Detecting Disease via Quadcopter for Paddy Crop Using Image Processing

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Abstract— Dynamic remotely operated navigation equipment is used for automation without human intervention, in different spheres of agriculture. In this project, we signify the design part of the Quadcopter with a camera to capture the images of paddy crop. The captured images are processed to find the paddy crop diseases and send the alerts to the owner, without human intervention in the fields. The quadcopter is used to capture the image from the location and to store it for further processing. The algorithm is to compare the stored images with the database image using a color pattern matching algorithm to identify the disease and to send the alerts. The LabVIEW vision assistant is used to detect the problems in the paddy crop. Further, the algorithm is used to find the number of grains, to state the crop growth assurance using the above-said approach.

Keywords— *Quadcopter, LabVIEW Vision Assistant, color pattern matching, Paddy crop, Image Processing*

I.   Introduction

In India, the paddy crop plays a crucial role in the economy, the farmer is facing many problems due to lack of availability of labor, increasing labor costs, improper guidance, crop damage, the climatic conditions and to assess the crop health. As the technologies emerging, drones [1] offer the potential for several significant challenges. In predictable weed control, the field is typically treated uniformly with a single herbicide dose by spraying the chemicals on the crops and the weed in the same way. The former does require much knowledge about the spatial distribution know about the type of plants is needed in common conventional farming [2].

The approach of agricultural system management and smart farming typically requires detailed knowledge about the current status of the fields. The favorite way of monitoring the farmland is using aerial vehicles such as UAVs. Compared to ground vehicles [3], UAVs can cover large areas within a short time, and do not impact the fields through soil compaction as ground vehicles. For on-field intervention, we need to know the type of field and the spatial distribution of the weeds at the earliest [4]. To overcome these issues against the crop for the farmer, quadcopter [5] used as an assistive device, this has high demand in the surveillance and industrial sector [6].

A helicopter is a flying machine which uses fast spinning rotors to push air downwards, to create a thrust force keeping the aircraft aloft. A quadrotor helicopter (Quadcopter) is a helicopter, in which the mechanism is same as a helicopter. The quadcopter control obtained by adding two more rotors to allow more degrees of freedom, which has four rotors. It is

extremely difficult and impossible to manage the rotors without electronic assistance. Three translations and three rotational in a total of six degrees of freedom and only four inputs rotors of quadcopter are severely under activated. In which we have six degrees of freedom rotational and translational motion is coupled, the dynamics of a nonlinear accounting of complicated aerodynamic system, unlike ground vehicles, helicopters, the quadcopter with very little friction to prevent their motion. It must provide its damping for stability and to stop moving.

Two significant movements considered in the quadcopter, thrust, and torque. Quadcopter consists of four propellers attached to the motors which create the push and help the quadcopter to elevate height. The motion of quadcopter based on the values given to it [7]. Two motors rotate in a clockwise direction while other two will turn anticlockwise direction, the four moments of a control motion of a quadcopter stands classified as Throttle, Yaw rotation (ψ), Pitch rotation (Θ) and Roll rotation (ϕ) shown in figure 1.
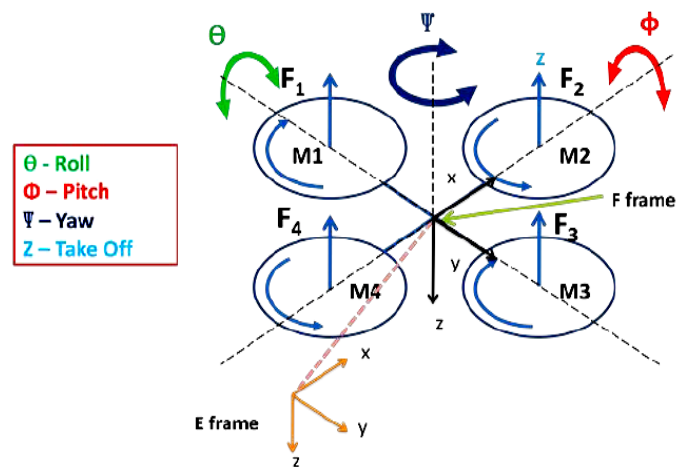

Figure 1: Roll, Pitch, and Yaw movement

Throttle, the moment of the quadcopter is a top or bottom of the controlled throttle stick of transmitter. Yaw rotation, the movement of the quadcopter to move is a left or right. Pitch rotation, the whole evolution of the quadcopter is in the forward direction or the backward direction. Roll rotation, the movement of the longitudinal axis of a quadcopter as it rolls left or right motion of the throttle shown in figure 2.

Another significant part is to focus on the camera path using image processing plays a vital role in the UAV based smart agriculture system. The complete method depends on identification of the color location using the variations in the

template colors and implementation using LabVIEW vision assistant tools [8-10] to obtain the output as per requirements.
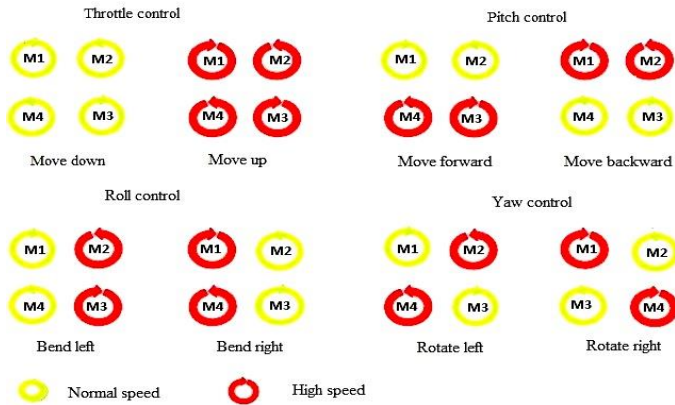

Figure 2: Relative movements of quadcopter control

The color pattern matching algorithm [11,12] used for identification of a total number of seeds in the paddy crop growth [13-15], the crop affected by the disease such as brown spot disease, blast disease, tungro disease and stealth blight [16-18]. To reduce the farmer manual work and he can have the direct access to the field on a region of interest. The camera images are accessed wirelessly through a webpage or from the memory card of the Raspberry Pi.

Section 2 the hardware particulars of quadcopter and raspberry pi with the camera. Section 3 describes the software tools required for the project. Section 4 complete hardware implementation in the project. Section 5 considers the color pattern matching algorithm using LabVIEW software. Section 6 the software implementation with procedures using different open source software tools. Section 7 the results and discussions. Section 8 concluding statements.

II. HARDWARE

The hardware setup consists of power distribution board, a flight controller with MPU 6050 these are connected to ESC to the four motors, and the flight controller board gets the inputs from the wireless four channel receiver to control the motor speed and rotation is shown in figure 3.
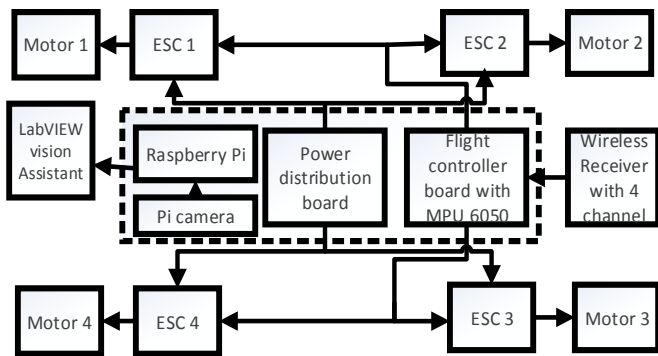

Figure 3: Block diagram of quadcopter setup with Pi-camera

The Raspberry Pi with a camera to record the video on the field to store it on the memory card. Once the recorded data collected and this is processed using LabVIEW vision assistant process on PC.

A. Flight controller

The multi-rotor flight controller board for quadcopter is to stabilize the flight board is shown in figure 4. It takes signals from MPU 6050 gyro/accelerometer passes to a microcontroller. It processes the user selected firmware and passes the control signals to the Electronic Speed Controller. The signals instruct the ESC to adjust the rotational speed stabilization of multi rotorcraft. The multi-rotor control board receives radio signals via aileron, elevator, throttle, and rudder inputs. The signal process sent to ESC tons the rotational speed of each motor to induce controlled flight (up, down, backward, forward, left, right, yaw). This board makes auto level function based on a microcontroller with 64K of memory, a piezo buzzer for audio warning when activating and deactivating the board.
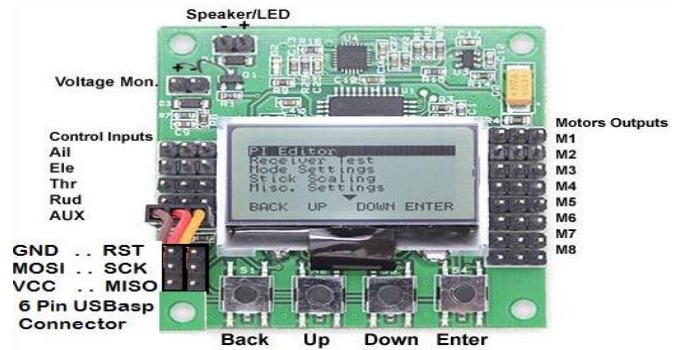

Figure 4: KK flight controller

B. Electronic speed controller

Electronic Speed Controller circuit is used to vary electric motor speed and its direction to act as a dynamic brake shown in figure 5. ESC often used for radio control most often for brushless motors and electrical low voltage power source to the motor. An AC with the maximum current rate of 30Amps, the battery voltage to provide specific power the chopping current gets selected frequency rather than just switching from one period on and another period off.
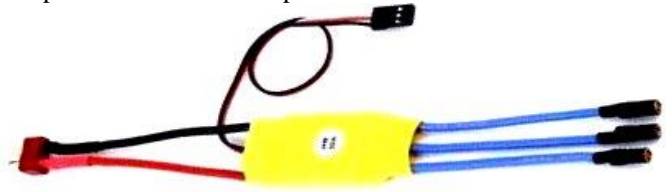

Figure 5: Electronic Speed Controller circuit

Then AC computed the function of commutator using an applied voltage to the coils in the predefined combination of on and off and reserved for liability to operate rotating magnetic field in status and to induce the magnitude test on the rotor to turn. The ESC detects the back EMF pulse to generate the rotor magnets passing the calls as a timing signal and to tell the synchronization.

C. Quadcopter frame

The F-450 Quadcopter frame shown in figure 6 is best suited for the project. Quadcopter requires the rigid structure to hold LiPO battery, 4 BLDC Motors, 4 ESCs and Raspberry Pi with the Pi camera.

Figure 6: Quadcopter frame with propellers

D. Transmitter and Receiver

Radio transmitter uses radio signals to control quadcopter wirelessly and send the commands to communicate through the transmitter antenna. The signals received by the radio receiver connected to the flight controller, the number of channels in the ct6b transmitter determines how many actions of the pilot can control. Minimum 4 channels are required to manage a quadcopter (Pitch, Roll, Yaw, and throttle) stick controls on the radio transmitter is known as a gimbal. RC receiver used to operate on 2.4 gigahertz radio frequency. Fly sky ct6b transmitter and fly sky receiver used for quadcopter shown in figure 7.

(a) Transmitter   (b) Receiver

Figure 7: A Radio transmitter and receiver

E. Lithium polymer battery

It's a rechargeable battery of Lithium-ion technology. It provides high energy, where the weight is a critical factor. The high voltage and extended runtime hold, small package, massive power and high discharge rate required to meet the need of power distribution for the quadcopter. The minimum capacity of a battery is 2200mAh is needed at a constant discharge of 30C with 11.1volts and the XT60 plug shown in figure 8.

Figure 8: Lithium polymer battery with high discharge

The motor uses the power of a battery based on the duty cycle as shown in the figure 9, if on and off state is 50% then 50% power is used, every 75% duty cycle 75% of the power is used, if the motor gets 100% of the power then it is in continuous on state for full throttle.
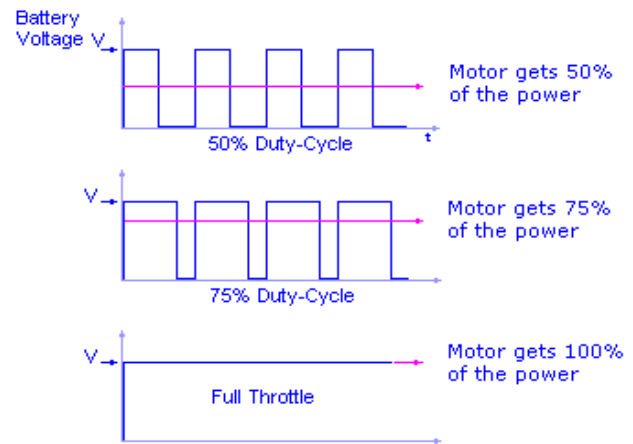

Figure 9: Motor consumes power from the battery

III.   SOFTWARE CONFIGURATION

The software used in Raspberry Pi is the raspbian operating system, Python language, putty software, HTML, CSS, JavaScript, flask web server, and Web socket.

A. Raspberry Pi Installation and Configuration

In Raspberry Pi is to boot and load the operating system:

1. Raspbian Operating System image is obtainable in Raspberry Pi website download in zip format. We need to unzip the file to extract the image, to write it into an SD card.

2. Etcher software is to deploy the image into SD card by using a card reader.

3. Insert Bootable SD card into Raspberry Pi, link an HDMI cable to the display, mouse, and keyboard to USB ports. For example, enter the username as "pi" and the password as "raspberrypi" to open the operating system.

4. Raspberry Pi software tool configuration is used to obtain the Interfacing preferences is shown in figure 10.

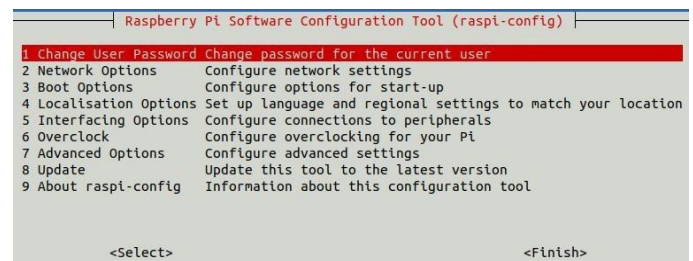**Camera**: To allow Pi camera interfaced to the Raspberry Pi board.

Figure 10: Software configuration tool for interfacing options

Expand file system: The operating system image distribution is of 2 GB, for an idle portion of the SD card permit expands file system partition. It approves the remaining free space of the SD card and then reboots the OS to configure the preferences permitted by the user.

B. Putty Client Connection

Access the Raspberry Pi board wirelessly on PC; the putty software tool configuration set up on a Windows PC. Enter the IP address in hostname or IP address field is shown in figure 11.
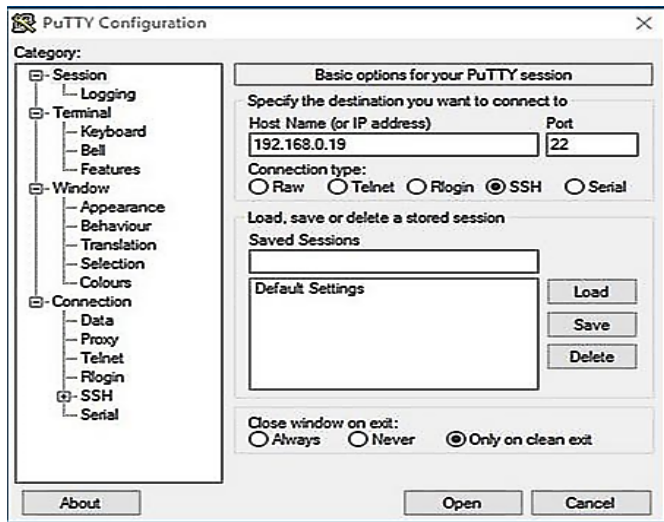

Figure 11: Putty software tool configuration

Click open to get safety alert in the terminal window display, enter username and password. The standard command line replaced with my@RaspberryPi:, now we are logged in and functioning with Raspberry Pi command line. To view the connection acquired wireless interface from Raspberry Pi to PC, the command line substitutes (such as Nano or VIM) are used to attain communication and easy to share files by means of the protected shell with VNC server. Attach the Raspberry Pi to a local router, use ifconfig to find the IP address; we need IP address to log in. When Nano editor is open, edit the content of the file, and then exit.

Then Superuser privileges are used to execute commands on dissimilar users in an organized way. Sudo doesn't start a new shell Advanced Package Tool (APT) is easily available software for the user interface. It consists of libraries to install or remove the software from the Linux distributions.   It streamlines the process of installing software packages moreover by compiling source code or from precompiled files.

C. Python and Supporting Packages

Python is high-level language syntax allows the programmer to fix the concept in fewer lines of code. It has dynamic system features, automatic memory organization, supports multiple programming models, with Object Oriented Programming functions, procedure, and considerable standard library access.

D. CT6B software configuration

The software is used to configure the fly sky ct6b transmitter.
Step 1: Install T6 configuration software on the PC
Step 2: Switch on the transmitter, the transmitter connects the program to the PC.
Step 3: Double-click on the application icon and the following screen will pop up shown in figure 12.
Step 4: System options, if the radius is not communicating to the software, you need to click this setting button in the system option section that will display the serial port selection dialogue we can pick the serial port of the computer assigned to the USB cable.
Step 5: Click on the get user button after establishing communication with radio this forces the configuration to clear its memory and read the real settings from the receiver back into the software. If any failure occurs in setting configuration, then we have to make changes and save data to the file. The setup memory contains 67 bytes of memory information the get user button replaces the software is 67 bytes with it reads from the radio shown in figure 12.
Step 6: The save button in the settings used for a file, we can reload the settings back into radio.
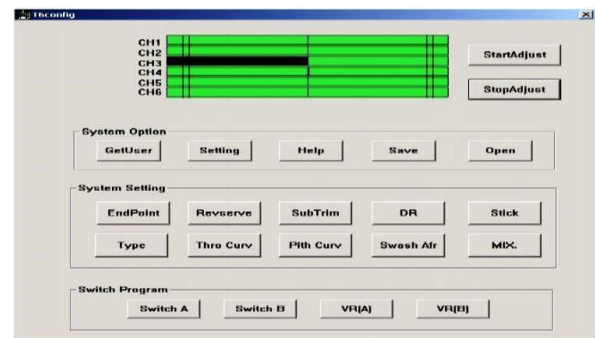

Figure 12: TC6B transmitter configuration

The open is to reload the previously saved configuration file into the software and radio.
Step 7: From system settings, different modes is possible for remote from Mode 1 to Mode 4 shown in figure 13.
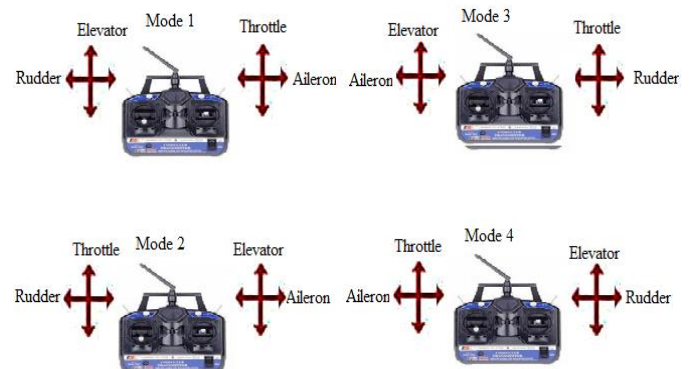

Figure 13: Different modes of operation to configure the transmitter

E. National Instruments Vision assistant

It consists of the following features as script window, records the image processing steps and settings of each level. We can run the script on a collection of images or a single image, and we can also modify and save the texts. Select browser to load the image in the vision assistant, we can select by double-click on the image browser. The processing window updates the image parameters, and the same changes are reflected immediately in the setup window as we modify the settings. The processing function window or setup window displays the list of image processing functions that we can use to develop an algorithm on how to show the parameters as you set for an image processing function. Each task is available through the process in function window has a setup window, in which the settings are to fix the service. The difference window will display the image source as we manipulate it in the processing window is shown in figure 14.
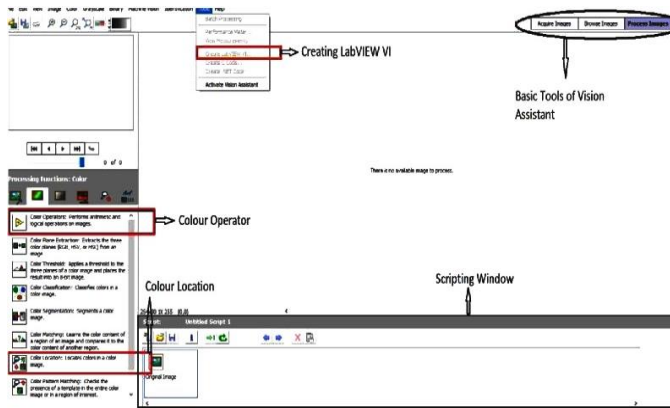

Figure 14: Vision Assistant window view

The performance meter will measure or estimate how long is script will take to complete the given image. The LabVIEW creation corresponds to the algorithms of a prototype in vision assistant. Code creation corresponds to the algorithm of a prototype in a vision assistant is based on the options select in the wizard that implements the image process steps of the current script.

F. Vision assistant tools

Inner query images vision assistant offers three types of image acquisitions snap, grab, and sequence. Snap requires a single image and displays it. Grab acquires the continuous set of images which is used to focus the camera. We specify the settings of a series of images and send it to the image browser. Browse provides information about the selected such as size location and type of image. Process the image in the vision assistant, load the image in the processing window. The color operation will perform arithmetic and logical operations done numerically on two different images with a constant value to obtain the output image numerically after adding/subtracting two images. The process is carried based on each color channel or each band image. The color location used to locate a known color region in an image. As we create a model or

template is the standard search, machine vision application search the model in each acquired image and calculate the score of the match. The score will indicate how closely the color information in the model matches to find the regions.
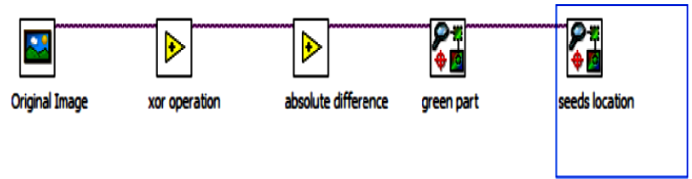

Figure 15: Algorithm approach using vision assistant

Color location algorithms locate the region in an image with specific colors. It requires the number of sections and locations of an image with particular color information. It relies on cumulative color information in the region, instead of how the colors arranged in the area. It doesn't require the orientation of the region location with sub-pixel accuracy.
Co-ordinate system is a different location (origin) and angle in an image based on the region of interest can relate the position and angular adjustments of regions are necessary. The coordinate system depicts two lines representation and the orientation, as well as the direction of its two axes shown in figure 15.

IV.   HARDWARE IMPLEMENTATION

A. Design and development of quadcopter

1) Flowchart for quadcopter
Step by step procedure is needed to adopt the model of the quadcopter is shown in figure 16, the hardware development for the quadcopter is required, we need to care enough to understand the design flow. The stages need specific support to calibrate, at first setup, calibration is necessary to fix the degrees of freedom, concerning the number of motors attached to the quadcopter.
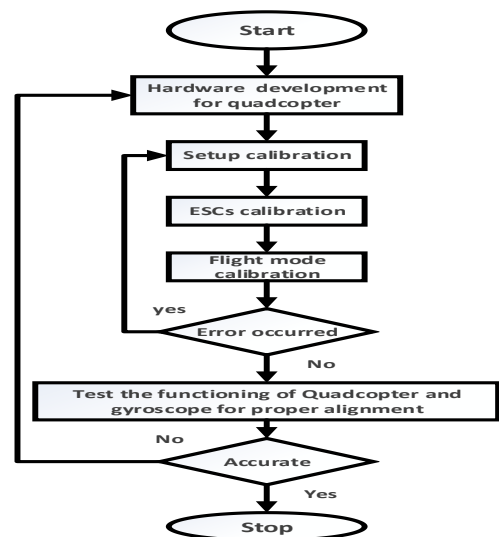

Figure 16: Flowchart for building a quadcopter

We need to set the transmitter control so that it tunes the channel calibrations concerning the joysticks. In case of ESC, here we have to calibrate motor speed so that it optimizes according to the motor rotational speed. The flight mode calibrations adjustments are required, to fix it in flight controller, the roll, pitch, and yaw concerning the quadcopter framework and payload.

B. Raspberry Pi

Raspberry Pi is interfaced with Pi camera of 5 megapixels to capture the videos and store it on the memory card for further process on the LabVIEW. The camera is used to record video in full HD, switch off the Raspberry Pi, connect the camera module to the camera port, start the Pi camera option and ensure the software is enabled. Open the Raspberry Pi configuration settings for allowing the camera to software, if it is disabled, permit it to reboot the operating system. We can try to preview the camera by selecting the Python programming in that open a new file and save a file with an extension. It is essential to set sleep mode for at least two seconds before capturing the image because the sensor has to set the light levels. We can manipulate the camera to configure the settings. The resolution is configurable to monitor the maximum resolution is 2592x1944 for still photos 1920x1080 for video recording shown in the figure 17.
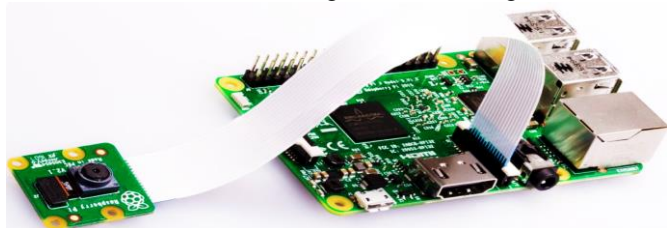

Figure 17: Raspberry Pi with Pi-camera interface

C. Building the frame

1. The tightly fixed framework is needed while screwing we have to ensure about external attachments fitted to the board.
2. Motor supported on the plates of the four corners at the plate of choice. The modules mounted on the frame facing inward, and the ESCs shouldered.
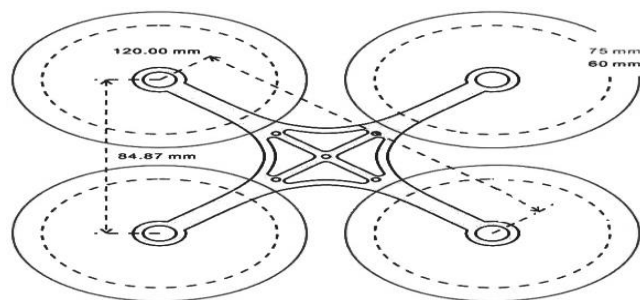

Figure 18: Quadcopter frame design with dimensions

3. ESC and power distribution board are placed together and wanted to match the correct circuit on the frame shown in figure 18.

4. The proper connections are made to connect the Controller, and the receiver fixed on the structure appropriately.
5. LiPO battery is correctly attached to the frame that equally distributed among frame, and the flight controller adequately placed in the center to avoid the vibrations on the frame.

D. Flight controller and radio receiver

Schematic diagram of the quadcopter shown in figure 19, four channel radio receiver wires connected to the input of the flight controller. The output lines attached to four ESCs to control the motors. We have to check the polarity, while connecting the device. The Lithium polymer battery linked to the power distribution of the frame.
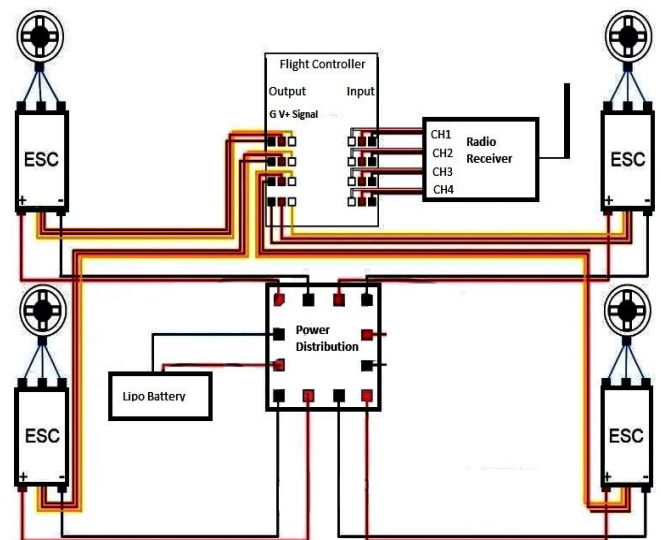

Figure 19: The schematic diagram of the quadcopter

E. Electronic speed controller

Electronic speed controller purpose is to provide the speed of the servo motor and its direction to act as a dynamic brake is essentially providing an electronically generated electric power low voltage source. And we need to care enough while selecting the ESC for the quadcopter because if we consider less ampere ESC then the motor amperes then it defects the ESC circuit. It allows in a smooth and precise way of motor speed for the more efficient manner in a mechanical action for moving operations shown in figure 20.
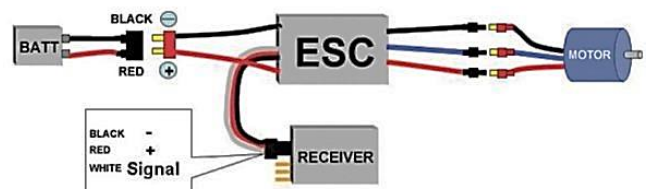

Figure 20: ESC interface with battery, receiver, and motor

F. Binding transmitter and receiver

1. Install the battery to the 2.5 gigahertz transmitter and turn it on.

2. Insert the binding plug into the channel 4 of this receiver.

3. Connect the ESC to channel 3 or external batteries to any one of those channels by observing the polarity.

4. Power the receiver using the external battery or connect the main battery to ESC, the LEDs should start flashing.

5. Press and hold the lower left switch on the transmitter and then switches on the transmitter power switch.

6. Observe the LED lights on the receiver, if the LEDs stop flashing then the receiver he is bound to the transmitter.

7. Release the match button on the transmitter power off the receiver and turn off the transmitter.

8. Remove the binding receiver plug and connect the servo and other channels shown in figure 21.

9. Test the receiver without pressing the match /bind switch to the receiver the LEDs glow steadily it indicates bound to the transmitter.
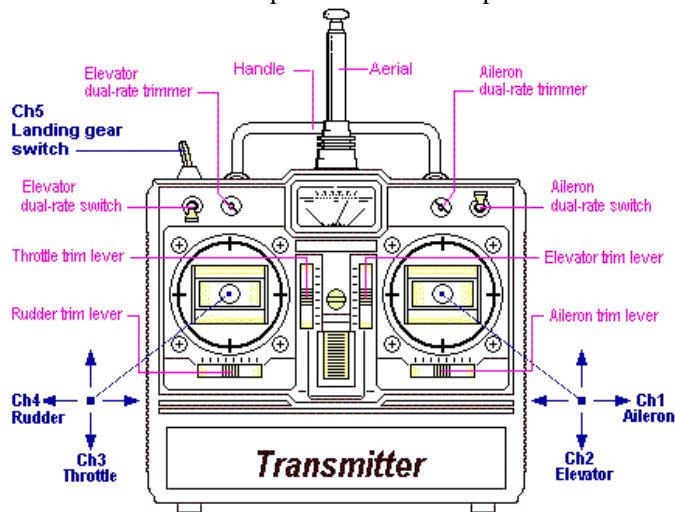
10. If the test failed to repeat the above-said process.

Figure 21: A Flysky transmitter

The pulse position modulation the way the data is encoded decoded in the RF career is often FM modulated in the systems. The transmitter circuit read each switch using potentiometer value and the switch positions serially, and each value converted into a pulse width. The width of the pulse concerns the position the control in the neutral position gives a false of 1.5 milliseconds, in the end, the point may be either 1 or 2 milliseconds depending upon the joystick has been moved shown in figure 22.
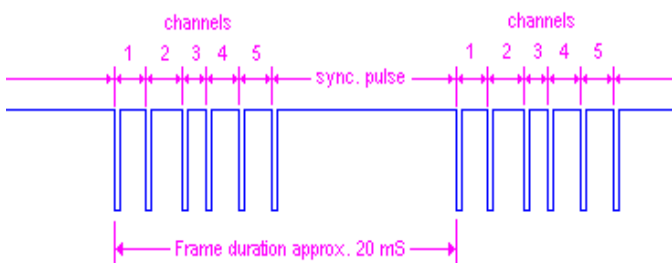

Figure 22: The channel Pulse Position Modulation

V.   SOFTWARE IMPLEMENTATION

A. Programming the KK controller

1. Initially, the connection between the flight controller fly sky receiver and ESC are established as shown in the figure 23.

2. Connect 2200mAh battery to power distribution board appears on the KK flight controller.
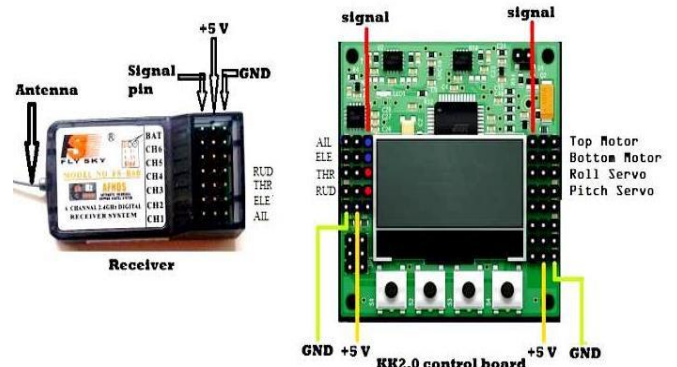

Figure 23: Receiver and KK flight controller

3. Press the enter button on the KK flight controller and see the submenu shown in the figure 24.

Figure 24: KK flight controller main menu

4. Click on the down button and select factory reset so that it deletes previously stored data.

5. Click on load motor layout and select the layout based on the requirement. Here we have chosen quadcopter x mode.

6. Click on the load motor layout, if you wish to check the direction of motors.

7. Select the mode settings and set the self-level to stick on the auto leveling can be switched on while arming.

8. Place a quadcopter on the flat surface and select the accelerometer calibration it generates values of the accelerometer in XYZ direction.

9. Press back and press enter button simultaneously and connect the battery to perform throttle calibration.

10. Select miscellaneous settings have to fix the values as per the requirement general the values are not changed.

### B. Quadcopter PID tuning

PID stands for proportional integral and derivative. The main aim of the PID controller is to correct the error, the difference between the measured value (Gyro measurement) and a desired set Point (desired rotation speed). It is a closed loop control system to get the preferred result by adjusting the input. Quadcopter PID controller to ensure the stability there

are three loops of their own PID coefficients one per axes. We have to set P, I and D values for each access (Pitch, roll, and yaw). P be subject to present error, I subject to accumulation of past errors, and D is subject to a prediction of future error based on a change in current. Setting PID values, select editor and fixed the P gain, I gain, P limit, and I limit.

C. Setting PID values

Select an editor and set the p gain, I gain, P limit, I limit for aileron, elevator, rudder. P will detect how hard the flight controller works to correct the errors and achieve the desired flight control. I sense the flight controller work to hold the altitude of the drone against external forces such as wind. Select receiver testing and verify. First, remove the battery compress back button and enter button simultaneously then connect the battery to perform the throttle calibration. In the transmitter move left to right at minimum throttle for arming the KK flight controller is shown in figure 25.

Figure 25: PID controller of one axis
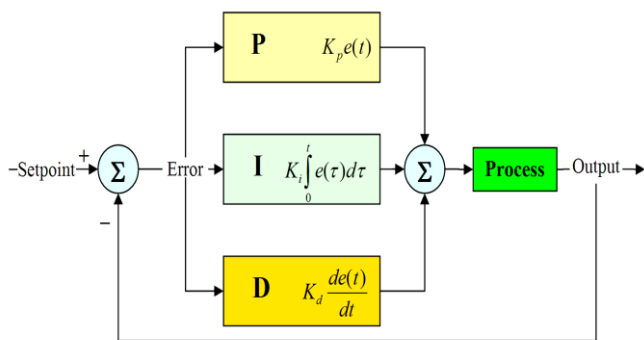
D. Per axis PID structure

The effect of each parameter variation of the parameters alters the stabilization and its effectiveness. Usually 3 PID loops with their own PID coefficients, one per axes has to set P, I, and D values for each axis. The parameters can cause the behavior of coefficients.

Proportional gain coefficient: It can fly stable without other parameters but to determine which is human control measured by the gyro. Higher the coefficient seems to be more sensitive and reactive to angular change.

Integral gain Coefficient: It increases depression of an angular position distributed at an angle of 20 degrees change and volt to written 20 degrees. It is useful for irregular men and ground effect due to turbulence from Motors. When I value is too high, the quadcopter might begin to have a slow reaction and decrease the impact of proportional gain as a consequence. Then it will oscillate considering the high P gain with low frequency.

Derivative green quotient it allows the quadcopter to reach more quickly the desired altitude. As the accelerator parameter amplifies the user input, it also decreases the fast action control. In practice, it will increase the reaction speed and enhances the effect of the P gain in specific instances. In case of an aerobatic flight, it requires is slightly higher P value, it needs somewhat lower I value, an increase in D. Smooth plane

requires a little lower P value, it requires a marginally high in I value, and a decrease in D value shown in figure 26.
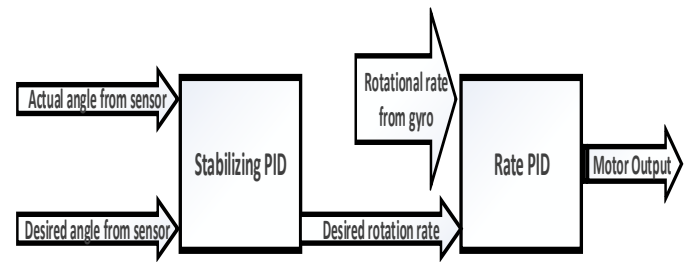

Figure 26: Per axis PID structure

VI. ALGORITHM APPROACH ON PADDY CROP

The stages of algorithm approach using vision assistant in LabVIEW. The step-by-step analysis specified in detail shown in figure 27.
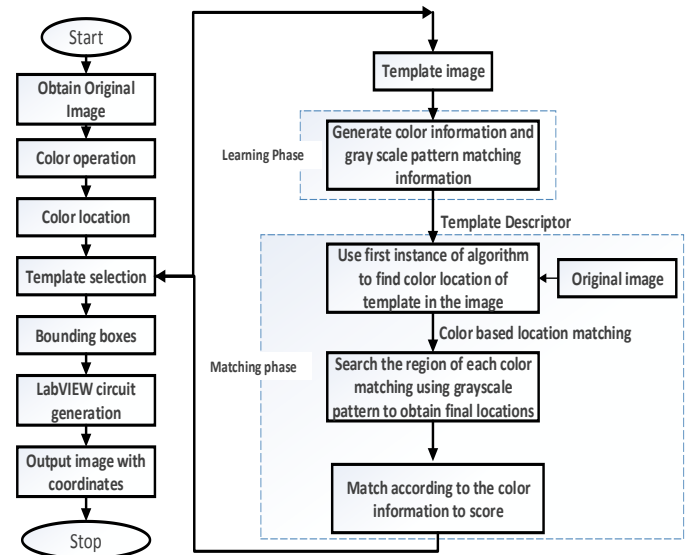

Figure 27: Image processing algorithm using vision Assistant

1) Read input image

The first stage of image processing for detecting the colors in it and capture it from the camera or load previously clicked picture from memory.

Input images for reading in RGB format, which is most familiar to represent the colored images, if the image size is MxN then the RGB format in a three-dimensional matrix of size MxNx3, where each dimension represents red, green, blue color components of the image.

2) Color operation

Extract RGB color bands from the input image into three separate dimension parameter, one for each color component. The RGB color images converted into the grayscale the grayscale image will be a two-dimensional image containing the intensity value of each of the pixel of an image. In general

grayscale image increases the speed of processing is visualization and reduce the complexity of the code by converting a three dimensional into two dimensional resulting in a reduction in a number bits in each pixel of an image.

3) Color location and template selection

The color matching is built in function to quickly locate the regions with specific color information in an image. The services extend the capability of color matching in which the objects of an image are unknown. Color location uses the color information in the template image and checks the occurrence of the template in the search image. The color template is used to compare the image pixel by pixel and the color information at the current location in the image using the color matching algorithm. Caller location process contains, two steps one is learning template, and another one is searching template, in an image using color location process. In the learning phase, the software extracts the color spectrum from the image template, compare the color information of the template using the color information of the image.

Search the region of the template is moved across the image pixel by pixel from top to bottom. Each pixel function in the color spectrum of the region, the color spectrum is associated with the templates color spectrum to match the score. These steps separated into two phases. First, the search phase will detect the possible locations even with little match cases. In this phase, it finds possible locations quickly in the image that may be a potential match to the template information. In image from Pixel by pixel verification and computing match scores is time-consuming. The following methods are used to improve the search process:

a) Sub-sampling:

If you sample points of color information is considered in the image for comparison with the template. It reduces the amount of data used to compute the color spectrum in the image with speed search process.

b) Step size:

The search process skips some pixels between the color comparisons thus, speed the search process. The step size shows the number of pixels to skip for color location, the initial step size as large as half the size of the template.

4) Bounding boxes

The 3D image is converted into a 2D array of data, out of the random boxes in the background object interface is selected. The boundaries are highlighted to diagonally detected objects through imaginary rectangle sides plotted parallel to the axis. To increase the number of matches on the input side and the number of outputs and coordinates are updated.

VII. RESULTS AND DISCUSSIONS

A. Quadcopter

The hardware module is shown in figure 28, the complete picture of the quadcopter with Pi-camera.

Figure 28: The complete hardware setup of the quadcopter

B. Webpage

Here http://localhost:5000 is a sample server, which we have hosted; the user has to enter the username and password. The webpage is to access camera lock and unlock.

Figure 29: User authentication required to access

When the user tries to access this highlighted webpage, it asks for the authentication as shown in figure 29, obtained by IP address or website with the server address.
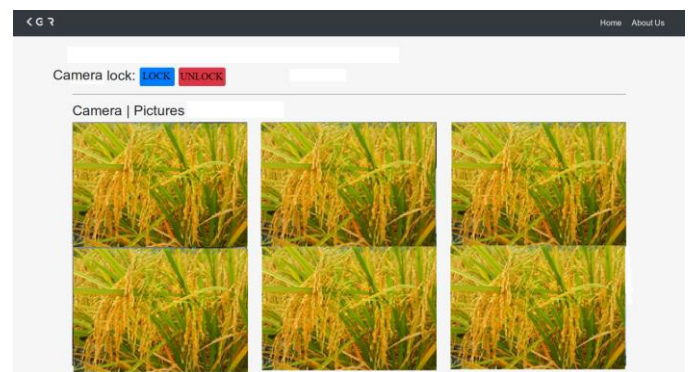

Figure 30: Captured images through the web from a quadcopter

When the user enters the correct information, then it is directed to open the web page. On this page, we can control camera lock by pressing the lock and unlock options to capture the images is shown in figure 30. The quadcopter is flying over the paddy crop agricultural field shown in figure 31.

Figure 31: Quadcopter flying over paddy crop

B.   Algorithm approach on paddy crop

The vision assistant software interface used to create image processing and machine vision applications. It describes the concepts of image analysis in machine vision and image processing.

1)   Step 1: Launch Vision Assistant

The user must install and NI software tools from the official website by creating an account and launch on the PC the launch vision assistant. Select start all programs, the National Instruments Vision Assistant tool opened.

Figure 32: Obtaining image from a crop

2)   Step 2: Acquiring Images

The vision assistant has some specific features for browsing processing and acquiring images. Can browse the image directly from the internet or obtain a copy from a personal computer, it is already captured/downloaded from the camera. To select the first processing image tool we have to open a new image and select the required image from the drive as shown in figure 32.

3)   Step 3: Color Operator

Arithmetic and logical operations are done numerically for different images of a constant value in vision assistant using this color operator to the mathematical operations are performed using the RGB pixel values.

Exclusive or operation: The Ex-or function is true if one and only one input value is true and false otherwise and similarly ex-nor is typically taken to binary or grey scale image as input, and a third output image whose pixel values of the first image XOR with the corresponding pixels from the second.

The operator takes a single input image and accesses each pixel with the specified constant value to produce the output is usually carried out individually on each corresponding weight in the pixel values in between/as a result is shown in figure 33.
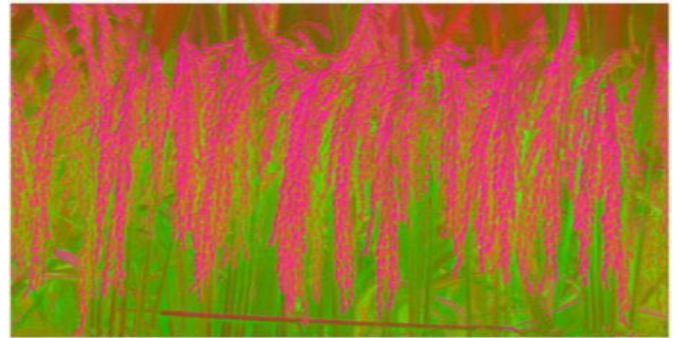

Figure 33: Image after applying Ex-or operation

Absolute difference operation: In this case, one image subtracts from other or a consistent model and return the absolute difference operation. The combination described in the following equation 1 & 2.

$$Dst(x, y) = |Src\ A(x, y) - Src\ B(x, y)| \qquad - (1)$$
$$or$$
$$Dst(x, y) = |Src\ A(x, y) - Constant| \qquad - (2)$$

Src – Source, Dst – Destination

The first symbol represents the image source A and second symbol image source B the third symbol represents the image type connected to the destination image shown in figure 34.

Set the absolute difference value between an 8-bit image constant and an RGB value, the variance calculated for each plane of RGB image. The absolute difference performed on RGB images, the absolute difference is intended for each color plane red, blue, and green of image source A and the corresponding color plane of the image source B.

Figure 34: Image after applying absolute difference operation

4)   Step 4: Color Locations and Templates Selection

The color location works on the color information of the region and doesn't use any shape information from the template. It doesn't find the angle of rotation of the match. It locates the position of the region in the image where size matches a template containing similar color information.

Pattern matching will quickly find the reference patterns with color pattern matching create a model or template that signifies the object for which you are examining. Then mission vision application search for the model in each acquired image calculating a score for each match. The score indicates the model matches of the color pattern found, the mission vision application search for the model in the required image will get a match score for each query. The rating of match model, the color pattern shows how closely it relates.

5) Step 5: Bounding boxes and matches representation
Image obtained after color operation using Ex-or and the absolute difference we can make use of the color location tool and select some particular templates which refer some specific colors from the image and load them. In each color location, as we use the algorithm in the vision assistant, the output saved and the number of matches of the templates increases, we get different locations, and it corresponds to the coordinates of the color shown in figure 35.

The block diagram of color pattern matching algorithm is to estimate the number of seeds shown in figure 36. For the above said, the front Panel for the seed estimation is shown in figure 37. The Particulars of the region of interest, file path selection, checking with the sensitivity and minimum match score. Ultimately it gives the result in the form of the number of matches (seed), the algorithm approach is providing tremendous results.

Figure 35: After bounding boxes and match representation

C. Algorithm approach to paddy crop disease
The standard templates of the original image which represents the condition in the crop, which may impair across the agriculture, are given in table 1. The block diagram of the agricultural field identifies the diseases of the paddy crop shown in figure 38. The file path attached to the different templates, which represent the disease of the crop by which we can estimate the health of the yield is measured as mentioned above using color matching algorithm, recommendations are considered to set the template, is shown in figure 39. The significant output results are obtained to estimate the blast, brown spot, and green.

Table 1: Standard templates of seed and disease

S.No	Standard template	Name of the template
1		Seed
2		Brown Spot disease
3		Blast disease
4		Tungro Disease
5		Stealth blight
6		Green
7		Dark Yellow

VIII. CONCLUSION
The project includes two significant parts of work, developed the quadcopter, and another part is to concentrate on the paddy crop problems using image processing. First, the quadcopter is built to handle camera carefully and to lift in the free space. The PID control operations are implied to rectify the errors occurred during the fly by the flight controller. The captured images can be viewed from the web page to see the crop status. The second portion of the work is carried out to process the paddy crop problems by collecting the crop images by applying color pattern matching algorithm gave immense results of matching the number of seeds to estimate. And this process is helping us to identify the disease occurred in the crop.

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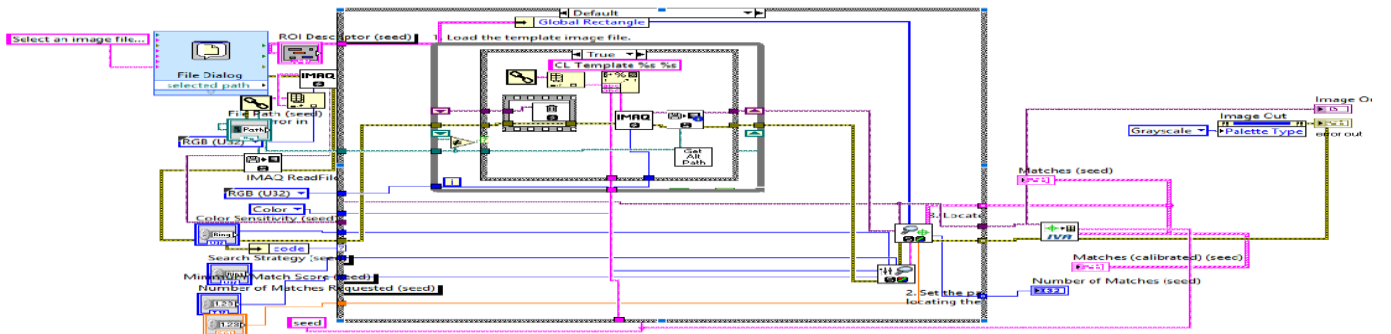
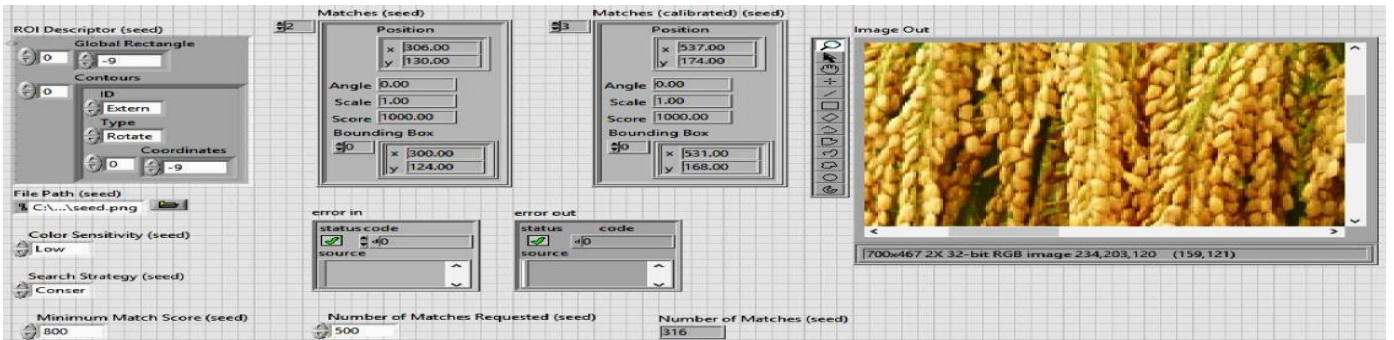Figure 36: Block diagram of matching the seed estimation

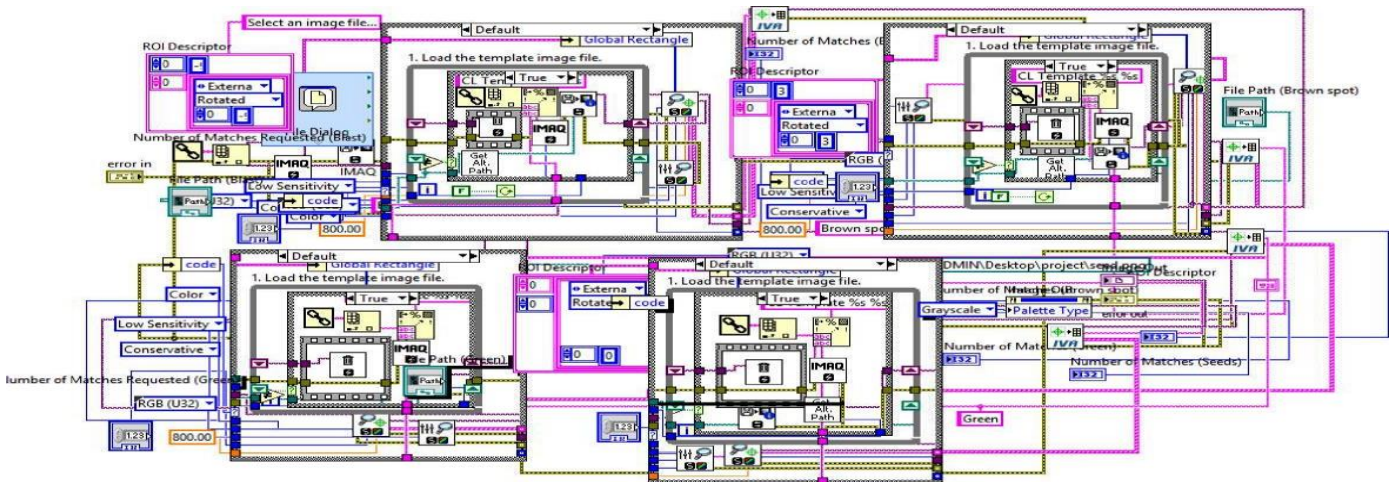Figure 37: Front panel of matching the seed estimation

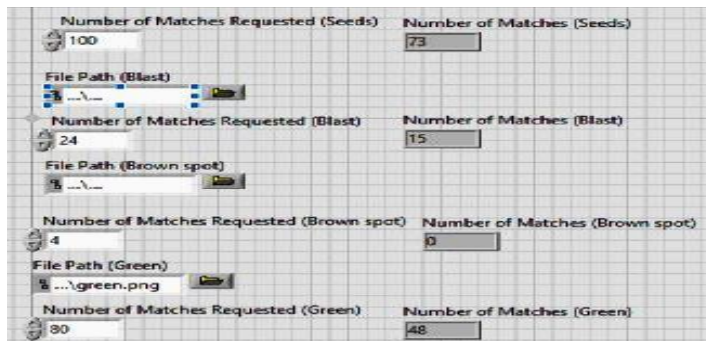Figure 38: Block diagram of finding the matches of different disease

Figure 39: Front panel of finding the matches of different disease