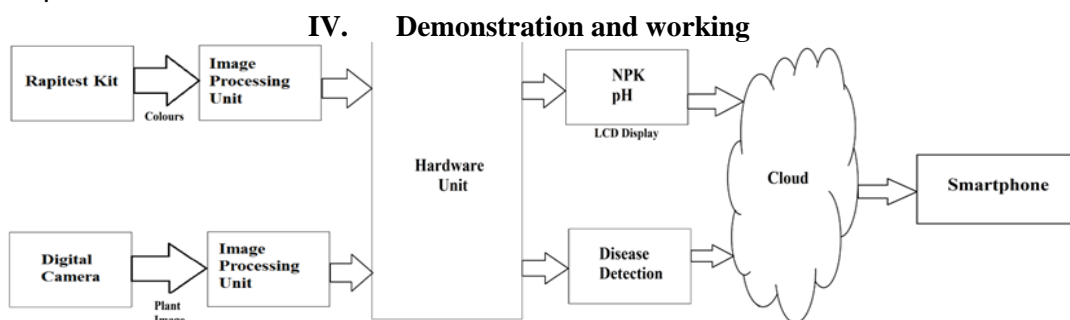
.

IV.   Demonstration and working
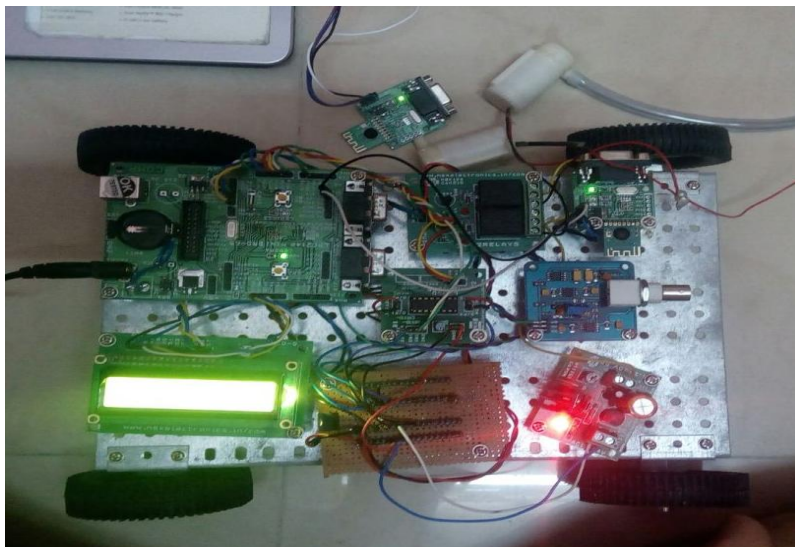

Figure 5: Functional block diagram

Figure 6:Hardware part

4.1 IoT

The internet of things is a system of correlated with digital and mechanical machines, computing device, objects, animals or people that are provided with the unique identities and the capability to transfer data over a network without requiring person-to-person or person-to-computer interaction. IoT has evolved from the convergence of wireless technologies, micro-electromechanical system(MEMS), micro services and the internet. The convergence has helped tear down the silo wall between operational technology(OT) and information technology(IT), allowing instructed machine generated data to be analyzed for insights that will drive improvements. Practical applications of IoT technology can be found in many industry today, including healthcare, energy and transportation, building management, precision agriculture.

4.2 MATLAB

MATLAB meant for MATrix LABoratory. MATLAB was created originally to provide trouble-free entrée to structure programming produced through the LINPACK (straight framework bundle) and EISPACK (Eigen framework bundle) venture.

MATLAB may be a advanced language designed for explicit registering. It coordinates computation, illustration and programming stipulation . besides, MATLAB is a sophistication cryptography vermicular from: it contain advanced in sequence structure contains worked in varied and investigate instrument and back question set programming. These part build MATLAB a superb instructing alongside analysis.

V.   RESULTS

The below observations are made,

Figure 7: Indication of pH value

The above figure shows the indication of pH value a selected soil

Figure 8: Leaf Disease Detection

The above figure shows the type of disease caused in the tomato leaf and for about 10 seconds the pesticides will be sprayed.

Figure 9: NPK value

In the above figure it indicates the NPK value and the type of infertility is caused to the particular field. This NPK is very essential factor for the any plant to grow The updates in a field is known to the farmer by using IoT with their Smartphone's that is, by creating a new account in a thingspaek.com. Updating the number of fields that a particular farmer is operating than we get a unique channel ID , this ID we need to install in a matlab code. Than the farmer will get all the information's like any changes in field, type of disease and the pesticides that should be applied to the plant for particular disease.

VI.   Conclusion and future scope

A. Conclusion

This venture proposed a leaf picture design arrangement to recognize sickness in leaf with a mix of surface and shading highlight extraction. At first the ranchers sends an advanced picture of the infected leaf of a plant and these pictures are perused in MATLAB and handled consequently in light of SVM and the outcomes were appeared. The consequences of this project are to discover suitable components that can recognize leaf ailment of certain usually made sickness plants. Right off the bat, typical and infected pictures are gathered and pre-handled. At that point, elements of shape, shading and surface are separated from these pictures. From that point onward, these pictures are grouped by bolster vector machine classifier. A mix of a few elements are utilized to assess the suitable features to find distinctive features for identification of leaf disease. When a single feature is used, shape feature has the lowest accuracy and texture feature has the highest accuracy. A combination of texture and color feature extraction results a highest classification accuracy. A combination of texture and color feature extraction with polynomial kernel results in good classification accuracy. Based on the classified type of disease a text message was sent to the user in the project.

B. Feature scope:

In this venture, we exhibited just couple of sorts of maladies which were regularly brought about and it can be reached out for more infection in future. Here just an instant message was sent to the agriculturist however in future a robot can be sent to splash the pesticides to the plants consequently without human connection.

References

[1]   Sari, Yuita Arum, R V Hari Ginardi, Riyanarto Sarno. "Assessment of Color Levels in Leaf Color Chart UsingSmartphone Camera with Relative Calibration". Information Systems International Conference (ISICO), 2013: 631-636.

[2]   Raid, Richard Neil, and J. C. Comstock. Sugarcane rust disease. University of Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, EDIS, 1998.

[3]   Camargo, A., and J. S. Smith. "Image pattern classification for the identification of disease causing agents in plants." Computers and Electronics in Agriculture 66.2 (2009): 121-125.

[4]   Asraf, H. Muhammad, M. T. Nooritawati, and M. S. B. Rizam. "A Comparative Study in Kernel-Based Support Vector Machine of Oil Palm Leaves Nutrient Disease." Procedia Engineering 41 (2012): 13531359.

[5]   Phadikar, Santanu, Jaya Sil, and Asit Kumar Das. "Rice diseases classification using feature selection and rule generation techniques." Computers and Electronics in Agriculture 90 (2013): 76-85.

[6]   Li, Daoliang, Wenzhu Yang, and Sile Wang. "Classification of foreign fibers in cotton lint using machine vision and multi-class support vector machine." Computers and electronics in agriculture 74.2 (2010): 274279.

[7]   Ginardi, R V Hari, RiyanartoSarno, and Tri AdhiWijaya. "Sugarcane Leaf Color Classification in Sa*b* Color Element Composition". 2013 International Conference on Computer, Control, Informatics and It's Application, pp:175-178.