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Big Data Analytics to Produce Big Results in the Agricultural Sector.

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Abstract:

Big Data Analytics in Agriculture crop yield analysis is emerging research field. India ranks second world wide in farm output. Agriculture and allied sectors like forestry and fisheries accounted for 13.7% of the GDP (gross domestic product), about 50% of the workforce.

The governments also spending lot of amount on Agriculture in the budget proposals (2016-17 budget by present government). But the economic contribution of agriculture to India's GDP is steadily declining with the country's broad-based economic growth. In addition to this, our country if facing a serious problem of farmers suicides across the country.

NCRB (National Crime Records Bureau) claims 46 farmers commit suicide every day in India

Activists and scholars have offered a number of conflicting reasons for farmer suicides, such as monsoon failure, high debt burdens, genetically modified crops, government policies, public mental health, personal issues and family problems. Agriculture will be transformed over the coming decade as 21st century digital technology becomes embedded into every aspect of production and farm enterprise management. Recent technologies are able to provide a lot of information on agricultural-related activities, which can then be analyzed in order to find important information. A farmer could take a picture of a crop with his phone and upload it to a database where an expert could assess the maturity of the crop based on its coloring and other properties.

People could provide their own reading on temperature and humidity and be a substitute for sensor data if none is available.
So by using the Big Data Analytics and other applications to increase the agricultural yield production and reduce the expenses of the farming by taking the accurate decisions.

Keywords-Big data, IoAT, Visualization, Climatic changes, Sensors.

Motivation:

Our country if facing a serious problem of farmer's suicides across the country.NCRB claims 46 farmers commit suicide every day in India. Activists and scholars have offered a number of conflicting reasons for farmer suicides, such as monsoon failure, high debt burdens, genetically modified crops, government policies, public mental health, personal issues and family problems. The solution to this problem can be solved by changing the agriculture in to more profits by using different technologies and tools by collecting real-time data on weather, soil and air quality, crop maturity and even equipment and labor costs and availability, predictive analytics can be used to make smarter decisions.

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Introduction:

Agriculture is the backbone of the Indian Economy and the development. The demand of food is increasing day by day. The researchers, farmers, agricultural scientists and government are trying to put extra effort and techniques for more production.

This proposal is intended to address research challenges in Agriculture sector, a new and interdisciplinary research area that spans the **Big data Analytics, Data Science tools, Hadoop, Python, R and Machine learning algorithms.** To feed the world's rapidly-expanding population in the coming decades, agriculture must produce more. Big data holds one of the keys for farmers control centers collect and process data in real time to help farmers make the best decisions with regard to planting, fertilizing and harvesting crops. Sensors placed throughout the fields are used to measure temperature and humidity of the soil and surrounding air.In today's conditions agricultural enterprises are capable of generating and collect large amounts of data. Growth in data size requires automated method to extract necessary data.

Introduction to Big data Analytics:

Big Data

The phrase 'Big Data' obviously implies volume. Big data is a term that describes the large volume of data – both structured and unstructured – that inundates a business or an ecosystem on a day-to-day basis. But it's not the amount of data that's important. It's what organizations or sectors do with the data that matters.

Big data can be analyzed for insights that lead to better decisions and strategic planning and execution in business, management and governance initiatives. The IT industry analysts and consultants have long acknowledged other characteristics of data that add commensurate challenges.

While the term "big data" is relatively new, the act of gathering and storing large amounts of information for eventual analysis is ages old. However from the IT prespective of big data can be corroborated and explained as the four Vs:

1. **Volume:** Organizations collect data from a variety of sources, including business transactions, social media and information from sensor or machine-to-machine data. In the past, storing it would've been a problem – but new technologies (such as Hadoop) have eased the burden.
2. **Velocity:** Data streams in at an unprecedented speed and must be dealt with in a timely manner. RFID tags, sensors and smart metering are driving the need to deal with torrents of data in near-real time.
3. **Variety:** Data comes in all types of formats – from structured, numeric data in traditional databases to unstructured text documents, email, video, audio, stock ticker data and financial transactions.
4. **Verities:** Different types of data are captured. It can be structured, unstructured or semi structures. Management is important to analyze further data types and file refers to many different, but for which traditional relational data bases are unsuitable.

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RESEARCH OBJECTIVES

Bill Gates, co-chair of the Bill & Melinda Gates Foundation, believes investments in agriculture are the best weapons against hunger and poverty.

The target end results of this effort are:

- To increase the agricultural production towards the increasing world's population.
- To reduce the expenses on agricultural farming.
- To identify the problems of facing the famers in India.
- To increase the market for the Agricultural products of India all over world.
- To identify the climatic seasons changes.
- To Forecast and historical weather information fine-tuned for agricultural decisions.

Different tools used for the data Analytics:

At Present, the tools that can be used for the analysis of the Agricultural data can be listed. The Usage of the different tools that can be used for analytics can be listed below.

Tool	Use	Remarks
language R	software environment for statistical computing and graphics	Graphical facilities for Agriculture data analysis and display either on-screen or on hardcopy.
Hadoop	Open-source software framework for distributed storage of very large datasets on computer clusters.	software framework for distributed storage of the collected large agriculture data set
Python	for data manipulation and analysis	To manipulate the Agricultural data.
Visualization Tools a)Tableau, b)D3, c)Data wrapper	Information that has been abstracted in some schematic form, including attributes or variables for the units of information	By using these tools visualization of the pattern is clear.

At present, high-tech tools are raising the bar, enabling farmers to crunch massive amounts of data collected through sensors to predict the best time to plant, what type of seed to use, and where to plant in order to improve yields, cut operational costs, and minimize environmental impact. John Deere's Farm Sight, Monsanto's Field Scripts, and Pioneer's Field360 are among the tools that allow farmers to collect planting and yield data from motorized farm equipment and input this information into a database that, when aggregated with multiple sources of anonymized data, produces detailed prescriptions.

WORK PLAN;-

This project links science with technology and big data analytics; we aim to help farmers

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better adapt to temperature extremes, droughts or excess water in fields so that they can make better decisions for the environment and maximize production and/or profits.The data collection is an important role in the work process. Here data consists of any form, may be image, text, sensor data, audio and video also.

Big data analytics in climatic changes discovery:

In India the direct impact of climate change would be effect plant growth development and yield due to change in rainfall and temperature .Increase in temperature would reduce crop duration, increase crop respiration rate change the pattern of pest attack and new equilibrium between crop and pest hasten mineralization in soil and decrease fertilization use efficiency.

Many crops have become adapted to the growing season, day lengths of the middle and lower latitudes and may not respond well to the much longer days of the higher summers. In warmer, lower latitude regions, increased temperate may accelerate the rate at which plant release CO_2 in the process of respiration, resulting in hastened maturation and reduced yield.

Actual Seasons:

Sowing Season: May to July.
Sowing Season: October to December

Harvesting Season: February to April
Harvesting Season: September to October.

Proposed Seasons:

By collecting the data of rainfall and temperature of last 5 years we can analyze the data by using different big data analytics tools to get the exact change in the Indian agricultural climate.

The Data that are collected can be used for the following conditions.

1. Historic weather patterns
2. Plant breeding data and productivity for each Strain
3. Fertilizer specifications and Pesticide specifications
4. Soil productivity data
5. Water supply data
6. Market spot price and futures data

Fig (1) Capturing data

Fig (2) live analysis of data

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Agriculture Internet of Things (IoAT):

It improves operational efficiency, drives productivity, creates new revenue sources and, ultimately, makes sustainability synonymous with profit.

Some of the benefits provided by the IoAT are listed below

- Sensor-based field and resource mapping
- Remote crop monitoring
- Climate monitoring and forecasting.
- Weather conditions can be easily predicted.
- Usage of fertilizers and pesticides can be minimized

Sensors can tell how effective certain seed and types of fertilizer are in different sections of a farm. Software will instruct the farmer to plant one hybrid in one corner and a different seed in another for optimum yield. It can adjust nitrogen and potassium levels in the soil in different patches.

Sensors used for the data collection:

Different sensors used for the data collection is shon in Table(1)

Some of the applications below can be seen in a particular manner of collecting data

Fig (3) Sensor for climatic changes detection

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Fig (4) Sensor for pesticide control detection

Fig (5) Sensor for moisture control detection

Fig (6) Sensor for disease detection

Fig (7) Using drowns to capture image

Proposed Framework for the solution to Agricultural problems:

The data can be sent to the Agri bank to get the appropriate solution regarding

- Pesticide Usage
- Seed Usage
- Crop Diagnosis
- Temperature and climate
- Loan Request
- Rain fall

Frame Work to send data to bank and to the farmer is shown in Fig (8)

Benefits of this Framework:

The data in the form of pictures can be captured through our smart phones can be sent to the bank. The Agricultural bank contains necessary tools to analyze the data and within a short period, the farmer gets the solution to his problem.

- All the fertilizers and pesticides that are used by the farmers can be supplied by the Agricultural bank only.
- All the Agricultural loans issuing can be done according to the data contains in the bank. By using this approach the right farmer will get the loan.

- Crop Insurance issues can be easily solved by this frame work.
- Crop damage by the natural calamities can be easily estimated by using this frame work.
- Fraud in the loan issuing matters can be reduced because all the accurate land records can be kept in this bank

CONCLUSION

Big data analytics solution helps farmers minimize their use of fertilizer, chemical and water while maximizing yields by analyzing a wider diversity of real-time sensor and historic data inputs. Through the use of rigorous big data Analytics, that prescription usually enhances the farm's overall profitability.

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Proposed Framework for the solution to Agricultural problems:

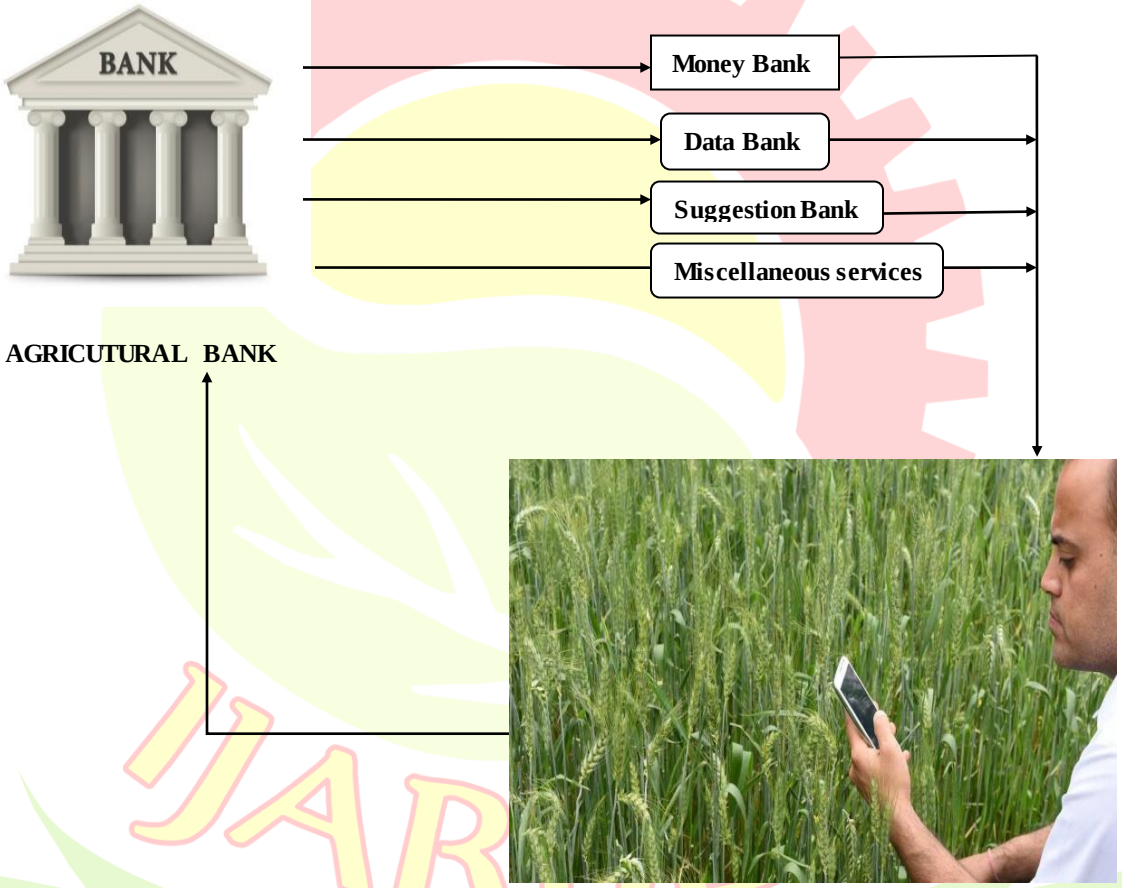

Fig (8) Frame Work to send data to bank and to the farmer

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Sensor	Description	Common uses
Accelerometer	Measures the acceleration force in m/s^2 that is applied to each of the three physical axes (x, y, and z) of a device (including gravity)	Detects motion and senses the changes in smartphones' orientation
Ambient temperature sensor	Measures the ambient room temperature in degrees Celsius (°C)	Monitors air temperatures
Gyroscope	Measures a device's rate of rotation in rad/s around each of the three physical axes (x, y, and z)	Detects rotation (spin, turn, etc.)
Light sensor	Measures the ambient light level (illumination) in lx	Controls screen brightness
Magnetometer	Measures the ambient geomagnetic field for all three physical axes (x, y, and z) in μT	Creates a compass
Barometer	Measures the ambient air pressure in hPa or mbar	Monitors air pressure changes
Proximity sensor	Measures the proximity of an object in cm relative to the view screen of a device	Detects if the phone is held up to a person's ear during a call
Humidity sensor	Measures the humidity of ambient environment in percent (%)	Monitors dewpoint and absolute and relative humidity
Global Positioning System	Measures the latitude and longitude of the current location of the device	Uses a user's location to show the nearby information
Image sensor (camera)	Records images and videos	Captures still picture or video
Audio sensor (microphone)	Measures sound in air into an electrical signal	Records voices
Fingerprint identity sensor	Reads a user's fingerprint	Identifies a user through touching
Moisture sensor	Identifies whether the device has been submerged in water	Detects if a device has internal water damage

Table(1): Different sensors used for the data collection