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The assessment of a smart farming system in VIKOR methods

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Abstract

In India, the most popular agricultural products include wheat, barley, fruits, vegetables, and fodder. Socioeconomic sustainability in agriculture is dependent on the weather. A farmer can make more money at a reduced cost by increasing productivity through wise crop selection. Based on available natural resources and cost Sort out crop alternatives, Promote sustainable agricultural practices and Identify the best suitable crop a multi-criteria decision-making model (MCDM) can be used. The most crucial factors are taken into consideration to determine if agricultural activities are sustainable. This study comprised four sustainability-related criteria. Using MCDM for sustainable agricultural practices in India The research focuses on developing the model. The most suited crop was determined using MCDM approaches, then Soybean, Apple, Rice, Corn, and Cucumber. And fruits emerged as a high-yielding crop. Such a system also applies to other areas, and for sustainable agricultural practices can be further extended to various crops. Water to develop an appropriate agricultural policy in India, The Ministry of Environment and Agriculture is anticipating assistance from the study. Corn is first place in wind-solar hybrid farm and the last rank is cucumber.

Keywords: Farming Crops, ICT, MCDM approaches

Introduction

Based on demographic criteria, Finding the most profitable crop is sustainable Very useful for agriculture. Currently, agricultural activities are greenhouses and Mechanization through precision farming methods, At the same time it conserves and enhances the available natural resources. Sprinkler and drip irrigation practice water conservation a novel example. To face rapid population growth, there is a need to increase the yield per unit of land. Between demand and supply to manage inconsistency, Sustainable crop production practices have become increasingly important. The need of the hour is to improve and improve the standard of living of the people and protect the natural resources of the earth. Sustainable agricultural practices are social, Linked to economic and natural resources. These factors are closely related to farmers' self-confidence and personal satisfaction. Crop yield and economic aspects of farmers including its market value. Low rainfall and the ecological condition of the arid zone is challenging due to high temperature. Agricultural products guarantee food security and contribute to the development of the country. According to the Food and Agriculture Organization (FAO), Natural soil nutrients, market value of crop yield, Water quality and carbon sequestration are essential components of agricultural production. 70% of the Indian economy is in rural households Agriculture plays an important role. It involves a lot of hard and time consuming work, i.e. watering the plants manually, Sales are stopped in the event of flooding or strong rains that restrict animals from grazing. These actions should be carried out precisely and successfully. They are very fundamental and the bare minimum. Additionally, poor resource usage degrades crop quality, lowers output, and upsets the ecological balance. Agriculture automation makes life simpler for farmers. Farmers are offered options by automated systems with sensors so they may monitor and carry out agricultural chores. Includes computers and data base technologies several techniques using automated systems have been proposed in the literature. But cheaper and for field control A simple solution is the need of the hour for farmers. An autonomous system made up of a master controller and the requisite sensors is suggested as a solution to the issues raised above. This system monitors the field, To manage agriculture related activities Designed to help the farmer. In the autonomous operation of the computer Sensors can play an important role. To harness the strengths of the agricultural sector globally Various IoT policies have been formulated by the Government of India. The basic objective of Indians is soil density, soil condition, Monitor the temperature and Alerting farmers to control pest related problems. For using IoT to transform the digital landscape In the year 2015 The policy on IoT in India is about communication and Published by Ministry of Information Technology. The foundation of the Indian economy is agriculture. About 70% of the people in India Recent developments in information and communication technologies, Site-specific data for fields It has allowed farmers to access more. Data gathering, variable processing and input utilisation rates are its three key purposes. Through automated means The agriculture sector can reduce a lot of manual labour. found in numerous agricultural areas The absence of mechanisation in agricultural activities is a significant issue. In India, traditional tools like the plough and scythe are used to carry out physical work for agricultural implements. our automated farming technology, which minimises physical labour automates agricultural processes. Ground water is also contaminated by the use of pesticides and synthetic fertilisers. They are swapped out in smart farming for organic fertilisers (eg manure, animal manure, green manure). And using it helps the soil's structure. The crop will be supported by ideal climatic conditions and well-

known "cash crops in India," but most farmers view it as the main cash crop they wish to produce when choosing which crops to grow. Since the procedure takes the longest possible time, these disorders are carefully examined. Analysis reveals that yield loss has been steadily increasing over the past few decades, which has resulted in a sharp reduction in agricultural production. In today's situation, When compared to suicides in any other part of the world, India is witnessing an unprecedented increase in farmer suicides in human history. According to studies, farmer suicides occur in the majority of the countries, but not in India. The unspeakable misery of the farmers, Pain is also the greatest human affliction. In one's own life Compared to near and dear ones it's not great or kind, because suicides inflict an unnatural end to a beautiful human life.

Farming Crops

To investigate the most recent developments, we set out to implement ICT in smart farming techniques. Meanwhile, we conducted a quick literature analysis on the published works of leading experts in this subject. For describing the connections between digital agriculture, see precision agriculture, digital earth, information agriculture, virtual agriculture, and more. A novel strategy is suggested. The need to promote digital agriculture was discussed. Using a smartphone for wireless sensor networks and smart farming Collection of sensor data and irrigation management for vegetable crops are offered. A smartphone can be used to collect environmental data and manage the irrigation system. Early tomato borer detection with cloud computing The idea of smart farming is put out. Utilizing IoT and cloud computing, this issue is resolved. Real-time GPS tracking monitoring is suggested using a Zig-Bee multi-hop mesh network for multipurpose vehicle route control and data collecting. Section pertaining to multipurpose vehicle route planning It encapsulates everything. Vehicle tracking systems use the computer to communicate and are based on the ZigBee wireless network and the Global Positioning System (GPS). Using environmental sensors and livestock-tracking technologies Focusing on an experimental smart farm, For Agriculture Case Study A web is provided. A system that symbolises awareness has been put to the test in an agricultural region, and the outcomes have been examined. A connected cube is utilised, allowing for huge data sharing and long-term analysis. From the above literature review, Monitoring external environmental factors, To carry out agricultural work Using a smart sensing system that communicates with a smart irrigation system We have found a new approach. We have found solutions to the issues this system was giving farmers. Their primary issues are a lack of energy, a shortage of physical labour, a lack of automation, a lack of agricultural knowledge, and an insufficient supply of macrominerals (N, P, and K). Disregard for the application of amount. Our system works by sensing and adapting to the environment. Occurs in cash crops Quality of plant production due to various diseases and As the size decreases drastically, In India, one of the fundamental human endeavours is agriculture. The process of identifying and classifying diseases and their types Considered an important task. Due to this fact, Any diseases detected in the plants, Making sure that mitigation actions are performed is crucial. This leads to a notable improvement in plant health, which accelerates the economic prosperity of Indian farmers and the nation as a whole. Some plant diseases are thought to pose the greatest harm to the agricultural industry. It reduces plant life and It greatly reduces the naked eye's ability to detect and classify various diseases. In case of crop loss due to certain diseases, Farmers commit suicide as they are unable to pay their debts Most of the studies conducted suggest that Distinctive includes shape, size and color In identifying similarities with visual properties leading to ambiguity Adapted process identifies various foliar diseases. Based on user input To evaluate the expert system These properties are used. To fight foliar illnesses The first stage is to take into account the traits necessary to establish the disease's presence or absence. Because they are used to cultivate leaf symptoms in various dormant crops, the employment of computers in agriculture is crucial Focuses on making medical diagnoses. After examining the issues farmers encounter when doing related jobs, We started developing a smart farming model to solve all the aforementioned issues that plague the agricultural industry overcoming a power shortage The system is equipped with solar panels. By wheeled mechanized crane system The problem of physical labor is solved the soil's macromineral concentration (N, P, and K), compost, and the appropriate soil moisture inadequate knowledge to address the issue of green manure ignorance. We have constructed a database server and evaluated the crops. thereby based on soil environmental conditions Cultivated in a particular season of the best performing crops Farmers can get all the details. For the growth of maize we implemented this, additionally, we tasted and assessed how much compost and green manure were needed for this crop. As needed by the crop, green manure and compost were applied to the soil. We have put our recommended approach, which includes all essential elements, into practise on the ground. The model has worked well for us in practise. The model accomplished its goal and was effective.

VIKOR method

The VIKOR approach, which was created as a multivariate decision-making technique to settle competing criteria, is non-deterministic. In order to help decision-makers arrive at a final choice and identify compromise solutions to an issue, this ranking approach prioritises choosing from a range of possibilities and applies contradictory criteria. In this case, a compromise solution is the option that comes the closest to the ideal, and a compromise is an agreement reached by mutual concessions. Another distance-based approach is TOPSIS, which finds a solution by comparing distances to the optimal and negative-optimal solutions, but it ignores how important each distance is in relation to the others. The VIKOR approach includes the following features in various MCDM tools. 1. The positive is far from the best alternative, whereas the best alternative as assessed by the VIKOR approach is closest to the best option. 2. The best option, as determined by the VIKOR technique, maximises group utility and guarantees that decision-makers will have the fewest regrets. 3. The VIKOR method takes into account the two distance measurements L1, I and L, i. It also offers information about grieving and is based on the Lp metric in compromise programming methodology. 4. The VIKOR approach weighs two factors while making decisions. The benchmark is one, while the maximum group usage is the other. The VIKOR method can be used to optimize multiple

response problems, because it is related to many answers causes the variation between character losses. Application in concurrent test run and It accounts for regret actions. Simultaneous optimization to solve multiple-response problems although some methods have been developed, They fail to take into account the variations in quality losses linked to various answers. This subfactor-level composite may lead to inconsistent quality loss between answers, which the client finds unsatisfactory. To solve this problem, a formal multi-response optimization procedure is given here. Method VIKOR in MCDM used to enhance the resolution of situations with various answers. The suggested method first calculates the optimal and negative-optimal solutions of each trial while taking into account the quality loss and weighting of each response. Then the app for that and Aggrieved actions can be determined. Utilizing the VIKOR Index for each test run and calculating regret from measurements Engineers can use the developed VIKOR Index to find the ideal parameter setting.Soybean, Apple, Rice, Corn, and Cucumber is alternatives factors and Water Content (g), Nitrogen (lb/ac), Phosphorous (mg), and Potassium (mg) is evaluation parameter.

TABLE 3 Manure Content Details of Different Crops Data Set

	Water Content (g)	Nitrogen (lb/ac)	Phosphorous (mg)	Potassium (mg)
Soybean	8.54	193	704	1797
Apple	85.15	150	11	107
Rice	11.25	120	115	115
Corn	75	112	80	270
Cucumber	95	130	24	147
Best	95	193	704	1797
worst	8.54	112	11	107

Table 1 indicates the information set for the Soybean, Apple, Rice, Corn, and Cucumber of the Water Content (g), Nitrogen (lb/ac), Phosphorous (mg), and Potassium (mg). Best values are negative factors in lowest value for data set and positive factors in highest value for data set. Worst values are positive factors in lowest value for data set and negative factors in highest value for data set

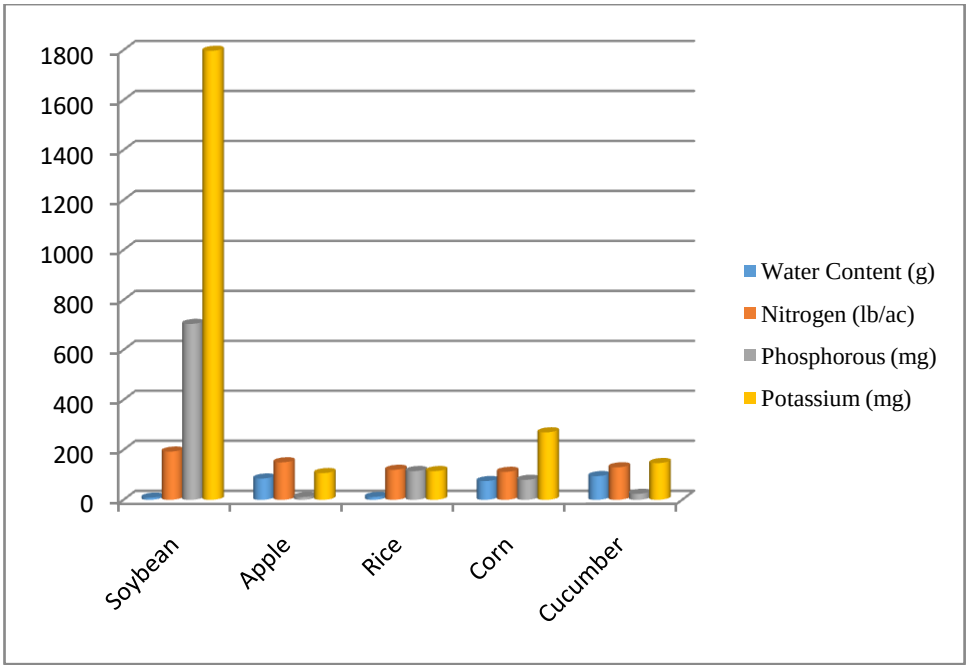

Figure 1 data set in graph

Figure 1 suggests the statistics set for the Soybean, Apple, Rice, Corn, and Cucumber of the Water Content (g), Nitrogen (lb/ac), Phosphorous (mg), and Potassium (mg). Soybean is highest value for data set. Rice is lowest value for data set.

TABLE 4 normalized in data set

	Water Content (g)	Nitrogen (lb/ac)	Phosphorous (mg)	Potassium (mg)
Soybean	0.25	0	0	0
Apple	0.028481	0.132716	0.25	0.25
Rice	0.242164	0.225309	0.212482	0.248817
Corn	0.05783	0.25	0.225108	0.225888
Cucumber	0	0.194444	0.24531	0.244083

Table 4 shown for that the normalized data set.

TABLE 5 Sj and Rj

	Sj	Rj
Soybean	0.25	0.25
Apple	0.661197	0.25
Rice	0.928771	0.248817
Corn	0.758826	0.25
Cucumber	0.683838	0.24531
S+ R+	0.25	0.24531
S- R-	0.928771	0.25

Table 3 shows the calculation Sj and Rj is the sum of normalization of the tabulation which is calculated from the Determination of best and worst value.

TABLE 5 Sj and Rj Calculation Qj

	Qj
Soybean	0.5
Apple	0.802898
Rice	0.873828
Corn	0.874814
Cucumber	0.319576

Table 3 shows the Qj value, the above Qj value is calculated from the sum calculated from Sj and Rj. The ranking is taken from the Qj value.

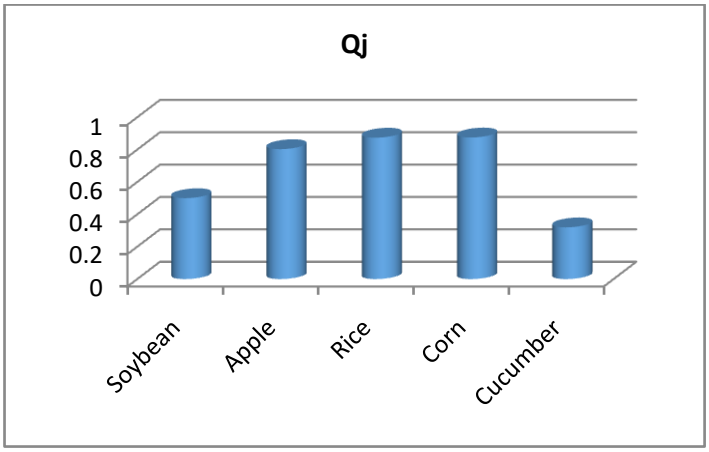

Figure 3 different between Qj value.

The calculation for Sj and Rj, which is the total of the tabulation's normalization and is determined from the determination of the best and worst value, is shown in Figure 2.

TABLE 6.RANK using VIKOR method

Soybean	4
Apple	3
Rice	2
Corn	1
Cucumber	5

According to Table 4, the soybean is ranked fourth, followed by the apple, rice, corn, and cucumber, all of which are in that order.

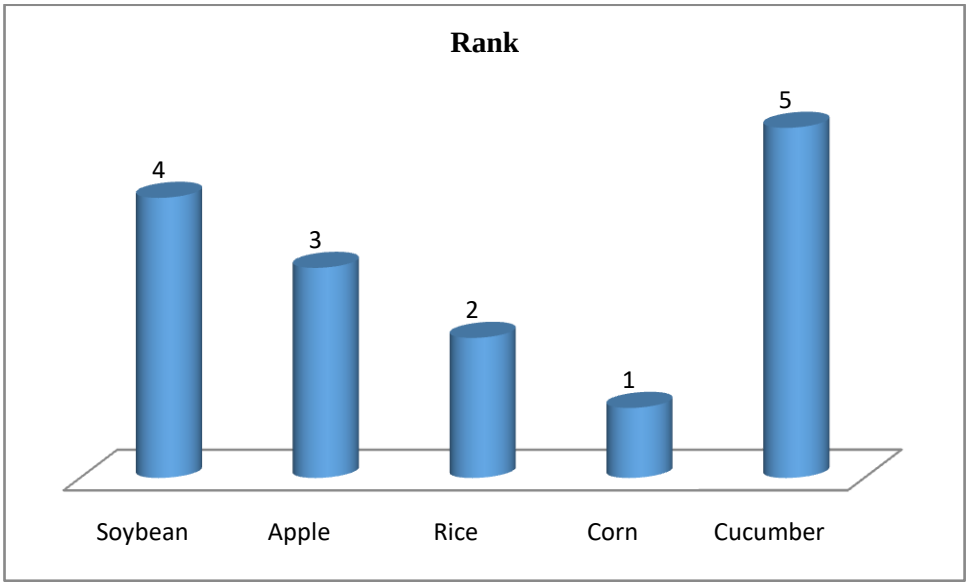

Figure 4 Ranking

Figure 3 shows that the soybean is on 4th rank, apple is on the 3rd rank, rice is on the 2nd rank, corn is on the 1st rank and finally cucumber is on the 5th rank.

Conclusion

70% of the people in India depend on agriculture for their living. 18% of the GDP is the majority. Lack of farm labor mechanization is the main cause of this bad performance. Our sophisticated sensing system offers precise results, and our sophisticated watering system adapts to the needs of the crops. Sprays the necessary nutrients successfully. The irrigation system was sprinkled with enough water based on the results of the soil moisture test. Liberate agricultural power greatly, alter the production process, and change agricultural practices. In order to create a smart agricultural system, user-friendliness is important. VIKOR, one of the techniques used in multiple criteria decision making, is extremely customizable. The method finds the optimal option out of a number of potential options by calculating the distance between ideal and anti-ideal solutions. Generally speaking, it is criticized for neglecting uncertainty. Corn comes in top place while cucumber comes in last in a wind-solar hybrid farm.

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