iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** V **Month of publication:** May 2024

DOI: https://doi.org/10.22214/ijraset.2024.60653

Smart Crop Prediction using IoT and Machine Learning

Prof. A. A. Chaudhari[1], Rishi Vyas[2], Shivam Supekar[3], Kartik Dhole[4], Darshana Gujare[5], Rushikesh Chandekar[6]
Department of Computer Science and Engineering, Prof. Ram Meghe Institute of Research & Technology, Amravati, Maharashtra, India

Abstract: Agriculture is a crucial profitable motorist. It's a key to healthy biosphere. People depend on a wide range of agrarian products in nearly all aspects of life. growers need to manage with climate change, and meet rising demands for further food of advanced food quality. In order to escalate the yield and growth of crops, the planter needs to be apprehensive of the climatic conditions, hence abetting its decision of growing the suitable crop, under those factors. IoT grounded Smart Farming improves the entire husbandry system by covering the field in real- time. It keeps colorful factors like moisture, temperature, soiletc. under check and gives a crystalclear real- time observation. Machine literacy in husbandry is used to ameliorate the productivity and quality of the crops in the husbandry sector. Use of applicable algorithms on the tasted data can help in recommendation of suitable crop.
Keywords: Agriculture, IoT, Machine Learning, Farmers.

I. INTRODUCTION

Agriculture plays a vital part in the Indian frugality. Over 70 of the pastoral homes depend on husbandry. Agriculture is an important sector of Indian frugality as it contributes about 17 to the total GDP and provides employment to over 60 of the population. Indian husbandry has registered emotional growth over last many decades. still, growers ' self-murders in India is fussing. The unexpressed reasons in order of significance behind planter suicides were – debt, terrain, low yield prices, poor irrigation, increased cost of civilization, use of chemical diseases and crop failure. A planter's decision about which crop to grow is generally clouded by his suspicion and other inapplicable factors like making instant gains, lack of mindfulness about request demand, overvaluing a soil's eventuality to support a particular crop and so on. The need of the hour is to design a system that could give prophetic perceptivity to the Indian growers, thereby helping them make an informed decision about which crop to grow. This calls for the need of smart husbandry, which requires use of IoT. operation of IoT in husbandry could be a life changer for humanity and the whole earth. Detector data analytics drives translucency into agrarian processes, as growers get precious perceptivity on the performance of their fields, glasshouses, etc. tilling powered by Machine Learning with its high- perfection algorithms is a new conception arising moment. Aiming to increase the volume and quality of products, this slice- edge movement makes sustainable productivity growth for everyone working in the husbandry realm. With this in mind, we propose system for Smart operation of Crop civilization using IoT and Machine literacy – a smart system that can help growers in crop operation by considering tasted parameters(temperature, moisture) and other parameters(soil type, position of ranch, downfall) that predicts the most suitable crop to grow in that terrain.

II. LITERATURE REVIEW

As per Climate Change Crop Yield hypotheticals report in [9], Crop Yields are projected to decline, with the larger declines to be anticipated in several developing husbandry which includes Southeast Asia(- 5 percent) and India(- 5 percent). [10] The variation in on- ranch losses across regions may be incompletely explained by the range of reasons which include structure and marketing challenges, infelicitous crop timing, unanticipated harsh climatic conditions and unfit to prognosticate suitable crops for husbandry in similar climates. The following comparison is show below

Rushika Ghadge, Juilee Kulkarni, Pooja More, Sachee Nene, Priya R L in [1] uses unsupervised and supervised literacy algorithms like Kohonen Self Organizing Map and Back Propagation Network. Dataset is trained by learning networks to classify it into organic, inorganic and real estate for prognosticating the type of soil. It compares the delicacy attained by different network literacy ways and the most accurate result is delivered to the end stoner. System will check soil quality and prognosticate the crop yield consequently along with it give toxin recommendation if demanded depending upon the quality of soil.

Reference Paper [2] determines real time slice of soil parcels using MODIFIED SUPPORT VECTOR REGRESSION, a popular machine learning algorithm and four modules. The Modules include Sensor connived to IoT device, Agri cloud, assaying the real time detector data and Agri stoner interface(AUI). The first module is movable IoT device NodeMCU) with soil humidity detector and pH detector, environmental detectors. Agri cloud module consists of storehouse. assaying the real time data module is processing of types of crops and small shops suggested using modified support vector machine algorithm. Agri- stoner interface is a introductory web interface. therefore, with the help of soil parcels planter will be suitable to get types of crops and small shops is grown in cropland with help of Modified support vector machine algorithm. 18 International Journal of Engineering Research & Technology(IJERT) ISSN 2278- 0181 Published by,www.ijert.org NTASU- 2020 Conference Proceedings Volume 9, Issue 3 Special Issue- 2021

[3] predicts temperature, humidity and pH value for crop vaticination using the ARIMA model. The model takes the values from database as input and also predicts what will be the value of that particular parameter after 1 month. The prognosticated values are also transferred to K means algorithm for bracket grounded on pH value therefore creating k clusters of crops having analogous pH value. KNN algorithm is used to prognosticate top N suitable crops which are displayed to stoner.

In [4], Machine Learning Algorithm(KNN) calculates the parameter to suggest the crop which is stylish to grow in the particular field grounded on the values entered at real time. A standardized dataset containing the minimal conditions for a particular crop is maintained and is used for the vaticination of the crop. The detectors are added to the field for which the readings are demanded to be calculated. The DHT11, MQ2, Soil humidity Sensor, Light Intensity Sensor sends the readings in real time to the pall garçon.

[5] evaluates the crop quality factor grounded onpre-established rainfall conditions and nature of soil using the trained set of data and enforcing Supervised and underpinning models of machine literacy. If any inimical conditions are perceived ahead of time, the volition and precautious measures are espoused so as to insure the good of the planted crops and agrarian land. Specific measures are also taken to prognosticate the right period of sowing, reaping and harvesting for the overall improvement of the product which can also be previsioned as a part of the ultramodern agrarian revolution.

Citat ion	Major Algorithm Implemented	Information Conceived
[1]	Kohonen Self Organizing Map and Back Propagation Network	• Dataset is trained to classify it into organic, inorganic and real estate. • Compares the accuracy obtained by different network learning techniques. Most accurate result is delivered. Predicts the crop yield along with fertilizer.
[2]	Modified Support Vector Regression	• Analyses the real time data and processes different types of crops suggested using machine learning. • With the help of soil properties suggested, farmer will know suitable crop to be grown
[3]	K-nearest neighbors (KNN) algorithm	• Dataset containing the minimum requirements for a crop is maintained. Sensors send the readings in real time to the cloud server • Suggests the crop which is best to grow in the field based on the real time values.
[4]	ARIMA model	• The model takes the values from database as input. Predicts what will be the value (weather) after 1 month to suggest crop
[5]	Reinforcement models like Markov Decision Process and Q learning	• Reinforcement models are used during varying weather conditions. • Predicts the right period of sowing too.

III.PROPOSED SYSTEM

The system aims to help growers for smart decision while prognosticating the crops. To increase the delicacy along with live data, major data for temperature and moisture from government website is also collected and stored. Also major downfall data is collected and stored. To be definite and accurate in crop vaticination, the design analyzes the temperature and moisture of the field – live data collected using DHT- 22 detector and major data collected from government website and/ or google rainfall API, type of the soil – used by the planter and the major downfall data. It can be achieved using unsupervised or supervised machine literacy algorithm. By learning networks, dataset is trained. The delicacy attained by different machine literacy ways are compared to get the most accurate result which in turn will be delivered to the end stoner. Along with the most suitable crop, the system also recommends the toxin for that crop. Responsive, Multilingual website is used by planter to communicate with the system.

A. Hardware Components

Digital Temperature & moisture Detector DHT22 detector is preferred to cover live temperature and moisture. This detector is proved to be more precise and accurate. It uses a capacitive moisture detector and a thermistor to measure the girding air, and spits out a digital signal on the data leg to Arduino Uno harborage leg. The range of DHT22 is 0 to- 100 RH for moisture and -40 to 80 degree Celsius for temperature.

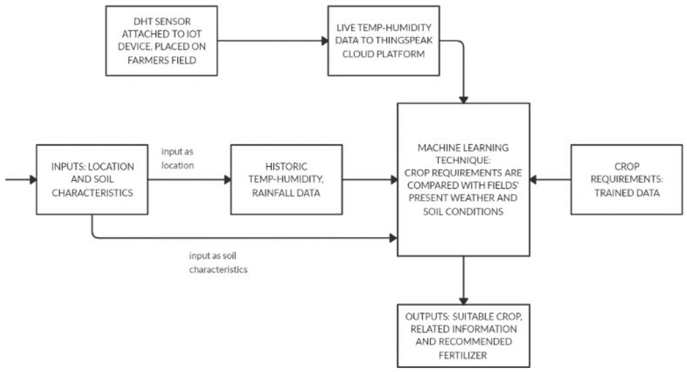


Figure 1. Block Diagram

The functionality of the armature(Figure 1) is as follows:

In the website, Farmer logins and enters the position of the field and the type of soil available at the field for tilling as input, both the input are reused further.

Position is used as an input to collect the major data of specified position i.e. the field. The major data is collected using government websites or third- party operations like APIs for rainfall and temperature, quantum of downfall in the region.

The live data is collected by placing the IoT device on the field. IoT device correspond of DHT 22 detector – Temperature and moisture connected to Arduino UNO along with ESP8266 Wi- Fi module. The live data is collected every hour and the stored- on Thing Speak pall platform. The live and major data is collected. The VAR Vector autoregression) model is applied on this collected data to read the downfall, temperature- moisture for a period of time when planter is supposed to cultivate the crop. Now, this read temperature, moisture and downfall along with Soil characteristic entered by planter are supplied to three different ML algorithms- Decision Tree, K- NN, Support Vector Machine wherein the combination of the below results and the predefined data set i.e. factual conditions of the crops present in the crop data store is compared. Eventually, by comparing the delicacy attained by different machine literacy ways, the utmost accurate result i.e. the most suitable crop is presented to stoner.

On the website, planter gets the most suitable crop as an affair. Along with this, the end stoner is handed with all the information about the crop and the stylish suitable toxin.

IV. RESULTS

Training dataset used, contains information about temperature, moisture, downfall parameters, and the crop pH corresponding to these parameters.

Nitrogen (N)	Phosphorus (P)	Potassium (K)	Temperature	Humidity	pH	Rainfall	Label
90	42	43	20.87974371	82.00274423	6.50985292	202.9355362	Chickpea
85	58	41	21.77046169	80.31964408	7.038096361	226.6555374	Chickpea
60	55	44	23.00445915	82.327629	7.840207144	263.9642476	Chickpea
74	35	40	26.49109635	80.15836264	6.980400905	242.8640342	Chickpea
78	42	42	20.13017482	81.60487287	7.628472891	262.7173405	Chickpea
69	37	42	23.05804872	83.37011772	7.073453503	251.0549998	Chickpea
69	55	38	22.70883798	82.63941394	5.70080568	271.3248604	Chickpea
94	53	40	20.27774362	8289408619	5.718627178	241.9741949	Chickpea
89	54	38	24.51588066	83.5352163	6.685346424	230.4462359	Chickpea

Figure 2. Training set

3 different types of Machine Learning algorithms are usable – Decision Tree, KNN and Support Vector Machine (SVM), and they're compared with respect to their delicacy. Decision Tree has the loftiest delicacy of all, and is therefore used eventually to prognosticate the crop.

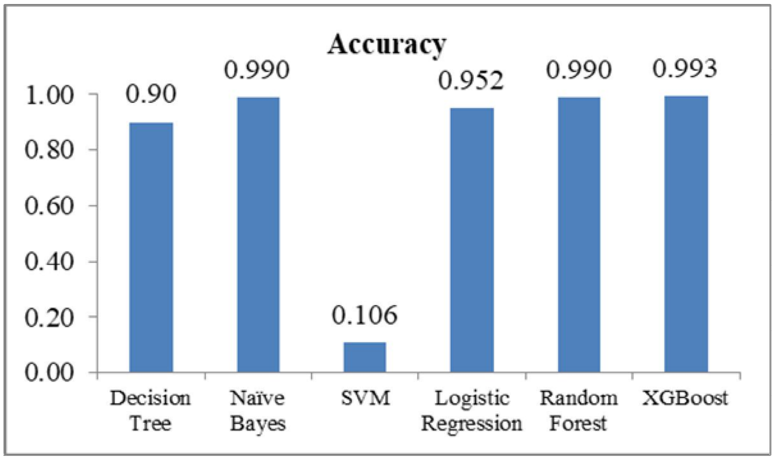
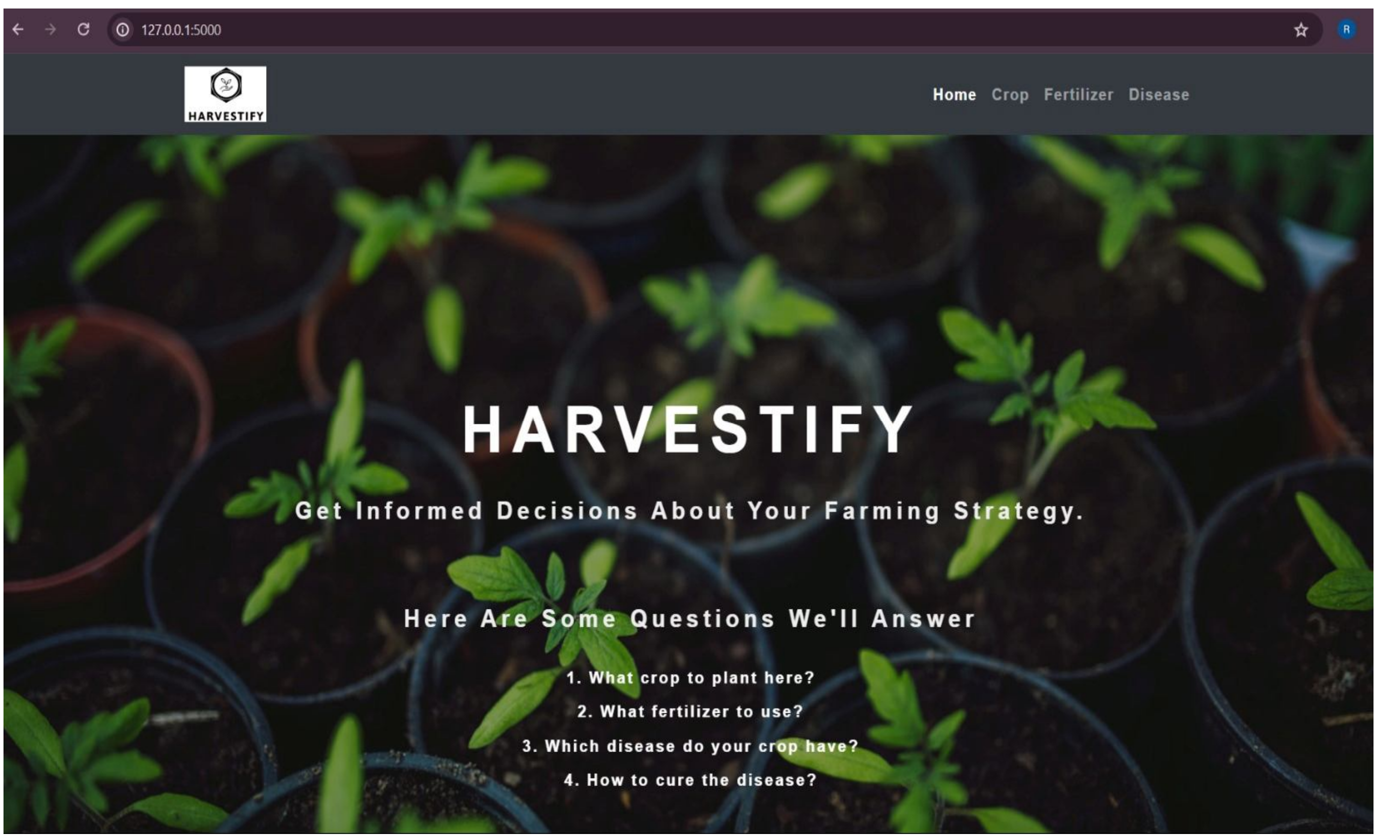
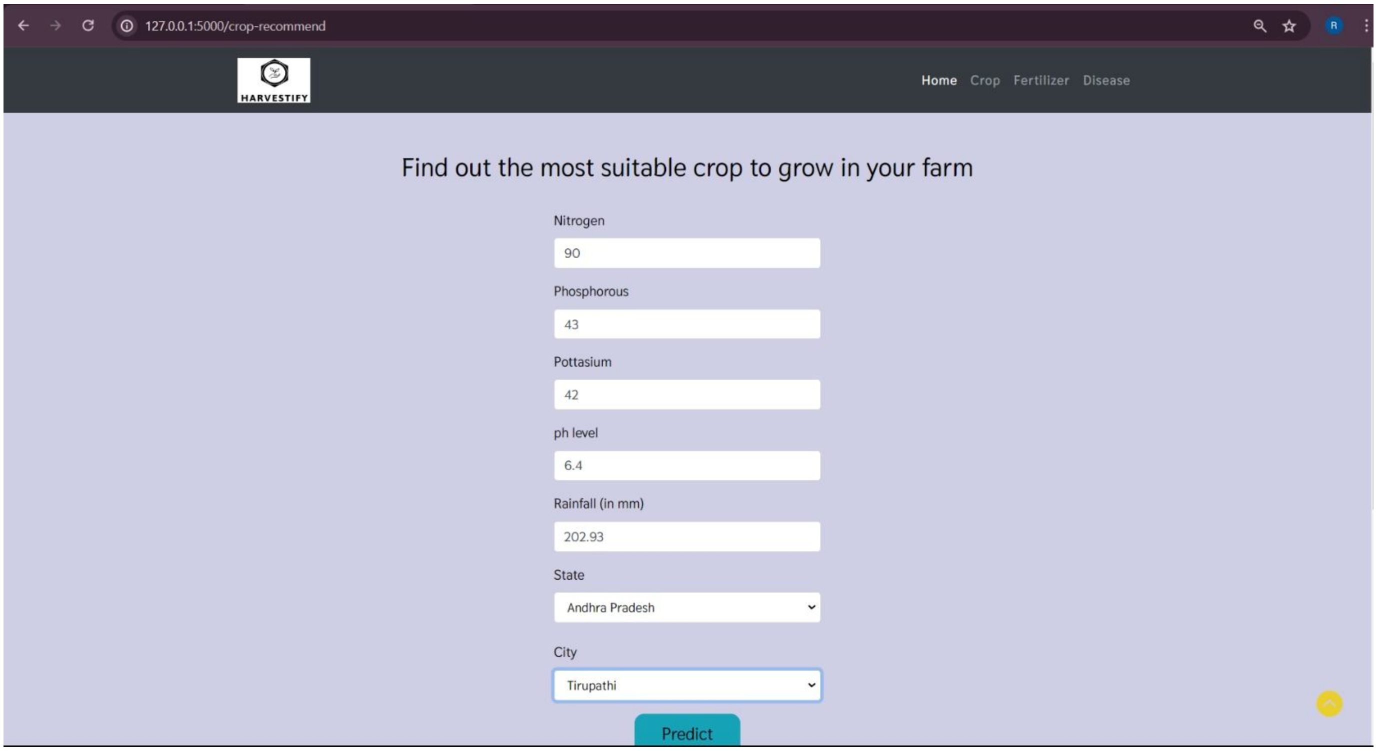


Figure 3. Comparison of the delicacy of the three algorithms

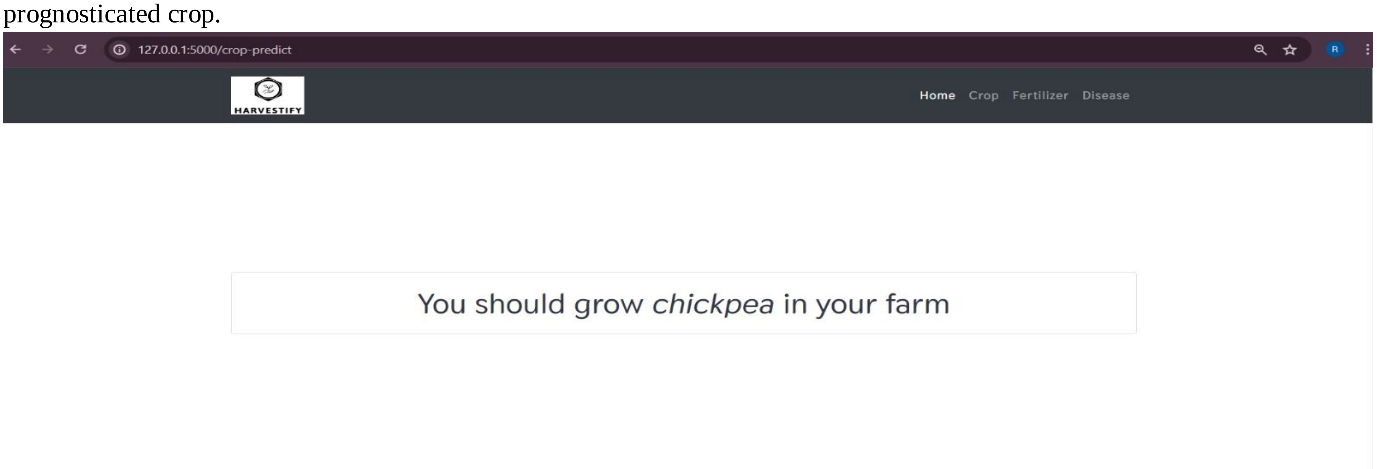
As XGBoost has loftiest delicacy, XGBoost for prognosticating the crop is used. Farmer uses the " Smart Crop Prediction " website, to enter the soil pH, position and the anticipated month to begin husbandry.
The Graphical stoner Interface(GUI) has been developed for the machine literacy models using the Flask Framework. For the backend of the point we've used Python. This point will prognosticate the stylish suitable crop for civilization. First, on our home runner, we get information about our system and also option whether to prognosticate the crop by using the detectors value and area also ahe features for Fertilizer recommendation and another feature is to find the disease by uploading plant leaf images



The next page is decided on what we select if we select crop then the user have to give the input like Nitrogen, Phosphorus, Potassium, pH level, Rainfall, State and City



By entering this values we will get a image of prognosticated crop. It'll also deliver a communication that you should plant prognosticated crop.



V. CONCLUSION

In this paper, we've proposed an innovative and comprehensive approach to smart husbandry that harnesses the important capabilities of two slice- edge technologies the Internet of effects(IoT) and Machine literacy(ML). By seamlessly integrating these two arising fields, our proposed system aims to revise the agrarian sector, empowering growers with unknown perceptivity and decision- support tools. The synergistic combination of live data aqueducts from IoT detectors and literal data depositories enables our system to achieve unequaled situations of delicacy in its prognostications and recommendations. By continuously covering real- time environmental conditions, soil humidity situations, rainfall patterns, and other pivotal factors, the IoT element provides a constant sluice of over- to- date information. contemporaneously, the integration of literal data allows our ML algorithms to identify patterns, trends, and correlations that may not be incontinently apparent, farther enhancing the system's prophetic capabilities.

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue V May 2024- Available at www.ijraset.com

Likewise, our approach leverages the power of multiple ML algorithms, each with its unique strengths and specializations. By employing an ensemble of algorithms and using their reciprocal capabilities, our system can give further robust and accurate analyses, counting for the essential complications and variabilities present in agrarian disciplines. The ultimate thing of our proposed result is to palliate the challenges faced by growers and contribute to the sustainable growth and productivity of the agrarian sector. By furnishing data- driven perceptivity, optimized resource allocation strategies, and timely cautions for implicit pitfalls or openings, our system empowers growers to make informed opinions, maximize yields, and minimize destruction. also, our approach has the implicit to enhance the quality of agrarian yield, icing that crops are cultivated under optimal conditions and clinging to strict quality norms. This not only benefits growers economically but also contributes to food security and promotes environmentally sustainable practices. In summary, our innovative approach to smart husbandry, driven by the community of IoT and ML technologies, represents a significant stride towards a more effective, productive, and sustainable agrarian future. By employing the power of data, analytics, and slice- edge technologies, we aim to revise the way husbandry is rehearsed, fostering a paradigm shift that benefits growers, consumers, and the terrain likewise.

REFERENCES

[1] Rushika Ghadge, Juilee Kulkarni, Pooja More, Sachee Nene, Priya R L, “Prediction of Crop Yield using Machine Learning,” International Research Journal of Engineering and Technology (IRJET) Feb 2018, pp. 2237-2239
[2] Radhika, Narendiran, “Kind of Crops and Small Plants Prediction using IoT with Machine Learning,” International Journal of Computer & Mathematical Sciences April 2018, pp. 93-97
[3] Shridhar Mhaiskar, Chinmay Patil, Piyush Wadhai, Aniket Patil, Vaishali Deshmukh, “A Survey on Predicting Suitable Crops for Cultivation Using IoT,” International Journal of Innovative Research in Computer and Communication Engineering January 2017, pp. 318-323
[4] T Raghav Kumar, Bhagavatula Aiswarya, Aashish Suresh, Drishti Jain, Natesh Balaji, Varshini Sankaran, “Smart Management of Crop Cultivation using IOT and Machine Learning,” International Research Journal of Engineering and Technology (IRJET) Nov 2018, pp. 845-850
[5] Akash Raj N, Balaji Srinivasan, Deepit Abhishek D, Sarath Jeyavanth J, Vinith Kannan A, “IoT based Agro Automation System using Machine Learning Algorithms”, International Journal of Innovative Research in Science, Engineering and Technology November 2016, pp.19938-19342
[6] Food and Agricultural Organization. (2018). The state of Agricultural Commodity Markets. 19-22.
[7] Food and Agricultural Organization. (2019). The state of Food and Agriculture. 23-27.