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Crop Mandi-Demand and Price Forecasting of Agricultural Crops through Mobile Application

Manjunath C R[1], Devaiah B M[2], Govind Yadav[3]
[1, 2, 3]*Department of Computer Science and Engineering, School of Engineering and Technology-Jain University,* Bengaluru, India

Abstract: ***Farming has been the foundation of the Indian economy for a long time. Be that as it may, in the previous couple of years, agribusiness in India has lost its strength over world farming improvement. There are numerous explanations behind the entanglement of horticulture in India. Prescient experiences in cultivating tasks, drive ongoing operational choices, and update business forms for diversion changing plans of action are given by utilizing enormous information. Therefore, the article presents the approach and methodology of precision agriculture in collecting, managing and analysing large data sets using big data analysis tools that contribute to the productivity. The goal of the article is to introduce the talks on how huge information investigation is compelling as a device to give convenient data to the ranchers in showing signs of improvement comes back from agribusiness. With help of huge information, instruments and structure can get ideal choices in cultivating. Yield proposals; figure the horticultural harvests costs in front of the season. Here, we propose a system that gives constant analyser report about atmosphere, soil, and status of market and limit restrict and continuous enthusiasm of market.***
Keywords: Agricultural crops, Big Data analytics, Warehouse, Predictive insights, mandi, and mobile app.

I. INTRODUCTION

As an adage goes that "nourishment is the fundamental need of the general population", the valuing of products, assumes a viable part to individuals' lives as it is a basic parameter. The monetary and social elements brings about vacillation of rural harvest costs. Markets have accessibility of different agrarian yields. The farming harvest costs may fluctuate as various elements impacts them; one yield can have shifting costs in various markets. Annually, farmers face a loss of 40% in total that is caused by either the damage of crops or the farmers deprived of being paid the right price for their yield. The main goal is to provide feasible solutions for the arising problems as well as for the betterment of agriculture sector.

Agriculture supports the livelihood of about 58 per cent of India's population. Agriculture is one of the largest livelihood providers in India since it has a diverse sector, concentrating more towards the vast rural areas**.** Agriculture is the major contributor to Indian economy as it is a main source of income as large population of India depend on agriculture. . The warehouse receipt system is another major issue. There is unavailability of proper monitoring system to know the availability of cold storage as well as warehouse to store the items before it reaches out to the market. Therefore, resulting in the goods being damaged.

The principle objective is to give achievable answers for the emerging issues and for the advancement of farming division. Tremendous data examination is the path toward investigating broad educational lists to separate hid illustrations, cloud connections, publicize designs, customer slants and other profitable business information. Another understanding to give propel climate choices, enhance yield efficiency has been created through the presentation of Big information investigation in agribusiness applications. It has maintained a strategic distance from pointless cost identified with gathering, utilization of pesticide and manures.

Prescient examination would help in settling on choices in cultivating that are powerful and shrewd by securing ongoing information on soil and air quality, climate, edit development and even gear and work expenses and accessibility, which is known as exactness farming. Huge information oversees constant by performing information investigation on enormous spilling information and in this way is relied upon to assume a critical part in exactness farming. As the extent of huge information increments, enormously information investigation, proficiency and throughput would be a test. In any case, for performing examination just certain measurements out of various measurements exhibit in unstructured gushing information got from various horticultural sources would be required.

A. Characteristics of Big Data

Big data characteristics help in understanding big data in a better way, it includes the 5V's: volume, variety, velocity, veracity and value.

1) *Volume*: It focuses on enormous amount of data generated at every second and dealing with the data. An estimated 2.3 trillion gb of data is generated every day.

2) *Variety*: Data can be obtained from different sources and is available in different formats. Not at all like prior days, information was more unstructured and might be gotten in structures, for example, photographs, sensor information, and encoded bundles et cetera. Thus, to store and investigate crude enormous information, progression in innovation and instruments is vital.
3) *Velocity*: The speed with which data is collected, stored, analysed and distributed to end users defines and determines the quality of big data management.
4) *Veracity*: Manages the reliability related with the information. On the planet including science, for each logical examination the thought is given to the nature of information and in addition exactness of the information. Veracity is another property of huge information, which implies information vulnerability. It for the most part manages precision of the gathered information and the degree of its exactness.
5) *Value*: it decides how valuable the data is. Along these lines, dissecting the information that can got from it. Hence, esteem is a standout amongst the most essential trademark among the V's related with Big Data.

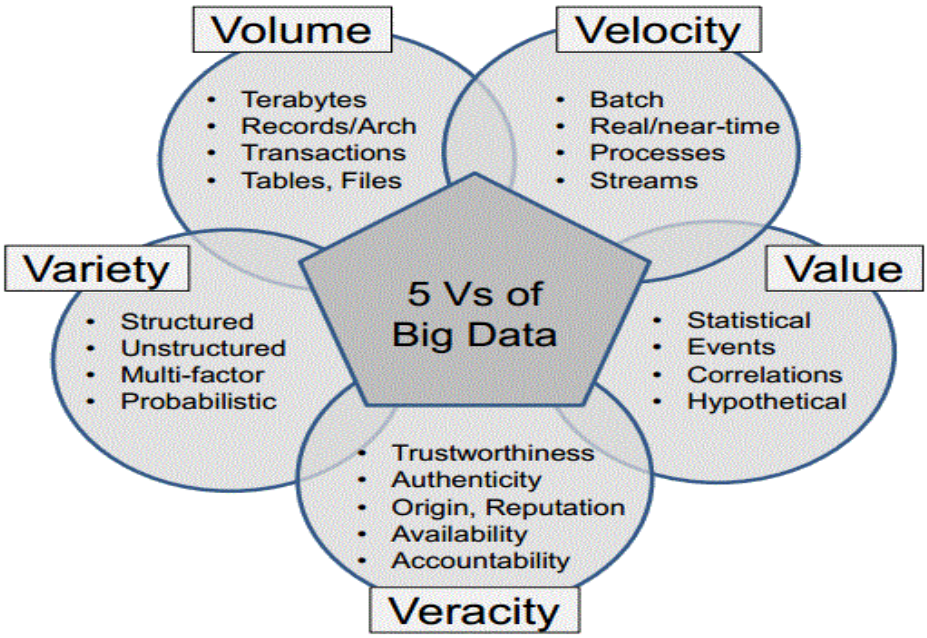

Fig. 1 Five characteristics of Big Data

All in all, the investigation of a specific agrarian region requires an expansive number of information tests, and hence each examination comes about for information that can surpass petabytes of data. In this scenario, there have been efforts to develop an environment that uses techniques and tools based on Big Data, and that uses weather reports and data related to production for conducting agricultural soil analysis.

II. PROBLEM STATEMENT

Agriculture and related activities are the backbone of majority of the Indian rural mass. About sixty per cent of the country's population is dependent on agriculture for their livelihood. The externalities of weather and non-availability of information from large sets of data in time to the farmers are causes of concern. The yields of various provincial things in India are in a general sense low, as present agricultural practices are neither prudentially plausible nor normally supportable. The result of the harvests relies upon the few elements like precipitation, season, temperatures, and the cost declared by the legislature. Agribusiness largely relies upon whether condition, precipitation and precise water level that assistance the agriculturist to design their harvest as indicated by momentum situation. Along these lines, huge information with outline help better climate gauging. Nevertheless, for agro area in India, the mechanical inclusion and its convenience should be developed and bestowed. Albeit the Indian Government for giving agro seller's data to ranchers has additionally taken couple of activities, it gives static information identified with soil quality at every locale. The legislature is likewise taking a shot at giving on the web and versatile informing administrations to ranchers for farming inquiries. The framework, which utilizes continuous information of soil quality in light of its present properties for basic

leadership, has not yet been actualized. Another complicated issue in India is simple things like those that warehouse receipt system. There is no proper monitoring system available to know the availability of cold storage and warehouse.

A basic leadership framework is required and all horticulture elements should be associated with increment the generation and facilitate the dissemination of rural items from agriculturists to promoting organizations and from merchants to ranchers at a correct cost. Decision-making system will also be responsible for helping farmers improve productivity and get right price for their yield. With help of huge information, Tools and system can get ideal choices in cultivating, for example, edit suggestions; estimate the agri crops costs in front of the season. Thereby, better methods can be adopted. Therefore, the mobile application focuses on solving these problems.

III.BACKGROUND WORK

Compelling procedures to enhance the execution of product yield forecast and strategies to exploit monstrous information identified with farming and sustenance security require significant comprehension. In the period of data, these targets could be acknowledged by means of Big Data applications. Ch. Chandrasekhar, Ch.Sekhar [2] proposed a system that helps farmers to grow suitable crops based on the climatic conditions and helping farmers get best price for their yield. The process happens in different stages like information gathering, data analysis, and alert system and visualization modules. K. Ravisankar, K. Sidhardha, Prabadevi B[5] proposed use of the Map reduction Techniques of Big Data Analysis which is advantageous over the datamining techniques. Bharath G, Anala M R[4] in their survey paper talk about precision agriculture was introduced in India by Tata Groups as Tata Kisan Kendra (TKK) in the first place. The project of precision farming by TTK aims at delivering end-to-end solution to farmers. Haoxiong Yang and Jing Hu [14] proposed the ARIMA display that respects information objects, which are shaped, by estimating objects after some time as an irregular grouping. It utilizes a numerical model to around depict this succession. The model can figure the future from past respect and the present a persuading power after it has been seen. In this manner, various such frameworks have been exhibited.

A. Existing Methodology

The information is gathered throughout the years to break down product points of interest and soil conditions; concerning the gathered information, a model was proposed. The model makes utilization of Big-Data examination for best harvest grouping, next yield to be developed for better generation, add up to edit creation in the region of intrigue, add up to compost necessities, and other information of intrigue that could be broke down. As there exists an interconnection between agribusiness related elements, it encourages the dispersion of collected harvests to the agro promoting offices and ranchers will have the capacity to approach the agro merchants for required horticulture items and administrations.

It helps in estimation of aggregate creation per edit district shrewd and state insightful, add up to compost necessities that assistance to screen the cost of farming items.

In the other existing studies, a variety of methods is implemented for the classification of the agriculture data. In these systems, agricultural data classification was done based only on a few of many factors available. Many of the existing systems the accuracy of classifying the data is lower as they are implemented using data mining techniques instead of the big data analytics. The existing systems do not deal with the dependency between the various factors affecting the crop production. More over the existing do not focus on old data, which is not up to date. Therefore, resulting in the classification and prediction of data not being true and accurate. Thus using “Big Data analytics” with up to date data results in accurate classification and better prediction of data.

Map Reduce is a processing technique and is another existing methodology used. It is a program demonstrate for circulated processing. The Map Reduce split information in two section one is critical and other esteem related with it. To start with, it maps information with relative information and after that lessen that by dispersing it with deferent hubs. All hubs mapped utilizing key hubs store information. Whatever information is accessible in the hubs is lessened by utilizing conclude work that contain scientific capacity and give yield that comprises of quick and dependable informational collectionBy using this strategy, we get data that is snappy and tried and true which is commitment to the BI application that further creates the 3D data see for essential authority and logical reports.

The new information handling structure isolates the figuring procedure into two stages, to be specific Map and Reduce. In Map stage, the middle key/esteem is created by work by dealing with all the information key/esteem (year/climate information). In Reduce stage, the capacity joins every one of the qualities with a similar middle key, and after that outcomes are created. Immediately, the atmosphere data is divided into various portions. In addition, information is characterized by specific standards by executing the Map work, which is then composed to neighbourhood hard drive. After Map stage, the Reduce work is executed,

where the rearranging and union, of middle of the road information having that year esteem is done and the outcome is put away to dispersed document frameworks. Finally, the outcome can be obtained by consolidating every one of the results from the Reduce stage.

Tata Groups introduced precision agriculture in India as Tata Kisan Kendra (TKK) in the first place. The project of precision farming by TTK works towards delivering end-to-end solution to farmers. TKK enables the farmers to obtain proper market value for their produce by playing a vital role in integrating the modern farming techniques and traditional practices to increase productivity. Figure-2 shows the practices followed by TTK [6].

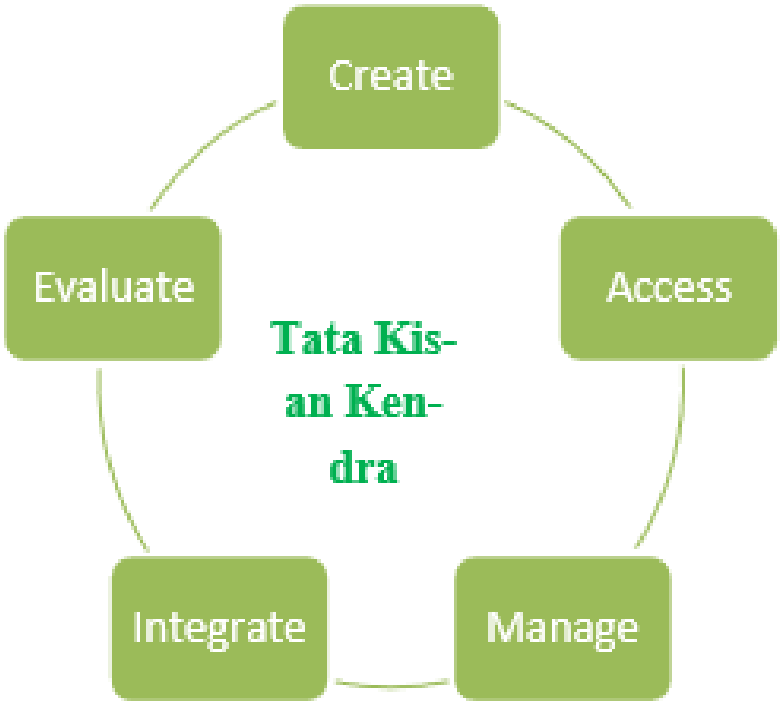

Fig. 2 TTK's Precision Farming Practices

The fundamental thought of the some present (ARIMA) models is that it respects information objects, which are encompassed, by surveying objects after some time as a subjective movement. It utilizes an intelligent model to around outline the social affair. The model can figure the future from past respect and the present an inspiration after it has been seen. It is a mixed model that courses of action with different components, arrange the evaluating eventual outcomes of different factors, and get the last measuring comes to fruition.

The blended model can be separated into two sections: week-by-week value change anticipating model and value change cautioning model. Week by week value change anticipating model incorporates time factor gauging model, space factor estimating model and time– space coordinated model, individually managing the season factor, the space factor (the impact of value change in different markets) and the reconciliation of yields of sub-models. Value change cautioning model manages exogenous factors. Along these lines, diverse information pre-processing techniques as per distinctive sub-models are utilized to acquire better anticipating outcomes.

The examination demonstrated that it is practical to foresee the request of farming items in a brief timeframe utilizing the ARIMA show. In addition, it can likewise be inferred that the more drawn out the foresee time is, bigger the numerical expectation of the fluctuation is. As a rule, ARIMA is a common sense model. Nonetheless, the model can manage the occasional vacillation anticipating which is caused by the worldly variety. The forecast of time arrangement display is extremely precise for the time being.

Some other system has also been proposed that reduces Middlemen problem and the experts can help the farmers learn new methodologies. It also gives the farmers a fair idea for planting the best crop based on the weather alerts that gives information about the climatic conditions. Therefore, farmers can choose the best crop based on the prevailing climatic conditions. It also provides a platform for the farmers that intimates them about various market prices and accordingly can get best price for the crops.

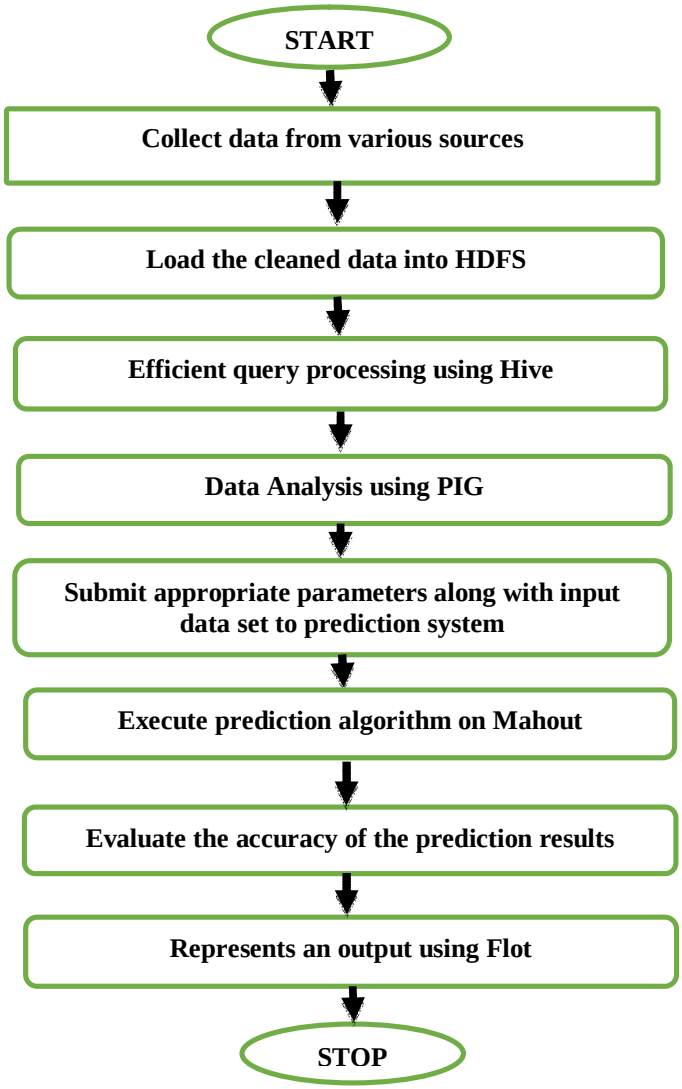

Fig. 3 System Work Flow Diagram [2]

In the system's workflow, the data obtained from various sources is captured by the farmer's smartphone machine learning library. Mahout is an efficient way of implementing the unsupervised machine-learning algorithm. Based on data collected from the past, prediction is done about the future.

Processing happens in different stages, such as Information gathering, Data analysis, Alert system and visualization module.

A. Limitations Of Present System

Many systems have been proposed and newer technologies have been implemented to produce better and efficient systems. In spite of all this, there exists some factors or drawbacks associated with each of them leaving a scope for improvement.

1) Farmers should be provided with the mobile application designed with local language for better understanding of the information.

2) Availability of internet facility to use the apps is also one of the major concern.

3) *Limited information stockpiling and protection:* The expanding volume, assortment and speed of farming huge information (AgBD) sets requests unnecessary processing power and computational assets to oversee and break down.

4) *Data sharing barriers:* Data privacy is a major concern of AgBD sharing, and private AgBD owners may be reluctant to share the data. Even if private data (e.g., administrative data; field treatment data) is shared, it is not certain that one private dataset will be compatible with another private dataset or with other public datasets.

5) *Insufficient data documentation:* To support big data analytical methods in agriculture, such as data mining, it is increasingly common for satellite imagery to be supplemented with more and more field data.
6) *Lack of connection between observation and theory:* Empirical models (e.g., machine learning outputs) generated by AgBD can be difficult to generalize outside of their target geography or period.
7) *Missing crucial data*: While novel data collection and analytical methods have generated valuable insights for agricultural production, data availability remains sparse in domains related to natural resources (e.g., water use), as well as other phases in the food life cycle.
8) In the gauging procedure of the ARIMA show, it cannot separate the patterns and regular part, which are utilized as a part of the first grouping.
9) With regard to the forecast of time, arrangement display the exactness is short named. As times expanding, the anticipated mistake will bit by bit increment.
10) Also in the ARIMA demonstrate, because of farthest point of the example information, the model might be defective. It requires expectation conditions to experience fitting updates. Just by doing this, the model can accomplish best impact.

IV. PROPOSED SYSTEM

To overcome the problems in the existing system, we propose a system that reduces Middlemen problem and farmers can learn new methodologies from the experts through this system. They can also plan for planting best crop as per the demand to yield higher profits. The system provides a platform for the farmers where they can know the prices of different markets and can sell their crop for best price. The main idea is the development of a mobile application- “Crop Mandi” that helps farmers get alerts regarding the climate and suggest them the best crop suiting the soil and climatic conditions. The app also helps farmers to get a clear idea regarding the demand and warehouse management. It also ensures that farmers get best price for their crop. It deals with the following points.

1) Record remote exercises on cell phones and tablets
2) Improve the exactness of information gathered in the field.
3) Reduce printed material, spreadsheets and authoritative overhead.

A. *Access Controls And Measures*

Keep up an a la mode archive library of natural controls or government benchmarks, promptly open from cell phones in the field.

B. *Gauge Or Ascertain Yields*

Utilize applications to perform moment, on-gadget counts in light of standard info information. Get moment writes about yields or anticipated yields.

C. *Access And Submit Examination Reports*

Certification that your examination reports are always correct and dynamic by submitting them from mobile phones clearly from the field. Upgrade quality control by enabling two-way data trade between record-keeping databases and mobile phones.

D. *Basic Stage For Seller And Buyer*

Venders and purchasers are associated by means of this stage and merchants (ranchers) will get the chance to offer their create at 15-20% climb than what he ordinarily gets from delegates. The application gives value revelation, value straightforwardness and value transmission.

1) A stage for individuals associated with auxiliary cultivating exercises to raise their pay by giving direct introduction to their items to end purchasers.
2) Various government schemes related to farmers, their use and benefits are listed in this section.

Either a state wide or nationwide app, which is divided as per the location or the state of the farmer. Since ought to have the information for that locale as far as soil ripeness, edit yield every year, sort of soil, trims previously and their value valuation and incremental qualities, water/temperature and conjecture from past present and future.

3) In India in the majority of the states, a large portion of the circumstances their fields are pointless and squandered and ranchers need to sit tight for downpours or characteristic assets for water and henceforth and they need to do other modest employments or simply kill time
4) Data ought to be given about the diverse sort of products that can be become independent of that area, live cases of couple of other super fruitful ranchers who have whipped the old styled of water system and yielded crops that were never known about or not mindful of.

There are lots of news and information we come across that people now have been growing something, which they never thought could be done!

5) Farmers need information about the different types of irrigation that is available as per his land size, soil tested, value time taken, and market needs.
6) Comparative information or outline for misfortune and benefit in view of comparable harvests.
7) Location recognition for high product request.
8) Daily statistics of crop demand in different market places.

E. Features

With the support of big data performance tools, analyse the data based on the need of location and type of crop suggestion can be delivered to farmers through mobile application. The mobile application can contain features as mentioned:

1) News feed: All updated news can be known through notifications.
2) Online learning: facilitates the farmer to know best practices with the help of tutorials.
3) Weather alerts: provides the information about the climatic conditions.
4) Buy products: can make order for the products.
5) Sell products: sell the products for enterprises and consumers.
6) Market status: can know the best price dealings in markets.
7) Language friendly: farmers can select the language they are familiar with, thereby resulting in better understanding and usage of app.

Queries: where farmers can clear their doubts.

In context of the VEC delineate, exam the relationship between plant thing regard fluctuation, grain yield and sown area. The numerical clarification of the VEC show is as indicated by the going with:

$$\Delta y_t = a_0 VECM_{t-1} + \alpha_1 \Delta y_{t-1} + ... + \alpha_p \Delta y_{t-p} + \beta \Delta x_{t-1} + \varepsilon$$

In setting of the VEC appear, exam the connection between plant thing respect fluctuation, grain yield and sown region. The numerical illumination of the VEC demonstrate is as shown by the running with.

After the Johansen test method [5], there is an entire arrangement joining relationship between agrarian thing regard fluctuation, grain yield and sown zone. From the Table 4.2 underneath, we dismiss the essential speculation that there is no consolidation relationship. The Johansen blend test displays that there is a blend relationship between the components.

Table 1. Johansen Integration test results

Hypothesized No.of CE(s)	Eigen Value	Trace Statistic	0.05 Critical Value	Prob.
None	0.530996	65.17189	29.79707	0.0000
At most 1	0.415342	34.12896	15.49471	0.0000
At most 2	0.255979	12.12130	3.841466	0.0005

The commonplace standard deviation of log (ensured) costs crosswise over completed mandis inside states is likewise high. To the degree, that high conventional standard deviation of log (certifiable) costs transversely completed mandis in the nation may be a consequence of various courses of action of wheat and rice made in various agro-environmental zones winning in various states, this discovering stifles this pressure. High inside state variety prescribes that the collection isn't absolutely an immediate aftereffect of critical worth. We show the outcomes for 2014 in table 4.2[14].

Table. 2 Variation of Real Prices within states

State	Standard Deviation
Andhra Pradesh	0.15
Chhattisgarh	0.13
Gujarat	0.14
Haryana	0.13
Jharkhand	0.14
Karnataka	0.18
Kerala	0.17
Madhya Pradesh	0.21
Maharashtra	0.16
Odisha	0.70
Punjab	0.26
Rajasthan	0.14
Tamil Nadu	0.21
Uttar Pradesh	0.11
West Bengal	0.07

In the principal technique, the connection between cost in a mandi and the quantity of business sectors in the area controlling for the same number of observables like neighbourhood trim creation, nearby request, neighbourhood precipitation stuns as could be expected under the circumstances and adaptable settled impacts to represent surreptitiously heterogeneity is analysed. The favoured nonparametric particular is the running with, where standard blunders are stuffed at locale and thing season level for inference.

$$\ln(\text{price})_{cmdt} = \sum_{r=5,10,15} \beta_{1r}(\#\text{mandi})_{mr} + \sum_{c \in C} \beta_{2c}\, \text{Rain}_{cdt} + \boldsymbol{X'\beta_3} + \epsilon_{cmdt}$$

Here, c is trim, m is include, d is region and t is time. In this way, we lose the faith cost of accumulate c, in show off m, in zoned at time t on the measure of mandis in the district. We break the locale into three holders – 0 to 5 km, 5 to 10 km and 10 to 15 km – and check the measure of different mandis in each archive. Rain$cmdt$ suggests trim region particular precipitation trances. While including the measure of mandis the zone of any mandi m, we weight each mandi by the retrogressive of the segment from mandi m. Along these lines, rivalry at each mandi m is:

$$\text{comp}_m = \sum_{(m,\, r)} dist_{mj}^{-1}$$

Where, $distmj$ is separate from mandi m to mandi j, and $M\ (m,\ r)$ is the arrangement of all mandis in the r km neighborhood of mandi m.

By at that point, we can take a gander at the relationship between regard separations and dispute separates between all mandi sets that are 20 km or 30 km disconnected from each other however on either side of a state edge:

$$\ln(\text{price})_{cmt} - \ln(\text{price})_{cm't} = \beta(compm - compm') + \epsilon_{cmt}$$

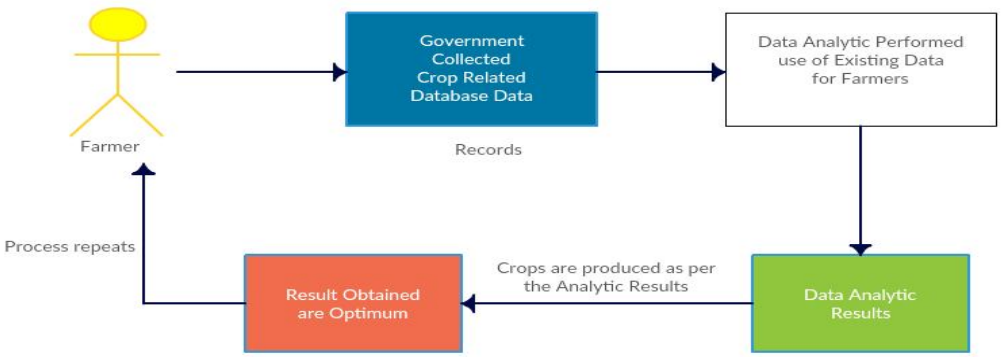

Fig. 4 Proposed Crop Production System

The existing Dataset (Agriculture production of different food grains from year 2003 to 2014 at all India level and Rainfall of India) of agriculture was studied and to this data the K-Means Clustering algorithm is applied to take reduced data as input and then store this data into clusters. Data stored in clusters will facilitate fast search in less time based on cluster hypothesis. The proposed work will help farmers to increase the yield of their crops. The further processing steps are as follows:

1) Storage of big data in clusters by using various clustering algorithms, reduce it to appropriate/valid content using K-Means clustering algorithm

2) Apriori algorithm helps to count frequently occurring features, which helps to predict crop yield for specific location.

Basically, the data from the past is collected and with the help of big data analysis tool and the prediction is made. Based on the need, the demand forecasting for a particular crop is done thereby helping the farmer yield better profit. The warehousing and cold storage related issues could also be overcome. The price forecasting helps the farmer get a right price for the crop.

V. CONCLUSIONS

In the present article, a mobile application is proposed that can be useful to the farmers who are not much aware about the latest technologies in agriculture fields. They can get notifications on latest weather information, better market for goods, government policies and benefits.

Basically, the data from the past is collected and with the help of big data analysis tool the prediction is made. It also gives the farmers a fair idea for planting the best crop based on the weather alerts that gives information about the climatic conditions. Therefore, farmers can choose the best crop based on the prevailing climatic conditions. It also provides a platform for the farmers that intimates them about various market prices and accordingly can get best price for the crops. Farmers can select the language they are familiar with, thereby resulting in better understanding and usage of app. Warehouse monitoring is another important feature that prevents the crops from being damaged.

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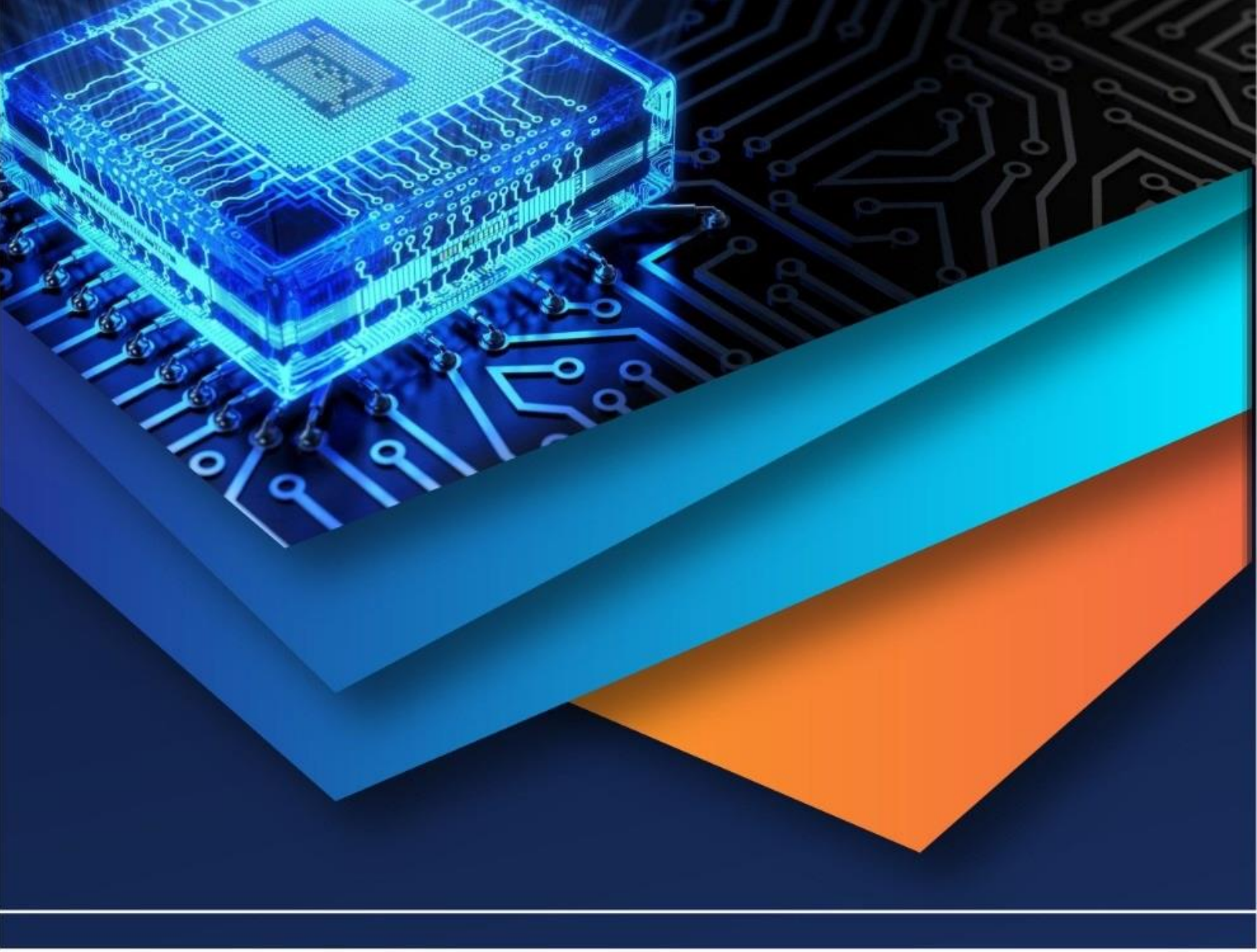

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