CROP RECOMMENDATION USING IoT AND MACHINE LEARNING

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ABSTRACT

Agriculture plays a significant role in our daily lives. Farmer is a backbone of our country who needs agriculture for their duty. Farmers are facing problem in choosing right crops to grow. Changing in climatic conditions are the major problems that are faced among the farmhand. Remote technologies can be used to improve growing of crops from traditional agriculture to precision agriculture. The recently developed technologies include data analysis and IoT (Internet of Things). To cultivate the accurate crop at accurate time this can be done using Machine Learning Algorithm. The soil parameters such as nutrients, potassium, pH of soil and weather parameters such as temperature and humidity are collected from sensors like DHT11. The geolocations are fetched using the GPS receiver by communicating with the satellite.

Keywords: *Agriculture, Precision Agriculture, Crop Recommendation System, KNN Algorithm, IoT, Machine Learning, Crops*

INTRODUCTION

The planned system is a smart agriculture system which helps farmers to grow crops and it increases the yield rate of productivity. This system is based on IoT and Machine Learning Algorithm. It finds useful in agricultural sectors for farmers. The soil quality and weathers parameters are measured and stored in data collected. The dataset consists of parameters like nutrients, potassium, pH of soil, temperature, humidity of various places. This system is very helpful for illiterate peoples to choose which crop has to be sown.

Crop recommendation using IoT and machine learning is an emerging field in agriculture that aims to optimize crop production by leveraging the power of data analytics and automation. This approach involves the use of sensors and IoT devices to collect data such as soil moisture, temperature, humidity, and nutrient levels. This data is then analyzed using machine learning algorithms to make informed decisions about which crops to plant, when to plant them, and how much fertilizer and water to apply. The ultimate goal of crop recommendation systems is to increase yields, reduce waste, and improve the overall sustainability of agriculture. By providing farmers with accurate and timely recommendations based on real-time data, these systems can help them make. Overall, crop recommendation using IoT and machine learning is an exciting area of research with the potential to revolutionize the way we approach agriculture. By combining the power of data analytics, automation, and agricultural knowledge, we can work towards a more sustainable and efficient future for farming.re

informed decisions and optimize their resources. Moreover, these systems can also help to reduce the environmental impact of agriculture by minimizing the use of fertilizers and pesticides, and reducing water waste.

OBJECTIVES

1. Increase crop yield: One of the primary goals of a crop recommendation system is to increase crop yield.
2. Reduce input costs: A crop recommendation system can help farmers reduce input costs by recommending the right amount of fertilizer, water, and pesticides based on real-time data.
3. Optimize resource utilization: The system can help farmers make informed decisions about resource utilization by analyzing data on soil quality, weather patterns, and crop health.

LITERATURE SURVEY

Crop recommendation using IoT and machine learning is a growing field of research, with a number of studies investigating its potential applications and benefits. Some keys are:

[1] A study published in the Journal of Agricultural Science and Technology suggested that using machine learning algorithms to analyze data from soil sensors can significantly improve crop yield and reduce water usage. The study found that a crop recommendation system based on machine learning algorithms could increase crop yield by up to 28% while reducing water usage by up to 37%.

[2] Another study published in the International Journal of Agricultural and Biological Engineering explored the use of a crop recommendation system based on IoT sensors and machine learning algorithms to optimize nitrogen fertilizer application. The study found that the system could reduce nitrogen fertilizer usage by up to 44% while increasing crop yield by up to 27%.

[3] A review article published in the Computers and Electronics in Agriculture journal highlighted the potential of using IoT sensors and machine learning algorithms to optimize crop management practices. The review noted that such systems can improve the efficiency of resource utilization, reduce waste, and increase sustainability in agriculture.

[4] A study published in the Journal of Intelligent Systems reported the development of a crop recommendation system based on IoT sensors and machine learning algorithms for maize cultivation. The system was able to predict maize yield with an accuracy of 96.87% and recommend the optimal planting time and amount of fertilizer and water required for maximum yield.

[5] A research article published in the Journal of Applied Remote Sensing explored the use of remote sensing technology to collect data on crop health and soil moisture for a crop recommendation system based on machine learning algorithms. The study found that the system could accurately predict crop yield and recommend the optimal irrigation and fertilization techniques for maximum yield.

Overall, these studies demonstrate the potential of crop recommendation using IoT and machine learning to improve crop yield, reduce input costs, and increase sustainability in agriculture. Further research in this field could lead to more efficient and sustainable crop management practices, benefiting farmers and the environment alike.

METHODOLOGY

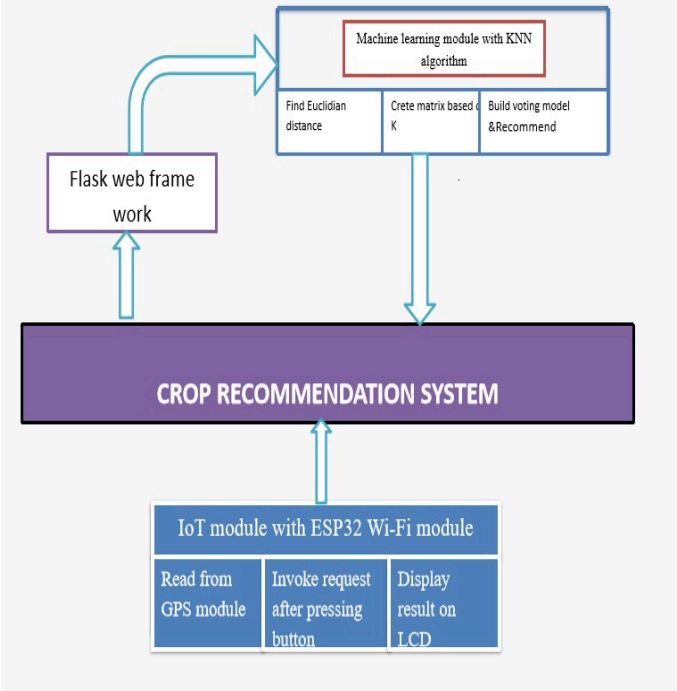

Figure 1. Block diagrams of the proposed project

Figure. shows various building blocks of the proposed project. IoT module esp32 development board is used. It is associated with a GPS module, push button, and LCD display, a flask web framework is used to receive the request from the IoT module, and the KNN Machine Learning algorithm is used to analyze data and recommend the crop. In this project using the GPS module to fetch the geo-locations of the particular field and it invokes by pressing the push button. Then the request is sent Flask web framework server which is connected to the machine learning model. The model includes the KNN algorithm and Euclidean distance based on k it creates the matrix then will build the voting model and will select the highest voted crop. Then the recommended crop is displayed on the LCD display.

SYSTEM IMPLEMENTATION

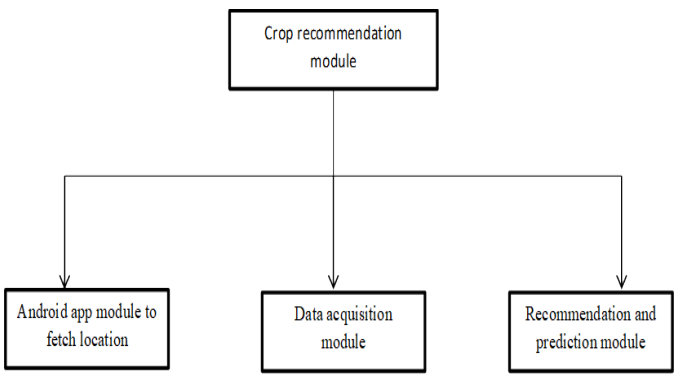

Figure 2: Design methodology of the proposed system

- Location is taken using GPS from an Android application.
- Co-ordinate values are sent to the rest soil grid website which returns the soil parameters of that particular location.
- Here we've taken one such soil parameter for example board work calculations.

Data acquisition module:

Their common function is to convert analogic signals like light, temperature, speed, etc. into digital signals for the computer.

KNN ALGORITHM

- KNN Algorithm is a Machine Learning Algorithm that is based on Supervised Machine Learning.
- It is used to train machines using labeled data.
- The model just needs to map the inputs with the outputs.
- In this project, the KNN Algorithm is used to classify the data and split the data into training and testing.
- It uses the Euclidean distance equation to classify the data and to find the nearest neighbor.
- In KNN Algorithm the K value must be always an odd number to classify the data. Because the result is based on a voting system.

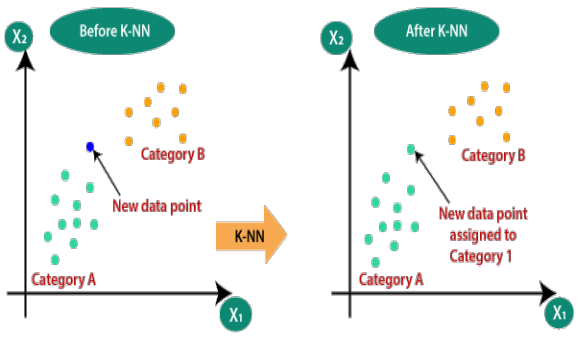

Figure 3: KNN Algorithm

RESULTS AND DISCUSSION

The proposed project is to help farmers in choosing the correct and appropriate crops. Did this project by taking 2200 datasets of different crops that include soil parameters like nitrogen, phosphorus, pH of soil, and weather parameters like temperature and humidity. Taken 1700 for training and 500 datasets for testing. By considering these parameters will find crops by applying the KNN algorithm. The project, can achieve 85% accuracy and it is good efficiency.

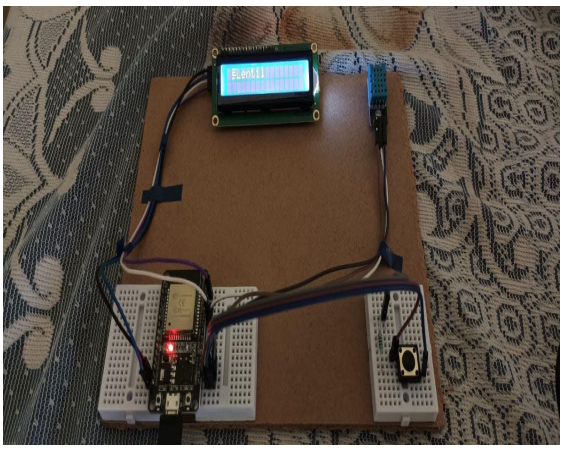

Figure 4: IoT Prototype

The geometric parameters are read from the GPS module, then it invokes a request after pressing the push button. Then the request is sent to a Flask web framework server which is connected to the machine learning model.

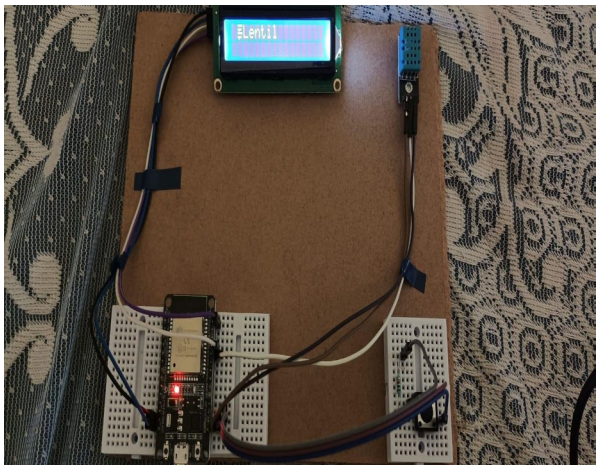

Figure 5: IoT Prototype displaying the result

After completing the machine learning process, it will predict an appropriate and suitable crop and it will be displayed LCD display.

CONCLUSION

In conclusion, crop recommendation using IoT and machine learning has great potential to revolutionize the agricultural industry by optimizing resource utilization, reducing input costs, and increasing crop yields while maintaining sustainability. By integrating data from IoT sensors, such as soil moisture and temperature sensors, with machine learning algorithms, crop recommendation systems can provide farmers with real-time information on crop health and environmental conditions, enabling them to make informed decisions about crop management practices. However, there are still challenges to be addressed in the implementation of these systems, such as the need for reliable and secure IoT infrastructure, the high cost of sensors and data storage, and the need for effective data analysis and interpretation. Nevertheless, ongoing research and development in this field hold promise for the future of agriculture, enabling farmers to make better use of resources, improve crop quality, and ultimately increase food production to feed a growing global population.

FUTURE SCOPE

1. Project could be further improved by increasing the volume of observation i.e., soil test data.
2. AI models could be used to get more accurate results.

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