International Research Journal of Education and Technology
Peer Reviewed Journal
ISSN 2581-7795

IMPLEMENTATION OF SMART SUPPLY CHAIN MANAGEMENT IN AGRICULTURE

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***Abstract*—In order to maintain global population growth and food security, agriculture is an essential industry. To full fill the rising demand for food while reducing resource limits, there has been a growing need in recent years to improve agricultural techniques. By using the, real-time data from microcontrollers to maximize agricultural output is one promising strategy. The potential of using real-time data from microcontrollers in agriculture to enhance production and resource management is examined in this abstract. With the help of a variety of sensors and actuators, microcontrollers can gather and analyse information on temperature, humidity, rainfall level, and other environmental factors that have a big impact on crop output and growth. Microcontrollers can wirelessly transfer the data they collect to a central system so that machine learning and advanced analytics can be used.**

Keywords*— Internet of Things; Real time data; Microcontrollers; Sensor s; Machine Learning;

I. INTRODUCTION

The term "Internet of things," or "IoT," represents an assortment of devices that can communicate data with other devices and systems over the Internet or other networks of communication. These devices might include sensors, processing units, software, and other technologies. The fields of computer science, electronics, and communication are all associated with the Internet of things. The term "internet of things" has been found to be misleading because gadgets simply must be linked to a network and individually reachable, not all of the internet. The Internet of Things, also known as IOT, holds the potential to significantly change the way we work and live.

IoT has made it possible for people to live and work with more understanding. For instance, employing IoT-enabled vehicles, smartwatches, and thermostats can enhance people's quality of life. For example, a person's thermostat can be set to an appropriate temperature, their lighting can be changed to a softer tone and intensity, and their automobile may interact with the garage to open the door for them once they get home. The conceptual framework organizes a network of sensors, linked items, and other web-connected things that may exchange data and obtain information for carrying out basic duties. Devices that gather and analyse data from locations, people, connected equipment, and operational technology (OT) are known to as the commercial internet of things, or IIOT. The observation [1-3].

The technique of Utilizing Real-Time Data from Microcontroller for Agriculture Yield Prediction: Cutting Edge Predictive Warehouse Management System is a sophisticated approach to optimizing agricultural operations. This system likely involves the integration of microcontrollers, which are small computing devices, to gather real-time data from agricultural processes. This data is then used to predict crop yields

Environmental variables which significantly impact the growth and production of crop. The information gathered by microcontrollers may be wirelessly transmitted to a centralized platform, allowing the acquisition of insightful data via the integration of advanced analytics and machine learning. These insights can help farmers make well-informed decisions concerning critical crop management chores like when and how to plan irrigation, control pests, and apply fertilizer. Because microcontroller-based systems offer automated control and real-time monitoring, they can optimize utilization of resources, minimize waste, and enhance overall agricultural productivity.

II. REALTED WORKS

Potnuru Sai Nishant, et al., Crop yield prediction combining machine learning and Indian agriculture [1]. This study forecasts the yield of nearly every kind of crops produced in India. This script is uncommon in that it enables the user to forecast crop output in whatever year they prefer by using fundamental factors such as States, region, season, and their location. The study applies strong methods of regression include Kernel Ridge, Lasso, and ENet algorithms to forecast the yield. It uses the stacking regression approach to enhance algorithm performance and produce a more precise forecast.

Fariha Shahrin, et al,Through the application of machine learning and a multispectral regions of satellites pictures, crop yields in Habiganj can be anticipated and agricultural practices analyzed [2] A Habiganj case study was undertaken at .Habiganj was chosen as the study location due to its unique geography, which leaves it susceptible to both flooding and droughts. This article integrates agronomic tracking and mapping in Habiganj with crop growth and results estimates. Remote sensing signs related to crop growth and yield are obtained following the analysis of the multi-spectral band Landsat-8 photos from Habiganj. K-means and Mask R-CNN techniques can be employed in Python and Matlab for examining crop growth estimation over time.

Kavita, et al., Machine Learning for Projecting India's Crop Yield [3]. The main barrier to food security is the increasing number of people. Demand increases as the number of people increases Farmers must thus produce more on the same area of land in order to meet the growing demand. Farmers can increase production with the use of technology and forecasting agricultural output. The main objective of this essay is to project agriculturalyield utilizing production, area under irrigation,yield, and area. Agricultural productivity has been assessed with four machine learning techniques: Decision Tree, Linear Regression, Lasso Regression, and Ridge Regression. Mean absolute error, mean squared error, and root mean square error were the cross-validation techniques adopted. Compare to other machine learning methods, the decision tree performs better.

Camilo Lozoya, et al, an additional component is Sensors Assessment of the Spectro Foliage Index for Precision Farming in Greenhouses [4]. This study explores two artificial intelligence (AI) systems for common wheat yield prediction in a bid to boost agricultural production estimations. The yield of wheat crops will be forecast in this article using two different AI systems. Farmers confront a number of difficulties in their attempts to forecast crop yield. Our project's ability to predict the output of wheat crops will be advantageous to the crofters. The random forest method provides an R2 value of 0.999, whereas the artificial neural network yields a loss score of 11.1772. In forecasting, the random forest method performs better than artificial neural networks.

R.Reshma, et al., IoT-based Classification Algorithms for Crop Yield Prediction and Soil Content Monitoring [5]. Internet of Things, or IoT, technologies can be used together with soil monitoring to increase agricultural output by correctly detecting soil factors such as temperature, humidity, PH, fertility/nutrient content, and wetness. After collecting and parsing that information in the cloud, we were able to turn out a trend analysis and optimize agricultural strategy. This so permits us to achieve highest productivity through smart management of resources and operational farming techniques.

Andiyappillai, Natesan. Effective implementation factors of the Woodard Management System (WMS)," the International Journal of Software Applications [6]. For this research, a case study of a top supply chain and logistics service provider was used to determine and assess the crucial components enabling an effective WMS deployment. Based on actual project execution observations and project documents, this was carried out. It is projected that this study will assist those in the supply chain and logistics industry in understanding these key components and then taking the required steps to ensure that their WMS deployment is a huge success for their company.

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Sahara, Chelinka Rafiesta, and Ammar Mohamed Aamer. "A review of a smart warehouse which employs the Internet of Things as well as combines data in real-time [7]. The International Review of Pervasive Technologies for Computing and Communications, 18.5 (2022): 622–644. Real-time data integration is still a barrier when creating an internet-of-things (IoT)-based warehouse. It requires an in-depth knowledge of cutting-edge abilities and technologies. The objective of this study is to pinpoint the vital components of IoT-based warehousing's real-time data integration procedures. Next, develop and put into effect a framework for integrating data which makes use of the Internet of Things for real-time data exchange and transfer.

Thus**,** Existing Conventional agriculture system relies on manual data collection. Limited use of predictive analytics for yield estimation. Basic warehouse management systems lack real-time integration. In existing system there is yield warehouse management based on yield prediction. There is manual warehouse management thus there is high probability of error occurrence.

II. PROPOSED SYSTEM

In proposed method, the agriculture field is monitored using sensors. This method helps to farmers to monitor their field area. integration of microcontrollers for real-time agricultural data collection. The value sensed from the field is then set to the Arudino Uno, it then compares the present value sensed with the previously stored values from the database and predicts the yield by using Random Forest Regression in the python language. Then, the crop yield is sent to the nearby warehouses and the capacity of the warehouses is monitored using the Java and mySQL, then the farmer sends the request for the allocation of warehouse in the nearby location. Warehouses sends a response, following to the farmer request.

Thus, complete utilisation warehouses are properly maintained. Warehouses are strictly monitored and proper departmentalisation of the crops on the basis of their storage capacity is incorporated, like for example immediate, long or short duration. Markets too, can witness their nearby warehouses and raise a demand form with respect to their market demand analysis, this particularly ensures that there is a proper consumer chain managed with proper allocation and availability ofcommodity on various markets. Thus, on increasing or decreasing price in accordance with the demand the commodities can be properly handled and transported to the consumer, thus maintaining price stabilisation. The next most important advantage of the proposed system is implementation of E-Logistics system. In this System, the consumer can directly purchase their needed goods or commodities from the nearby warehouses on the given web, with their prices and their available variety shown. Consumer can purchase from their nearby markets, thus avoiding middlemen.

They could be increase of price when demand increases, thus by avoiding middlemen and with the proper warehouse management systems, the entire supply chain and the price stabilisation of commodities and availability of commodity is taken care of. This system serves as a transparent system, thus black market, trade and illegalities can be prevented.

III. SYSTEM ARCHITECTURE

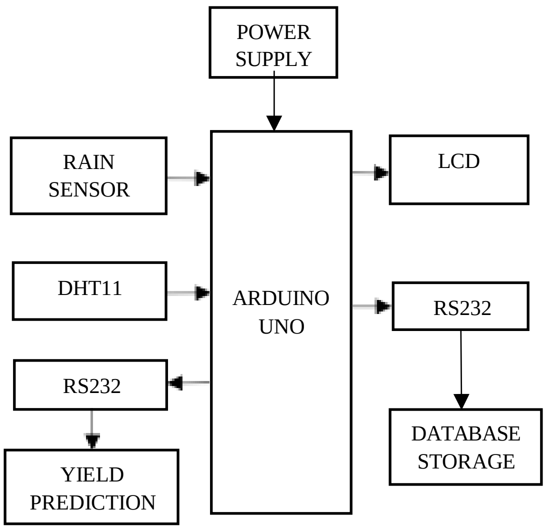

Fig 1: Block diagram of Smart yield prediction

IV. METHODOLOGY

The main processing unit of the system is the Arduino Uno microcontroller. It starts and saves the values across the system management application. The Arduino gathers essential information for improving agricultural productivity by interacting with a variety of sensors. The DHT11 sensor is used for measuring the temperature and humidity in the field. This information is essential in determining the outside factors influencing crop growth.

A rainfall sensor additionally serves to measure the volume of rainfall in the field, which is required for effective cultivation and management of water. The information from the sensor is analysed by a Python program, which uses it to predict output. Given Python's powerful algorithms for learning and data analysis abilities, predictive models based on historical data values may be created.

VII. RESULTS AND DISCUSSION

Numerous benefits are provided by this novel approach, such as accurate yield predictions, resource efficiency, and simplified warehouse operations. With the use of technology, farmers are able to make well-informed decisions based on precise and current crop information. This gives them the opportunity to allocate resources more wisely, which eventually results in higher yields and more profitability.

The system's sophisticated predictive analytics also enable customized strategies that can change in response to shifting market demands and environmental conditions. Moreover, post-harvest operations are optimized by including a state-of-the-art warehouse management system. As a result, there is less waste, better inventory control, and better distribution planning.

In the end, This Helps Promote More Sustainable Agricultural Practices While Also Saving Money.

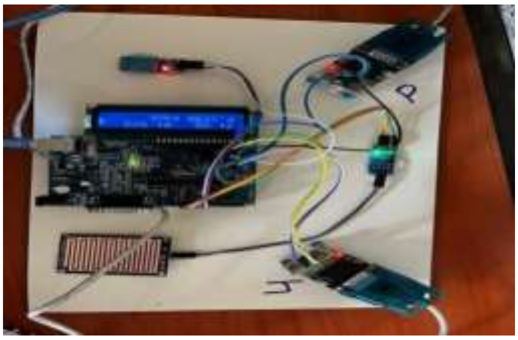

Fig 2: Hardware components integration

The Fig 2 showcases the connection of the hardware components needed in the system It consists of a rain sensor and temperature humidity sensor .

Fig 3: Farmer login portal

The fig 3 depicts the farmer login portal. This portal mainly provides the following information, it processes the crop yield prediction in the hectare scale. Then it displays the various warehouses near the farmers location.

Fig 4: Crop yield prediction

Fig 4 shows that, thus by connecting the value encountered from the field to the Arduino Uno, it uses Python's Random Forest Regression to forecast the yield through contrasting the present value identified with previous saved data from the database.

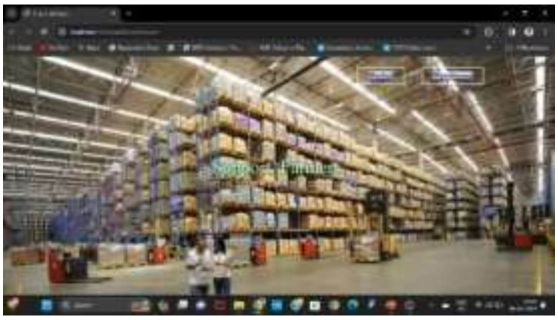

Fig 5: login for warehouses and market place

Fig 5, is the login web for warehouses, market place and customer. Farmer requests that a storehouse be placed in a convenient location. Warehouses receives the farmer's request and responds accordingly. Thus, fully utilized warehouses are maintained in good shape.

Crops are appropriately separated into departments based on the amount of space they can contain, and as short, long, or immediate according to their duration, and warehouses are closely monitored. Markets possess the capability to monitor nearby warehouses and produce a demand form by analysing market demand.

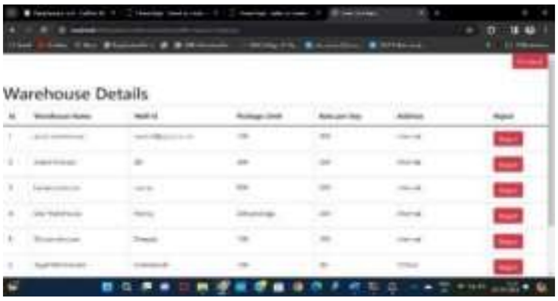

Fig 6: Warehouse details being displayed

Fig 6 illustrates the various warehouses details displayed for the farmers. So that Farmers get to know their nearby warehouses and their available storage capacities.

Fig 7: Demand form from market side

Fig 7 is a demand form raised by the market place. Markets, can witness their nearby warehouses and raise a demand form with respect to their market demand analysis, this particularly ensures that there is a proper consumer chain managed with proper allocation and availability of commodity on various markets

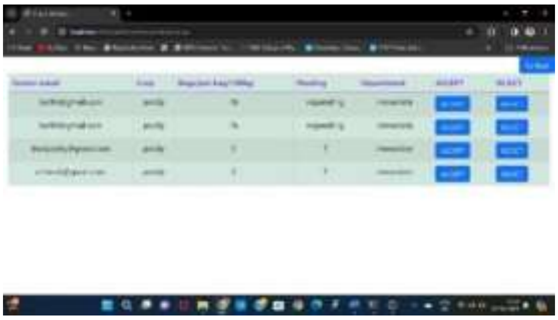

Fig 8: Warehouse side indication of demand raised by market

The indication of demand forms raised can we viewed in the format shown in Fig 8. Warehouses, can either approve or reject the demandraised by the market

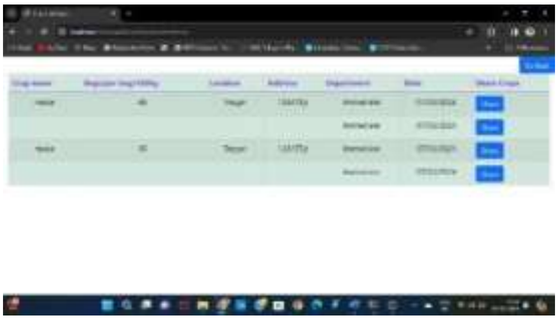

Fig 9: Approval or Rejection from Warehouse side and E-logistics framework

Fig 9 depicts the, Deployment of the E-Logistics framework. With this system, consumers are able to purchase the commodities or goods they need from the local marketplaces on the supplied website, which displays the prices and range of alternatives. Customers can buy directly from their local marketplaces, cutting out the middlemen.

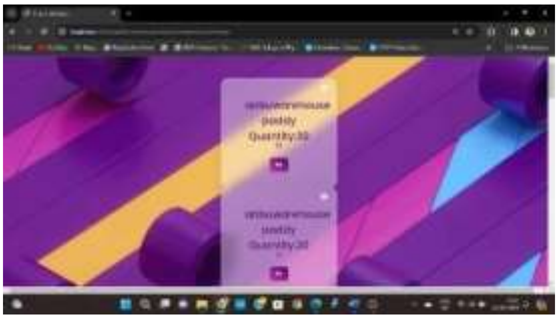
Fig 10: Smart Logistics

Fig 10 is the customer login portal, where the customer location is being entered and the nearby warehouses are displayed.The crops availability and their price are being displayed

Fig 11: Buy form

Fig 11 is a buy form where,Customer can add to their cart according to their needs and the bill is being generated.

Fig 12: Payment from customer

At the end the customer is taken into the payment portal as in Fig 12,where Card details are entered and payment is made.

The whole supply chain, their price stabilization, and the availability of supplies are taken care of through eliminating middlemen and employing appropriate warehouse management systems. Prices can increase in accordance with increases in demand. Since this system is transparent, illicit conduct, the black market, and making trades may be avoided.

VIII. CONCLUSION AND FUTURE WORKS

Agriculture could go through changes in the future and farmers may be granted the ability to adopt data-driven choices if production predicts are accurate. This technology may lead to higher crop yields, a more effective use of resources, and better warehousing operations, all of which could promote lucrative and sustainable agricultural methods in the long run. The smart greenhouse can be used for a variety of agricultural applications and offers many opportunities for improvement.

It may be configured and utilized to cultivate any kind of plant in any type of setting. Solar panels and turbines powered by wind are examples of renewable energy sources that are used to power automated greenhouse gear. In conclusion, the incorporation of real-time data from controllers into agriculture along with cutting-edge predictive management systems for warehouses represents a monumental breakthrough in contemporary agricultural operations.

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