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IoT Based Intelligent Management System for Agricultural Application

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ABSTRACT
The growth of technology in any sector is not there in agriculture and this is a problem for India. The government has struggled to do anything for the farming sector which is in an exceptionally deplorable state. The pause in decision making also has led to India's high rate of unemployment owing to the quality of the economy. The applications in well-developed countries involve robotics, aircraft, and artificial intelligence, but they can raise the cost of running and sustain. Currently, operating drones such as these is difficult. In India, only a few farmers can afford to employ such high-tech machinery to farm owing to financial constraints. The project is aimed at developing an affordable quad copter for farmers to use on their crops, with the goal of growing their output. We are developing core a framework with support of Raspberry Pi and OpenCV that can help predict crops yield with the help of inputs from numerous different sensor packages.

KEYWORDS: *Raspberry PI, Open CV, Embedded System, Internet of Things, Agricultural*

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I. INTRODUCTION

Water is important for life. Water occupies more than 70 percent of the Earth's atmosphere. Of the water in most of the canals just a little more than 3 percent is clean. Water management is relevant. The irrigation method used by farmers sometimes use more water than is required. Irrigation in agriculture is a complicated process. More than half of the water used is cast out. The irrigation method would become more accurate with less wastage of water. GSM technology and even fuzzy logic framework would enable the homeowner to know the state of his or her yard. Thus, the owner would be able to track their field and mow their lawns automatically. Although these existents cannot relay the system's state very easily [2 ,3 ,9]. The owner can only realise after the event. Since the Sensor data is transmitted from one block to another blocks previous ventures, there is a risk of having broken block and recognition would not be obvious. The proposed framework of smart agriculture utilises LAN technologies used to link people and items [5,6,7]. This results in higher output volume and efficient utilisation of capital. Thus, this device would be built to improve the water storage capability and automated spraying of fertilisers.

In precision agriculture, drones have a various range of applications that can be used from soil and crop field analysis to applications like planting and pesticide spraying. It is seen that Drones can also be used for various imaging technologies such as hyper spectral, multispectral, thermal etc. which can provide the farmers with time and site-specific information from the purpose of predicting crop health, fungal infections, growth bottlenecks etc.

Drones can also identify drier regions in a field and measures can then be taken for irrigation such regions with better techniques. It is important for Precision agriculture which provides farmers with such concrete information that enables them to take informed decisions and utilize their resources more efficiently.

The use of unmanned aerial vehicles (UAVs), also known as drones, and connected analytics has great potential to support and address some of the most pressing problems faced by agriculture in terms of access to actionable real-time quality data [16, 17 ,18]. Sensor networks based on the Internet of things (IoT) are increasingly being used in the agriculture sector to meet the challenge of harvesting meaningful and actionable information from the big data generated by these systems [10,11].

II. Literature Survey

To develop the cost-effective and environmentally friendly decision support framework is another suggestion in this article. Therefore, improving ways of utilising water would render it efficient. The ambiguous reasoning was selected for human behaviours and crop conditions. In this way, the Smart Irrigation Method is applied effectively. Mengzhen Kang, this paper proposes to demonstrate how a plant can be handled as a parallel body [1]. This method could change the expert framework by incorporating learning abilities and by combining all knowledge resource gained from data processing into the final model. Such may offer very true prescription on theoretical basis that are helpful to make real breeding effective. Therefore, utilising a temperature sensor and time-domain delta-sigma converter will yield higher resolutions for better performance. To meet the consistency criterion, a reference clock is used. This helps the result to be transformed into a digital result quite easily. This restriction can be solved in the smartphone apps. The microwave scattering relies on the soil characteristics. This paper was studying into the roughness scale for soil in the agricultural phase in back scattering. Eight distinct forms of roughness were gained and viewed. In this manner, components having medium frequencies were observed as essential elements for the soil. In order to generate more food in the future, Yandun predicts that agricultural production must be doubled [4]. All these objectives are hindered by environment, expense, depletion of soil, no supply of farmland, etc. It presents the calculation of phenotype dimensions with respect to measurements.

The aim of this segment is to classify key approaches via numerous surveys. The purpose of the study was to gather a wide range of knowledge from a number of outlets on diverse subjects. Any of the following suggestions have been taken into account. There is need for tiny autonomous nano drones. The article discusses production of nano drones in recent years owing to increased advancement in microelectronics and AI. Using drone for agricultural purposes and surveillance would rise in the coming years. Research of nano drones to large scale drones will only happen if there is expanded research and development towards drone technology. The viability of automation of nano-drones is extremely complicated in relation to its subsystems and modules. This is in accordance with the interconnected device method suggested by Authors in [8].

They created a privacy-aware pedestrian detection and tracking device for Crazyflie Nano Drones which utilises a camera as a sensor module and ANN model-based microprocessor which detects the entity in front of the drone and sends the order to the micro-controller to stop. The shield's proportions and weight are worth remembering too. The Crazyflie's shield was prepared to fulfil the drone controller. The shield operates automatically without the use of any external control or instruction. Before developing any autonomous drone, one issue must be foreseen is motion prediction and trajectory regulation. Sensors supply sensor data while the programme executes the computational phase of micro-controller and regulates the position of the aircraft by the performance of the step [10,11,12]. A PID controller is described by Axel Reizenstein in his final report by using PID controller. Nano swam drones are described in the G. C. A. Cimino's report. The autonomous swarm of drones run with one shared aim to increase productivity. The article states that the swarm drone technique is used using positional vectors. There are a great variety of potential applications for this technology. The conventional methods of farming took much time and labour to track and achieve. It also means that the farmer can "fly" the system over the field, purpose of which basically to check whether there are any plants which need nitrogen or just some water to boost their development. The infrared sensors on these drones are used to demonstrate the problems in farmlands, as is seen from the photos acquired from these drones [13,14 ,15].

These photos contain normalised difference vegetation index maps, and which were previously generated with the help of satellites and aero planes by measuring the difference of the near-infrared and visible light radiation. Combined with the sensor and GPS tool, the knowledge is converted into photographs and videos which are geo-referenced such that they can be used. This is particularly crucial because GPS technology is a key technical engine for farming.

III. project methodology

This segment would explain how to build this project and how it's organised. Any further work on this report will be appreciated. Micro drones that are grouped as swarms would be attached to a central framework of control. With the aid of autopilot tech, these drones would have a pre-programmed course. Raspberry Pi can do the same operations as can be performed in a machine. This is a fairly flexible micro controller with 40 optical input/output pins. The ARM CPU/GPU is built to do certain tasks in an optimised manner. HDMI is a socket that links the projector to the TV.

Figure1: Raspberry PI Model

RCA jack for analogue TV output and other computers, etc. There is USB port used to connect mouse and keyboard. The 5V connecter may be inserted for power supply. In order to boot the system, the SD card will be required. There is no AUX in the system. LED (Light Emitting Diode) is used for illumination.

This is how the raspberry pi can be used. When the drone has travelled over the area, it will use different sensors to research the optical properties of the crops. With this method, the central computing unit will process through the documented picture data using OpenCV and the ML programme will operate on the provided data and deduce the meaning. The conventional aerial drones are large-sized (about 250 mm) weighing more than 400 grammes. These items add considerably to range, payload and battery power of Unmanned Aerial Vehicles (UAVs). Besides this, there's high cost of these drones and its efficiency are unreliable and breakable. In comparison, these unmanned aerial systems are very costly to support. Nano-drone as the name implies would be small-sized and more power effective than any others. This concept may be further adapted for work on carrying several types of small drones which together can survey a large area and carrying out testing and other uses effectively.

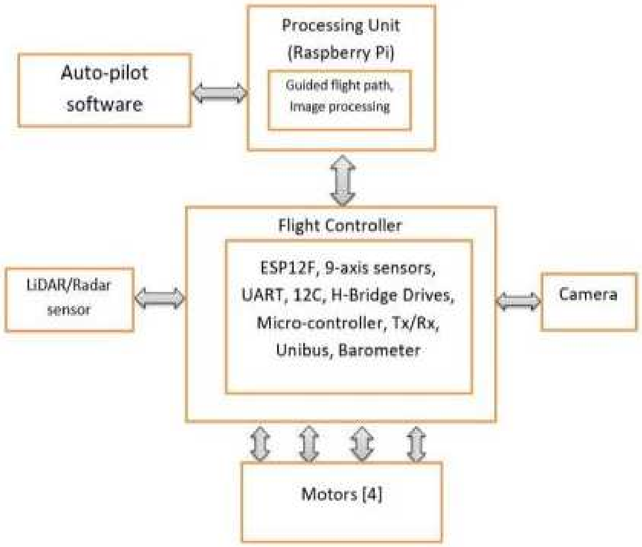

Figure 2: Block overview of the project structure

OpenCV is used to measure the harvests from farmlands. Computer vision is even improved today. Programmable algorithms can be produced using Artificial Neural Network (ANN) to train, process, and predict the performance using different processed data (in image processing).

IV. system working

This segment discusses further about the ultimate objective of the project. In this portion of this initiative, it includes software implementation of drone, and image processing utilising OpenCV (Figure-2).

There are basically important main fields in this device implementation occurs such as Production environment/dependency configuration. The automated algorithms can be used in evaluating the autonomous flight, Land Management Centre, MAV Connection Module, Dronekit /API for Arduino Due. To know the process flow, A flowchart (Figure-3) of the above segment consist of :

A. Drone: Drone Hardware-necessary hardware elements are PX4 and Raspberry Pi such as NAVIO.

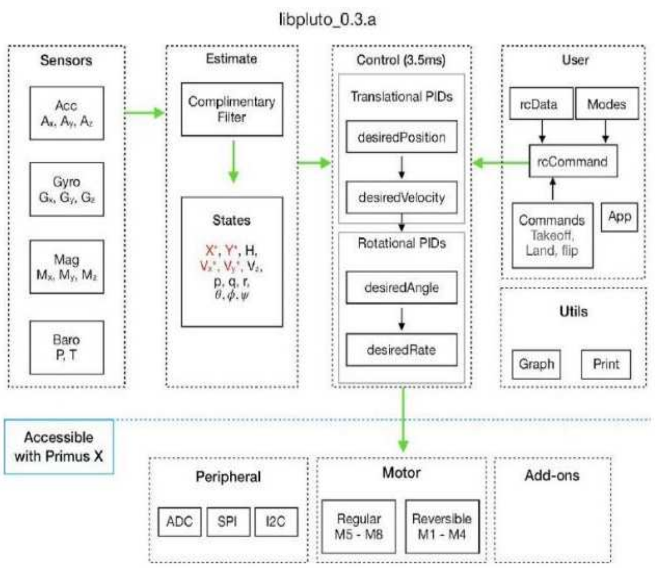

Figure 3: Basic schematics of a flight controller

This is a benefit since both pieces of hardware are readily accessible, and Pixhawk can be run on Windows OS as well as on the Linux OS. In this segment, there are two applications, and they are PX4 pilot and Ardupilot. All function by the same theory.

B. In this sheet, there is only MAVLink which is used to connect with the drone. This is because radio contact would be necessary while the MAVLink Drones are in the air.

C. Land Control Facility: I. Two antennas, one for the ground station.

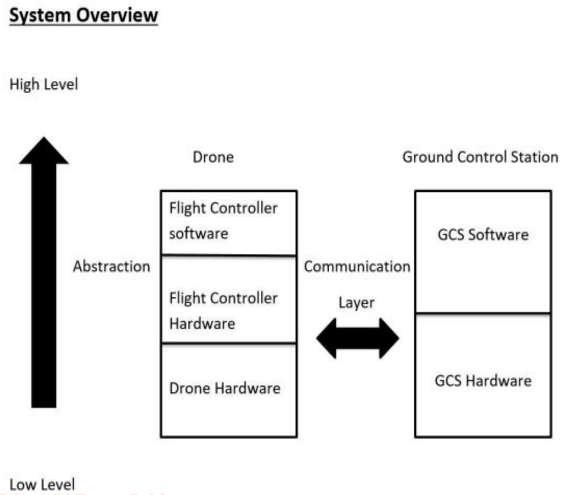

Figure 4: Software and hardware abstraction of the drone blocks

Ground Control Station (GCS) is a software used to control and interact with drone or UAV. The applications that are available are free and open source. Drone kit is a project that runs on python files.

An image is composed of tiny items called "pixels" or picture elements. There just isn't much... A picture includes several points in rows and columns. Inspect this picture to evaluate the number of rows and columns expressed as resolution. According to this illustration, an Ultra HD television has the resolution of 3840 by 2160 or 3840 × 2160. A device does not understand pixels as squares of colour. It only understands numerical results. Using different colour templates, the machine has translated colours to numbers. In computer graphics, RGB stands for Red, Green, and Blue. Of pixel is made up of the mixture of those three colours. With RGB people may have an understanding regarding different colours in the world. Since a machine can only comprehend numbers, a pixel is defined by three numbers: the sum of red, green, and blue in that pixel. In gray scale (black and white) pictures, the pixel reflects light strength. The values of dim vary from 0 (black) to 255 (white) (white). Anything between 0 and 255 is often a hue of grey. To recognise the objects, colour recognition is used in different types of pictures. Our target is to get a certain colour of a pixel from an image. For the Color Detection, it is necessary to recognise that a picture is a set of pixels. In order to detect the Colour Picture, which is collected by the cameras on the drone, we'll need a library named cv2 that helps us to modify pictures. We are going to transform the picture into hue, saturation, and meaning variables. An important function in OpenCV is the Track bars since they display us the upper and lower range limits of the colour of a picture. We use six colour channels, hue min, hue max, sat min, sat max, val min, val max. We need to add the Picture Values to the Source Image. We use the imshow feature to take the photographs and shows on screen. function imshow() is used to represent a picture in a browser. Windows automatically scale to the image. Syntax: cv2.imshow(window name, image) This picture is to be seen. It does not return any profit. "OpenCV-Python is a library of Python interfaces designed to solve various computer vision and pattern recognition problems." This approach takes a picture from a particular file. If the picture cannot be read, this function returns an empty matrix. Syntax: openCV.Cv2. imread (route) flag defines the way the illustration is to be interpreted.

V. CONCLUSIONS

This paper was produced with the purpose of offering proper understanding of the issue we have investigated. The steps to finishing a project were pointed out in the paper. This is an unfinished article; the project has not finished yet. Further inquiries and evidence are required before sending a final study. We have checked the implementation but due to device failures it is not entirely complete. The work with OpenCV on colour recognition has been so far completed. There can be added algorithms to openCV such as neural network and edge detection recognition. There has been a shortage of funding and expenditure for the electronics and hardware portion of the drone. However, if there is no hardware sufficient to test the drone, it may also be evaluated on a simulated platform.

If this UAV-WSN based surveillance system is applied widely soon, farmers will be able to benefit from the acquisition of real time farm information. Farmers will not need to spend a significant amount of time on acquiring farm data and will have access to disaster warning and weather information when a disaster event seems possible. In future More UAV-WSN research and development work is required.

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