International Journal of Control and Automation
Vol. 13, No. 2, (2020), pp. 771 - 775

Smart Farming Using Deep Learning Technique

[1]S Sri Heera [2]Rahul D, [3]S Sudarshan Athreya, [4]S Suriya Narasimman, [5]K Muthu Harini

[1]Assistant Professor Department of Computer Science Engineering, Easwari Engineering College, Chennai, Tamilnadu, India
[2345]UG students, Department of Computer Science Engineering, Easwari Engineering College, Chennai, Tamilnadu, India
[1]sriheera2205@gmail.com,[2] drahul1104@gmail.com,[3] sudarshanathreya1999 @ gmail.com ,[4]snarasim@gmail.com [5] muthuharini333@gmail.com

Abstract

The trend and technology of the world is always set in the direction of optimization and precision. The agricultural sector has also been changing rapidly to keep up with modern times. It has been made clear that crops require adequate amounts of nutrients alongside water to grow into healthy plants that can sate the human populous. Previous irrigation systems use either permanent sensors to measure moisture content or use robots to irrigate the plants. Existing technology can measure the growth of plants using only the diameter or length of leaves. Currently Weeds can be only detected using permanent fixed equipment. The fixed sensors may trouble the growth of roots. The robots since being wireless may not be able to transmit large amounts of data for providing efficient and fast communication. For some plants the growth prediction may not be accurate mostly when the plants are mature. Weed's precise locations cannot be determined for automatic weeding to be performed. The proposed system aims to create a model to monitor both external and internal status of the plants. Techniques like Computer Vision for image processing and Long Short-Term Memory is used for the growth monitoring of the plant and Convolutional Neural Network is used for weed detection. Apart from identification of the weed, the exact location is marked and required action is taken with the help of drones. The communication is done using Global System for Mobile Communication to achieve fast data transfer.

Keywords: *Computer Vision, LSTM, CNN, GSM*

1. Introduction

Stone Age to space age, increasing agricultural production and decreasing the manual labor involved, has spun various revolutions. This modern age also strives to achieve the same goals but through more efficient and automatic tools. Increasing the results in agriculture is the need of the time to feed ever increasing mouths. To achieve this, it is not only important to irrigate plants in efficient amounts, but is also required to maintain the health of the plants. Yields may get affected due to bad soil, weeds or pests. For detecting and maintaining the appropriate conditions the proposed system's mobile device along with irrigation, will also continuously monitor the plants growth and provide necessary support. Plant growth is fundamentally attributed to the stem diameter. This factor decides the quality of the plant during vegetative growth stage. The diameter of the stem can also be used to ascertain the amount of water required for many different species. Apart from diameter, flowering and fruit bearing are also important factors to monitor the growth and health of the plants. To protect the plants from external threats, like weeds and pests, continuous monitoring is essential. The other important factor that determines the quality of plants is avoidance and prompts removal of weeds. Weeds are the non desirable plants that

ISSN: 2005-4297 IJCA

grow along with the intended plants, they over crowd the growing spaces, resulting in higher competition for resources. This leaves the plants with inadequate resources for growth. Pests cause reduction in water quality, increase in soil erosion, degradation of land, and destruction of plants. Thermal imaging and image detection techniques are used to detect the destructive pests in the agriculture field. Since pesticides have adverse effects on humans, they are sprayed automatically using drones.

Deep learning is a subset of machine learning in artificial intelligence (AI) that has networks capable of learning unsupervised from data that is unstructured or unlabeled. It is also known as deep neural learning or deep neural network. Deep learning provides many algorithms and models for predictions and classification problems.Image processing is the technique to remove the noise and extract the required features from the image. Image processing technique is used for the purpose of edge detection, object detection and can also help to get critical information from videos.

2. Literary Survey

The author [1] proposed system uses soil moisture sensors to collect the moisture content using robots. This is transferred using LoRa to the base station for the further process and to release water. Communication through LORA is not reliable for robots that are moving through fields. The system uses image processing techniques with MATLAB, to detect the disease in the plants and to provide a solution without any human interventions. The system does not contain any way to capture pictures from the field and there is no mechanism to find the cure for the disease[2].The colour detection technique and image processing to obtain crop-row image for monitoring weeds. The system does not separate the crops and weeds accurately [3]. To analyses images using SVM model for the purpose of identifying pests. Using SVM models requires images in high resolution and it also increases the need for storage space, moreover SVM requires a very accurate training model[4].To monitors the growth of the plants continuously using infrared sensors. Infrared sensors performances get reduced in the sunlight and it supports only a shorter range[5].The authors developed the system monitors the growth of rosette plants with the help of time lapse videos of other plants. The detection of plant leaves could be erroneous in case of complex plant shapes [7] and determines the amounts of phosphorus in the soil with the help of artificial neural networks and temperature, humidity and soil moisture sensors. These sensors have to be removed and replaced after each harvest. This process is both expensive and time consuming [8].

3. Existing Technology

a. Soil Moisture Sensor

Soil moisture sensors are used in the small mobile devices to measure the soil moisture content and communicate back to the base station using LoRa to release the required amount of water [9].

b. Low-power Image Sensors

These are wireless autonomous monitoring that uses image sensing to identify pests. The pest count is sent back to the main station. Depending on the count further action can be taken regarding crop protection. Apart from pest's image sensors are also used to find the growth of the plants using its diameter and leaves size [10].

c. IR and Ultrasonic Sensors

The technique uses a unique method to identify insects. An ultrasonic sensor that takes only the frequency of sound produced by the wings of insects as input is being used.

ISSN: 2005-4297 IJCA

Depending on this frequency the type of insect is discovered and this information is sent to the farmer via GSM module [12][13].

4. Proposed System

The proposed system aims to use automatic mobile devices, which will use Raspberry Pi, to move around the various points in the farm and collect data of the plant's environment. The mobile device will be collecting soil moisture content, Images of plants and its surrounding. Soil moisture content is obtained using soil moisture sensor. Soil moisture content is obtained by calculating the resistance and capacitance of the soil conditions. Video feeds of the plants and its surroundings are recorded using a Raspberry Pi Camera. Adafruit AMG8833 IR thermal sensor is used to thermally detect the pest that are not detectable by photos. All the data is sent to the base station which consists of Raspberry Pi. Raspberry Pi will direct the release of water through the pump. It will also be used for removing noises in the data and for the images to be processed.

Each image will also be linked with Geo-Tag to keep track of the image location. For analyzing and processing the images about growth of plants, Long Short-Term Memory recursive neural network algorithm is used. Flower and fruits will be detected using Res-net convolutional neural network algorithms. Weeds and other pests that may cause harm to the plants can also be detected through the Res-net Convolutional neural network algorithms and they are mapped. The analysis will provide a view of how good the plant has been growing, and if it has been affected by any weeds or pests. In case of detecting the defects in growth or weeds or pests the Raspberry Pi will send the location of defect. A database that contains all the appropriate liquid/gas for each defect is scanned. The appropriate agent is chosen and released with the help of drones, to prevent the droplets from entering the human system.

4.1 . Implementaion

In Figure 1 Raspberry pi acts as the system controller. It controls the GSM module which is used to send the information to the base station, soil moisture sensor is used to get moisture data, servo motors enable the autonomous mobile device to move, GPS module and the ultrasonic sensor is used for movement within the field. They allow the autonomous device to move around the field while avoiding any obstacles and also constantly checking its location using GPS. Adafruit AMG8833 allows for the thermal detection of pests. Raspberry PI Camera is used to capture the image and video information while the autonomous device moves through the field.

In Figure 2 Raspberry pi is used to perform various Image processing and Deep learning techniques, it also controls the GSM module for communication, water motor for irrigation and drone to spray the fertilizer/pesticides. Control tower acts as a backbone for the system by providing link between the automatic field monitoring system and field applications

ISSN: 2005-4297 IJCA

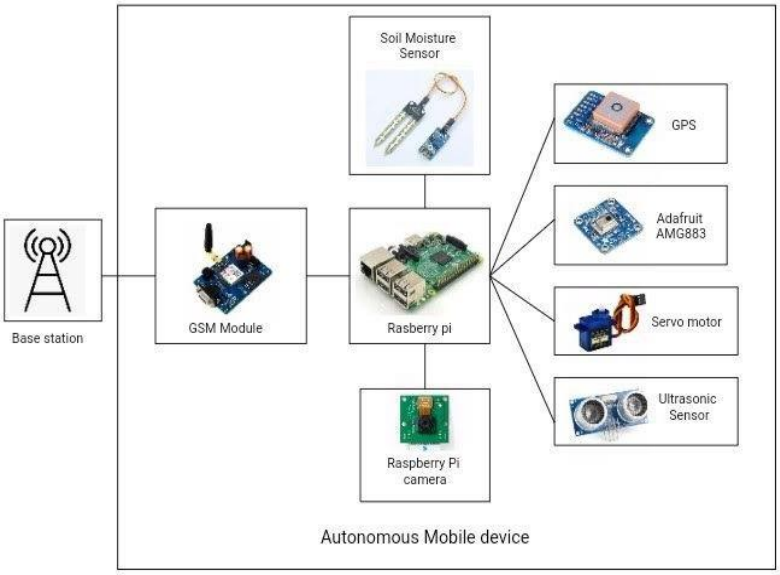

Figure 1. Automatic Field Monitoring System

.

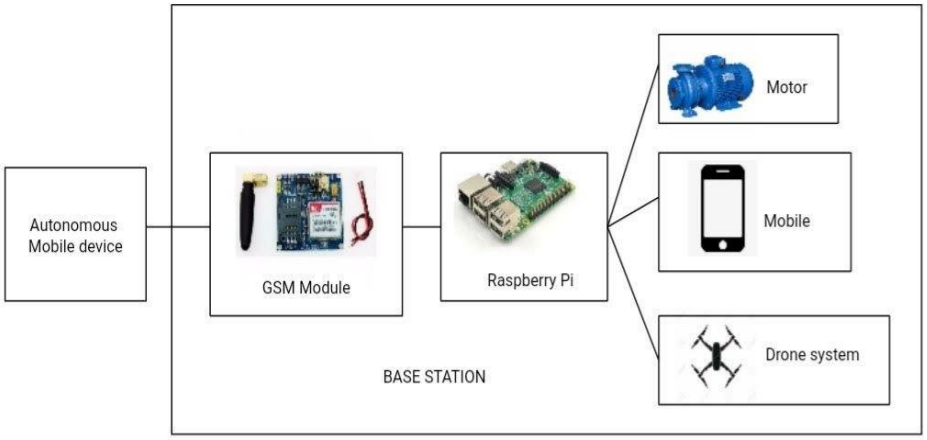

Figure 2. Control Tower

5. Conclusion

The use of modern technology has allowed many innovations in the field of agriculture. By incorporating techniques like Deep Learning and image processing, the proposed system is able to perform different agricultural tasks like irrigating, monitoring plant growth, and weed and pest detection. The proposed system will allow for a more automated way of agriculture and cut down labour costs to a great extent. By monitoring plant growth and avoiding weeds and pests the plants grow well and provide better profits to the farmer. The application of drones for the purpose of spraying the pesticide can avoid health issues for the farmer when done manually. The proposed system will increase the produce to feed the ever increasing mouths without requiring hands.

References

[1] S. Sri Heera, P Suganthan, S Sudarshan Athreya, S Suriya Narasimman, M Rakesh "Automated Irrigation and Smart Farming" International Journal of Engineering and Advanced Technology (IJEAT), Vol. No. 8, (2019), pp. 1450-1452.

[2] K.Anitha, G.Keerthiga, A. Hema Malini "Plant Health Monitoring System Through Image Processing and Defects Overcoming Through Embedded System", International Journal of Recent Technology and Engineering (IJRTE), Vol. No. 8, (2019), pp. 406-408.

[3] V. S. Malemath, Mrs. Sharanamma M. Hugar "A new approach for weed detection in agriculture using image processing techniques", International Journal of Advanced Scientific and Technical Research (IJST), Vol. No. 3, (2016) pp. 356-359.

[4] P. Ashok, J. Jayachandran, S.Sankara Gomathi, M.Jayaprakasan "Pest Detection and Identification by Applying Color Histogram and Contour Detection by Svm Model", International Journal of Engineering and Advanced Technology (IJEAT), Vol. No. 8, (2019), pp. 463-467.

[5] K.VinothKumar, T.Jayasankar, M.Prabhakaran and V. Srinivasan, "Crop Based Irrigation System with Plot Selection", Fronteiras: Journal of Social, Technological and Environmental Science, Vol.6, No.2, May-Aug 2017,pp.265–273.
DOI: http://dx.doi.org/10.21664/2238-8869.2017v6i2.

[6] Babette Dellen, Hanno Scharr, Carme Torras "Growth Signatures of Rosette Plants from Time-Lapse Video" IEEE/ACM Transactions on Computational Biology and Bioinformatics,Vol. No. 12, (2015), pp. 1470-1478.

[7] Johan J. Estrada-López, Alejandro A.Castillo-Atoche, Javier Vázquez-Castillo "Smart Soil Parameters Estimation System Using an Autonomous Wireless Sensor Network With Dynamic Power Management Strategy", IEEE Sensors Journal, Vol. No. 18, (2018), pp. 8913 - 8923.

[8] Johnny L. Miranda, Bobby D. Gerardo, and Bartolome T. Tanguilig III "Pest Detection and Extraction Using Image Processing Techniques", International Journal of Computer and Communication Engineering, Vol. No. 3, (2014), pp. 189-192.

[9] Almaw Ayele Aniley1, Naveen Kumar S.K, Akshaya Kumar A. "Soil Moisture Sensors In Agriculture And The Possible Application Of Nanomaterials In Soil Moisture Sensors Fabrication ", International Journal of Advanced Engineering Research and Technology (IJAERT), Vol. No. 6 , (2018), pp. 134-142.

[10] Pooja Kharat, Ameya Salvi, Omkar Sawant , Nilesh Rathod "Research paper on Vegetation Health Monitoring Using Agricultural IOT", International Journal on Recent and Innovation Trends in Computing and Communication, Vol. No. 4, (2016), pp. 200-202.

[11] Muhammed Enes Bayrakdar "A Smart Insect Pest Detection Technique With Qualified Underground Wireless Sensor Nodes for Precision Agriculture", IEEE Sensors Journal, Vol. No. 19, (2019), pp. 10892 - 10897.

[12] Kanishk Sisodiya, Mandeep Singh "Design and Development of Ultrasonic and IR Insect Detector for Oilseeds Crop", International Journal of Engineering and Advanced Technology (IJEAT), Vol. No. 7 ,(2016), pp. 52-56.

[13] Johan J. Estrada-López ,Alejandro A. Castillo-Atoche, Javier Vázquez-Castillo , Edgar Sánchez-Sinencio "Smart Soil Parameters Estimation System Using an Autonomous Wireless Sensor Network With Dynamic Power Management Strategy", IEEE Sensors Journal, Vol. No. 18, (2018), pp. 8913 - 8923.

ISSN: 2005-4297 IJCA