A Review of Sensor Application in E-Farming

Samrudhi Kaware,
Assistant Professor,
G H Raisoni College of Engineering and Management, Pune, IndiaEmail:
samrudhi.kaware@raisoni.net

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Abstract—Sensor applications have a serious influence on everyday objects that improve the human quality of life. Key topics should be soil biological sensing, crop production and post-harvest implementation. Topics associated with soil sensing involve soil content control, sewage systems and soil erosion movement paths when harrowing, while seedling detection issues involve assessment of winery spray drift applications, implementations ofwinter wetland thermal imaging, forest wellness systems and remotely sensed applications.

Keywords—E-Farming, Machine Learning, IOT, Deep Learning

I. INTRODUCTION

Agricultural farming is the key Profession all around India. Despite this due to climatic variation and global warming the farmers facing huge problems such as less cropyield, various diseases on leaves, stems, fruit, etc. The living standard of farmers has been highly affected due to poverty and the mortality rate of farmers is increasing day by day. Modern technology automated machines, sensor application, imageprocessing, spectral data analysis, machine learning leading the world to new heights. The major agricultureoperations are land preparation, seedbed preparation, plantation, irrigation nutrition, plant/crop protection, and harvesting. All these operations can be automated by sensor application. Land preparation can be done using GPS based tractors and driverless work by programming. Sensor application is helpful for farmers in Argo marketing. E- farming will be helpful for farmers to sell their products all over India and abroad by getting the basic knowledge of the website. This paper illustrates the review of the application ofsensors in agricultural farming and e-marketing, various SMSfacility in the local language provided by the e-portal.[2]

II. REVIEW

Deep Learning in Agriculture

DL is the most favorable solution to image processing because of the decreased need for feature engineering (FE). The conventional method for image classification problems was based on hand- engineered features, the consistency of which had an impact on the overall results. FE is a challenging, time-consuming procedure that has to be updated if the dataset changes. FE is a cumbersome operationthat dependent on the guidance of experts and does notgeneralize properly. DL downside is longer preparation time, testing time is quicker than theories that focus on ML. DL incorporates problems that could arise when using pre-trained models on limited or substantially different datasets, scalability issue due to the complexityof models and hardware constraints.[1]

In Table 1, features are developed along with the images acquired by the sensing methods. Current sensing technologies, such as multi-spectral, hyperspectral, satellite- based imaging. Synthetic apertureradar (SAR), thermal and near-infrared (NIR) cameras are used to a limited yet growing degree, although optical and X-ray imaging are used in the processing of fruit and packaged foods. DL is about "deeper" neural networks that provide a centralized representation of the data via a diverse range of convolutions. This improves information learning abilities and therefore higher robustness.

Future of DL in agricultural production is the only problems of land involve categorization, crop type estimation, crop phenology, weed detection and fruit grading. It is impressive to check how DL would deal with agricultural related problems like Leaf classification (Classify leaves of differentplant species), Plant and Leaf disease detection, Plant phenology recognition (Identify plants from leaf vein patterns of white, soya and red beans) with agricultural applications such as Mapping land and plants, phenology of crop, observing crops etc. [1]

Table 1 Describes Remote sensing techniques used to enhance agricultural application with data analysis methods.

Sr No	Agricultural Applications	Remote sensing	Methods for data analysis
1.	Mapping of land and plants	Hyperspectral imaging, multi-spectral imaging, SAR	Image fusion, SVM, end member extraction algorithm, co-polarized phase difference, linear polarizations, distance-based classification, decision trees, linear mixing models, logistic regression, ANN.
2.	Phenology of crops	Satellite remote sensing(general)	Wavelet – based filtering, fourier transforms, NDVI
3.	Index of photosynthetic activity and seed canopy	Hyperspectral imaging, multi-spectral imaging	Linear regression analysis, NDVI
4.	Observing of crops	Satellite remote sensing, NIR camera, SAR	Feature extraction, linear regression analysis, co polarized phase differences, linear polarizations, classification and regression tree analysis
5.	Crop classification and ecosystem readjustment	Remote sensing in general, cameras and photo-detectors, hyperspectral imaging	Principal Component Analysis, feature extraction, linear regression analysis
6.	Crop height, estimation of yields, fertilizers effect and biomass	Light Detection and Ranging(LIDAR), hyperspectral and multi spectral imaging, SAR, red-edge camera, thermal infrared	Linear and exponential regression analysis, linear polarizations, wavelet based filtering, vegetation indices, ANN.
7.	Irrigation	Red-edge camera, thermal infrared	Image classification techniques, decision trees, linear regression analysis, NDVI
8.	Pest detection and management	Satellite remote sensing, microwave remote sensing, thermal camera.	Image processing using sample imagery, linear and exponential regression analysis, statistical analysis, CEM nonlinear signal processing, NDVI
9.	Weed detection	Remote sensing in general, optical cameras and photo-detectors, hyperspectral and multispectral imaging	Pixel classification based on k-means clustering and Bayes classifier, feature extraction techniques with FFT and GLCM, wavelet-based classification and Gabor filtering, genetic algorithms, fuzzy techniques, artificial neural networks, erosion and dilation segmentation, logistic regression, edge detection, color detection, principal component analysis
10.	Packaged food and food products – identification of contaminants, diseases or defects, bruise detection	X-ray imaging (or transmitted light), CCD cameras, monochrome images with different illuminations, thermal cameras, multi-spectral and hyperspectral NIR-based imaging	3D vision, invariance, pattern recognition and image modality, multivariate image analysis with principal component analysis, K-mean clustering, SVM, linear discriminant analysis, classification trees, K-nearest neighbors, decision trees, fusion, feature extraction techniques with FFT, standard Bayesian discriminant analysis, feature analysis, color, shape and geometric features using discrimination analysis, pulsed-phase thermography.
11.	Greenhouse monitoring	Optical and thermal cameras	Linear and exponential regression analysis, unsupervised classification, NDVI, IR thermography
12.	Agricultural expansion and intensification	Satellite remote sensing in general	Wavelet-based filtering

Table 1: Tabular representation of Computer vision onAgricultureIOT Based Monitoring System in SmartAgriculture

The IOT-based improved agricultural system can prove to be very helpful to farmers, since over as well as less groundwater irrigation is not beneficial for agriculture. The threshold values for atmospheric zones such as moisture,pressure and temperature can be established on the basis of the climatic factors of that specific area. The platform also senses the invasion of animals, which is the major reason for crop reduction. The whole system generates an irrigation schedule based on field and climate repository data sensed in real time. This system can strongly advise whether or not a farmer needs irrigation. There is a need for continuous internet connectivity. This can be overcome by extendingthe system to send a suggestion via SMS immediately to the farmer on his mobile phone using the GSM Technology instead of the smartphone app.

Smart farming has been designed with the help of the Internet of Things (IOT). The remotely operated vehicle operates both in manually and automatically, for various agriculture activities such as spraying, cutting, weeding, etc. The controller keeps track of atmospheric pressure, moisture, soil composition and supplies water to the field accordingly.Based on the use of green energy and smart technology, agriculture sector will find better productivity.

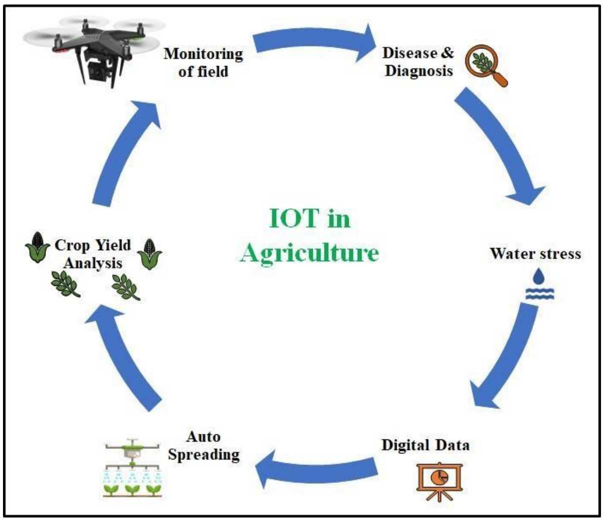

Fig. 1 IOT in Agriculture The primary contribution of this research is to provide genuine insight into:

- World desires from of the agricultural sector.
- Very latest events in IoT, both scientific and manufacturing, are illustrated and how these advancements help to provide solutions to the agricultural sector.

Disadvantages of agriculture industry

- The role of IoT in acknowledging these restrictions and other issues including such resource depletion and appropriate consumption, food spoilage, climatechange, environmental pollution and industrialization.
- Strategies and policies that need to be considered when implementing IoT-based modern technologies.
- Significant challenges that remain to be addressed and possible solutions that have been further required, while recommendations are done toimprove these obstacles.

Major Applications

Intelligent agricultural practices, IoT can contribute to enhance solutions to many conventional farming problems, such as drought response, yield standardization, land appropriateness, irrigation and pest control. Figure 2 lists thehierarchy of primary advantages, services and wireless sensors used for improved agricultural application areas.

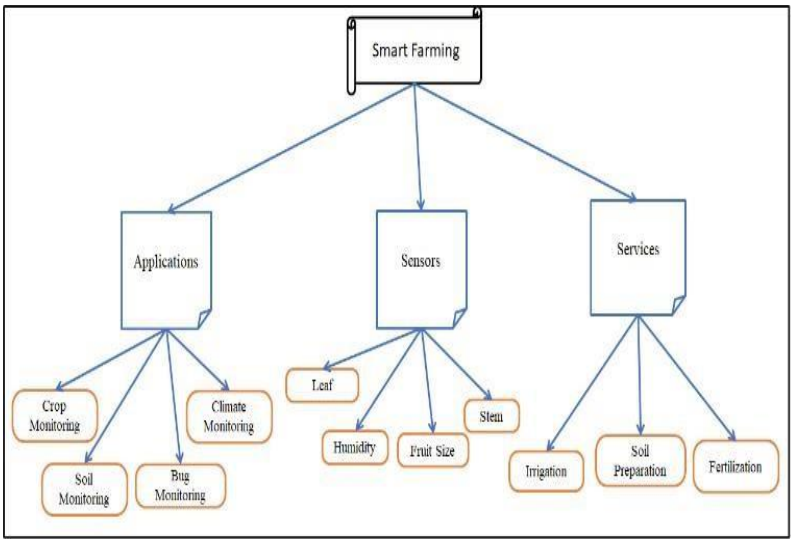

Fig. 2 Applications of smart farming

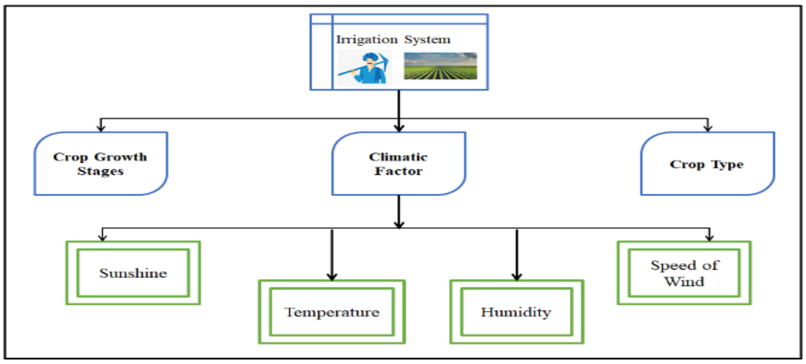

Fig. 3 Applications of smart farming

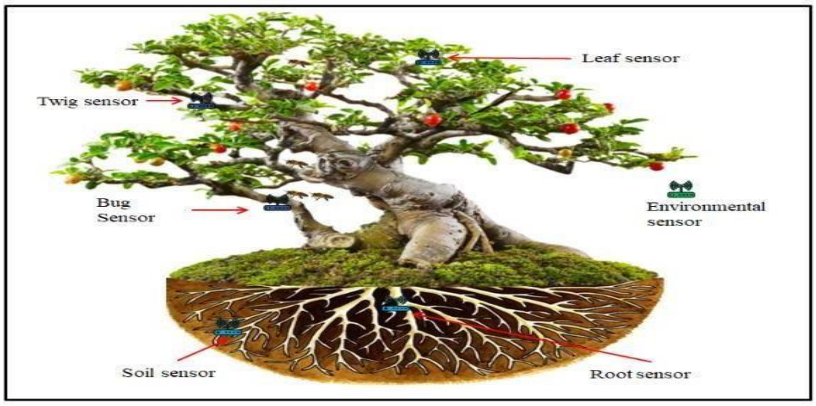

Fig.4 Sensors placed on tree

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