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Automated Machine Learning based Agricultural Suggestion System

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Abstract - *In India's socioeconomic structure, agriculture is essential. For a nation where over 58 percent of the people is engaged in farming, it is a severe problem when farmers fail to select the crop that is best suited for the soil using conventional and non-scientific methods. Depending on the soil types, the planting season, and the farming region, farmers occasionally failed to select the appropriate crops. As a result, people commit themselves, leave the agricultural industry, and relocate to urban regions in search of work. This study has developed a system to help farmers choose crops by taking into account a variety of variables, including the sowing season, soil type, and geographic location, in order to address this problem. Furthermore, precision agriculture is advancing in emerging nations that focus on site-specific crop management and is being implemented using modern agricultural technologies.*

Key Words: Machine Learning, Django, Intelligent Crop

1.INTRODUCTION

1.1 Factors Considered

The suggested method considers the preferences of the client in addition to environmental aspects like average yearly rainfall, average temperature range, and geographic position within the state, as well as soil characteristics like soil type, pH value, and nutrient concentration. Additionally, if the right plant is chosen, the farmer will receive the projection regarding the yield.

1.2 Crop Selection

Despite lacking the necessary knowledge, the farmer may have decided to purchase land from other parties. A far lower yield will always result from selecting the incorrect plants. If the family is forced to survive only on this income, it will be difficult. Researchers who could otherwise contribute to creating national case studies are constrained by the complexity and lack of availability of reliable and current data. We have the resources at our disposal, so an offered as a solution, based on artificial intelligence models, to provide predictive understandings on plant sustainability and recommends the capacity to address significant environmental and financial criteria expertly.

1.3 Farming

Agriculture is a risky industry to work in. Plant production is influenced by the climate, geography, biology, politics, and economy. These factors can lead to certain dangers, which can be evaluated by using the appropriate mathematical or analytical methods. For usage in models, precise information on previous crop yields is necessary, and it also aids in the decision-making process for farmers and government organisations. Now that computing and data storage have advanced, we have access to enormous amounts of information. It has been difficult to extract knowledge from this raw data, but this has spurred the development of new approaches and strategies like information mining, which could link the knowledge in the information to the evaluation of plant yields. The aim of this study was to examine the most recent data mining techniques.

1.4 Machine Learning in Farming

The total economy of India depends on the agriculture industry. However, a structural change that has occurred in the Indian agriculture sector recently has put the sector in a difficult situation. The only way to ensure agricultural production continues and finds a solution is to make farming more profitable and desirable to farmers. Following these standards and giving farmers the knowledge they need to use AI to make knowledgeable decisions about their crops is the goal of this term paper. In this study, we use supervised machine learning techniques to forecast the best plant for a specific weather scenario as well as the likelihood that a harvest will be successful. A web-based interface is now accessible as well.

1.5 Proficiency in Technology

The main objective of this inquiry is to evaluate the system's technological requirements. No well-established system ought to. Much of the technological infrastructure in use today is required. The already existing technical infrastructure will be under a lot of strain as a result. As a result, the customer will have several demands. Because only minor, if any, alterations are needed to apply the existing system, it must have a low degree of demand.

1.6 Cultural Competence

Customers' satisfaction with the system is a question that is asked as part of the research process. This method includes teaching the user how to use the technology to its fullest potential. The system should not make the consumer feel intimidated, but they should agree to its use. The approaches utilised to enlighten and acclimatise its users will have a direct impact on how well a system is received by its end users. He needs to have more confidence because he will be using the system, so that he can also make suggestions.

2. LITERATURE REVIEW

An agrarian nation's economic growth and food security depend on preparation in the agriculture sector. A important aspect of agricultural planning is crop selection. Government objectives, market prices, and production rates are only a few of the many variables at play. Several scholars have investigated statistics and machine learning to enhance agricultural forecasting, weather forecasting, soil classification, and crop classification. It could be challenging to select the crop to plant each time given the restricted amount of available land. This study suggests a strategy for resolving the plant selection conundrum and maximising the prospective return rate of plants over seasons called the Crop choice Approach (CSM) in order to maximise national economic development. Plants' net return rate may rise as a result of the suggested approach.

E. n. Shri et. al (2016). The objective is to build a strong model that, given a particular type of soil and a particular set of environmental variables, can properly predict the longevity of a given crop in a particular state. Give advice on the appropriate plant varieties for the area to help the farmer avoid losing money. Third, based on last year's numbers, kindly provide a revenue evaluation of various factories. The suggested system actually uses one application of Expert systems are a type of machine learning, which enables computers to learn and advance without explicit programming from a programmer. After that, without further human input, the program's accuracy will be automatically enhanced. Several academics are looking right now.

Lisa et. al (2014). In order to build a reliable system for forecasting future returns, the authors investigate the potential of employing actual monthly weather data as a foundation. A non-parametric statistical model and non-parametric regression techniques were used to put the aforementioned forecasting tool into action.

M. Lekhaa (2017). This study offers a thorough review of the application of machine learning algorithms in agricultural production environments. Both the random forest approach and Big ML were employed by D. U. Rashmi (2018) equations of regression to evaluate crop functions. Furthermore, 48% of farmers claim they have little interest in teaching their children how to farm and instead want them to pursue urban careers. This is due to the fact that when choosing crops, farmers sometimes make mistakes.

According to Ms. Shakoor et al. (2007) artificial intelligence, scientists have created a set of decision-making guidelines for use in forecasting the future state of plants in order to lessen the consequences of water stress on them.

Dimitriadissavvas et. al (2008). Using AI techniques, crop costs were forecasted, and intelligent systems offered real-time advice.

D. e. Kussul et. al (2009). Systems with AI capabilities also offered suggestions for crop monitoring. By utilising deep learning algorithms, crop yields may be increased. Tom, Kevin Bobby, et al. (2020) The majority of individuals in our country—58%—make their living mostly from farming. Examples of this include planting during the incorrect season or growing something that doesn't thrive in their soil. Due to farmer suicides and the usage of farmland for uses other than farming, the farmer may have chosen to purchase land from outside parties despite the fact that the average monthly income of a farmer in 17 states was found to be Rs. 1700/- in the Economic Survey of 2016–17.

3. ANALYTICAL METHODS

3.1 Goals

The layout of both the unified modeling's first targets is set up as follows:

1. Provide consumers with a ready, object modelling bpmn so they can transfer and generate effective types.
2. Provide business can continue but also specialised procedures to increase a thorough.
3. Maintain independence while still learning new programming language families.
4. Give us a solid foundation on which to grasp it and the programming language.
5. Promote innovation by breaking the market up into segments.
6. Encourage the use of higher level development ideas like pieces, collaborations, and architectures.
7. Combine industry norms.

3.2 System Requirement Specification

HARDWARE REQUIREMENTS:

- **System** : Intel i3
- **Hard Disk** : 1 TB.
- **Monitor** : 14' Colour Monitor.
- **Mouse** : Optical Mouse.
- **Ram** : 4GB.

SOFTWARE REQUIREMENTS:

- **Operating system** : Windows 10.
- **Coding Language** : Python.
- **Front-End** : Html. CSS
- **Designing** : Html,css,javascript.
- **Data Base** : SQLite.

Fig -3.1: System Requirements

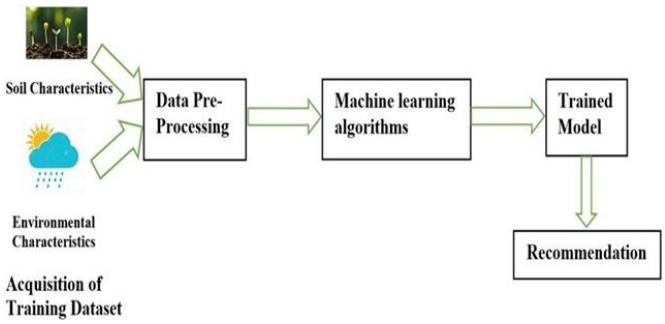


Fig -3.2: Architecture

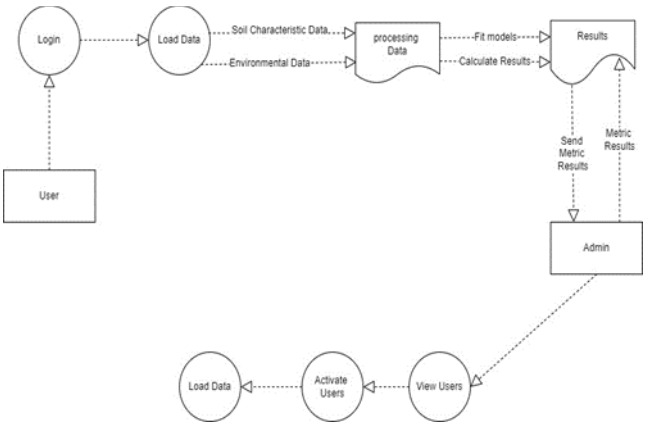


Fig -3.3: Data Flow

3.3 Context Diagram

An example of a cognitive illustration that is derived from simply a be using analysis is a use case description, like in the unified programming language (uml). The latter's goal is to produce a positive source document of a services offered by such a system based on yeah performers, their own goals (expressed as the use of cases), and so any connections between all those usage occurrences. To show how the systems function were being done as to which movie star should be the primary primary goal of each use case model. In this procedure, cast member characters may also be 1/25th scale.

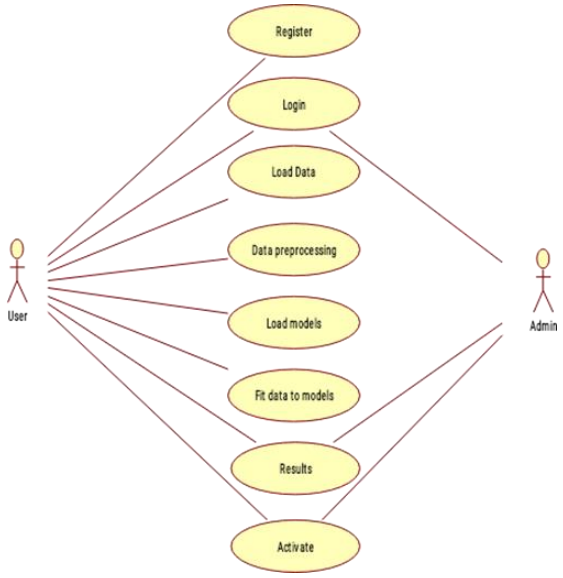


Fig -3.4: Context Diagram

4. IMPLEMENTATION

4.1 Modules

- User
- Admin
- Data Pre-processing
- Machine Learning

4.2 DJANGO

Backend continues to have a rising Django environment that encourages creation of novel, but clean-cut, logical configuration. So that you may start writing for someone's iPhone without having to reinvent the same back, this must be put together with developers to handle a lot of the work involved in digital marketing. Software that can be downloaded for free.

Its elimination and the creation of sophisticated, database-driven web pages will be Django's ultimate goals. Godot emphasises "pluggability" and reuse in all sub-assemblies to create better products and to support the idea that DIY projects shouldn't be done again. Across the board, including for the configuration set of file formats, scripting language was being employed.

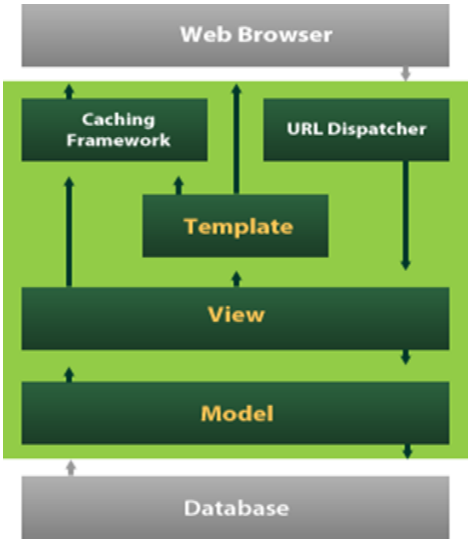


Fig -4.1: Django Layout

Additional regulatory create, interpret, alert, but rather reject connectivity that is formed flexibly by deep thinking and set up such as through mgr model types will be provided by Laravel.

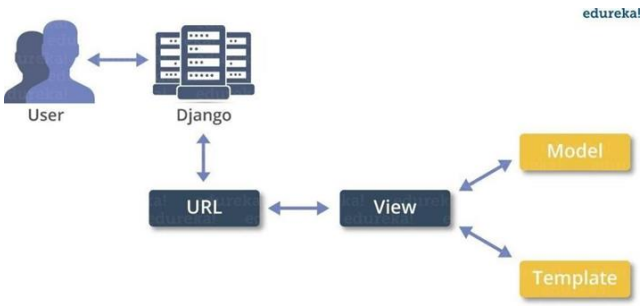


Fig -4.2: Flow Chart

4.2 Create a Project

On either Windows or Linux, all you have to do is open a terminal or a cmd prompt, go to the directory where you want your project to be built, and enter the code.

4.4 System Test

The ultimate purpose of testing is to locate faults. In the process of evaluating, flaws or weaknesses in a work product are sought after. It's a means to evaluate the performance of the system as a whole, as well as of its constituent parts, subsystems, and processes. In order to ensure that the software meets all of the system's needs and presumptions, it must first be put through a procedure known as software testing. Exams come in a wide variety of forms. Each type of testing addresses a certain need for inspection.

4.5 Different Types of Tests

4.5.1 Examining Equipment

By identifying which inputs lead to the desired outputs, test cases that check the correct operation of the underlying programme logic are utilised in system testing. All decision branches must be verified, as well as the internal code flow. Applications' individual software parts are tested. Before their merging, it occurs after the completion of a single system. Being familiar with the structure being tested is necessary for the success of this invasive type of testing. Unit tests look at a specific software, infrastructure setup, or business process. Unit tests ensure that every individual step in a business process is carried out in line with the written requirements and that its inputs and anticipated outcomes are well-defined.

4.5.2 Examining the Whole

Integration tests are created by software developers to check the interoperability of the several components of their apps. The total result of screens or fields is more important to event-driven checking. Integration checks confirm that the parts' combination is correct and consistent even though unit screening demonstrated that the components were separately satisfied. Combination testing is intended to find issues that result from combining different components.

4.5.3 Observational Trial

Detailed proof that all of the features promised by the business and technical specifications, the system documentation, and the user manuals have been made accessible is provided through functional tests. The following elements are crucial to functional testing:

Acceptable Inputs: Predetermined paths of valid inputs must be allowed. Missing Data: Certain types of missing data must be rejected. Identified capabilities should be put to use. As a result, it's important to practise the outputs of the selected application courses. Systems/Procedures: invoking a system's or procedure's interface is required.

The requirements, essential features, or special test cases are the focal points of practical test planning and preparation. In addition, it is important to take into account data areas, specified procedures, and subsequent processes when assessing business process change insurance coverage. Additional tests are discovered, and the value of existing tests is calculated, before functional testing is considered complete.

4.5.4 Checking the Whole System

System testing ensures that the integrated software system as a whole functions as expected. It verifies a configuration

to ensure typical and repeatable outcomes. The arrangement-oriented system integration test is a kind of system screening. Method summaries and flows, which emphasise driving procedure linkages and assimilation elements, form the basis of system screening.

4.5.5 Screening in a White Box

White box testing is performed by a software tester who is familiar with the software's internals, including its operations, structure, and language. It serves a purpose. It's utilised to check out areas that are inaccessible from the "black box" of the game.

4.5.6 Contrast-Based Testing

When doing a black box scan, testers don't need to be familiar with the module's internal workings, architecture, or programming language. such many other kinds of testing, black box tests need a definite starting point, such a requirements document or a needs record. A black box test is one in which the programme being tested is ignored entirely. There is no way to "look" within. The test provides inputs and reacts to outputs without considering how the programme operates.

4.5.7 Tests on Equipment

Although coding and unit testing are sometimes done as two separate phases of the software application lifecycle, unit screening is often performed as part of a combined code and device test phase.

- The Strategy and Methodology of Examination
- Both manual testing in the field and documented practical tests are in the works.
- Objectives of the Exam All subject area entries must be functional.
- The recognised link must then activate the desired page.
- No lag time may be tolerated in the user interface, notifications, or responses.
- Functions for verification
- Verify that the data entered is in the correct format.
- The option to enter data twice must be disabled.
- The destination page for each link should be obvious.

4.5.8 Evaluation of Integration

Combination testing in software is a method of creating interface-based failures by incrementally integrating two or more software components on a single platform.

The goal of an integration test is to ensure error-free communication between various components or software programmes (such as those making up a software system or, more generally, those running at the enterprise level).

The above listed test scenarios all successfully passed the examination. There were no issues at all.

4.5.9 Evaluation for Permission

User participation is crucial during the Individual Approval Screening step of any project. The system's ability to perform its intended functions is also guaranteed.

Results of the Exam: The aforementioned test scenarios all passed with flying colours. There were no hiccups.

5. RESULTS & DISCUSSION

Fig -5.1: Home Page

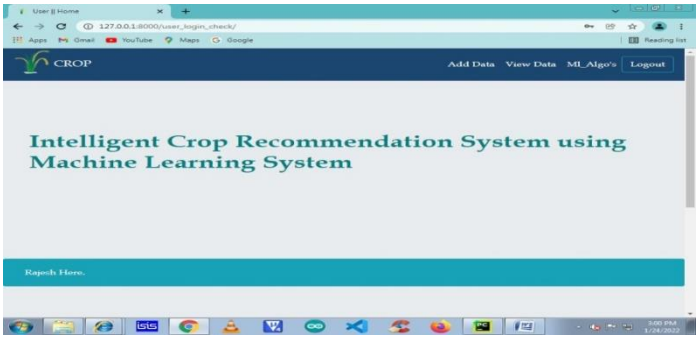


Fig -5.2: User Register

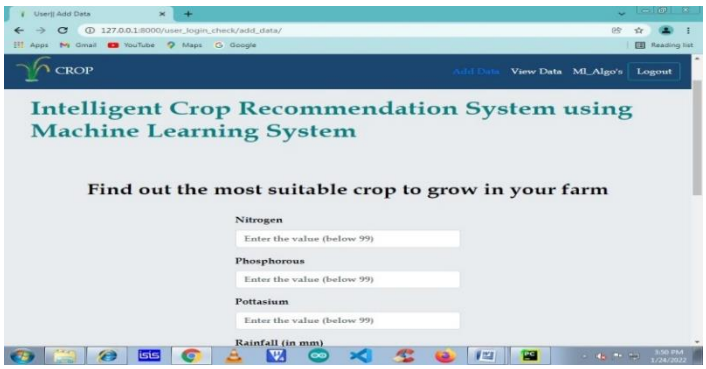


Fig -5.3: User Add Data

Fig -5.4: Add Data Final Results

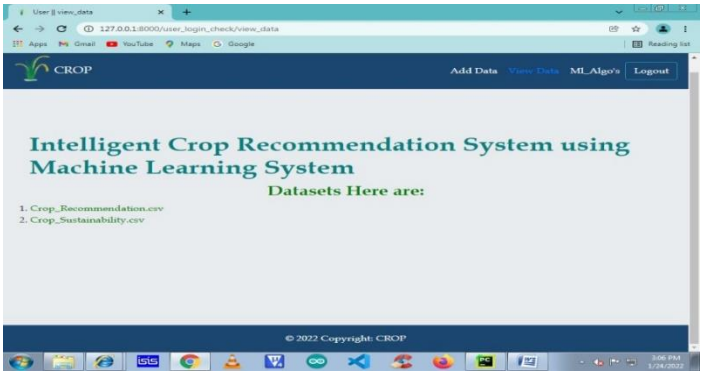
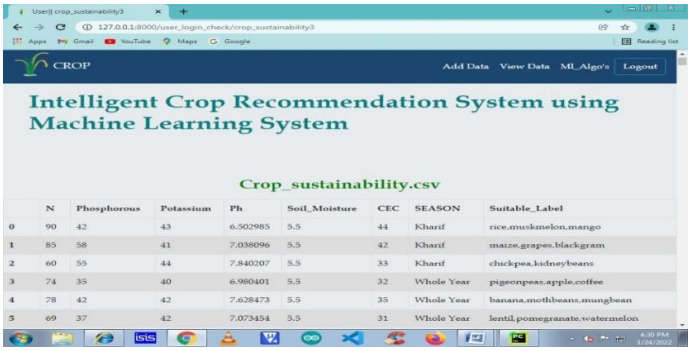


Fig -5.5: User View Data

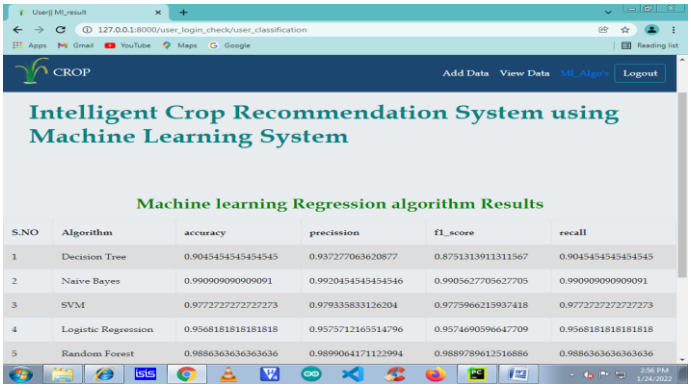
	N	P	K	temperature	humidity	ph	rainfall	CEC	label
0	90	42	43	20.879744	82.002744	6.502985	202.935536	44	rice
1	85	58	41	21.770462	80.319644	7.038096	226.655537	42	rice
2	60	55	44	23.004459	82.320763	7.840207	263.964248	33	rice
3	74	35	40	26.491096	80.158363	6.980401	242.864034	32	rice
4	78	42	42	20.130175	81.604873	7.628473	262.717340	35	rice
5	69	37	42	23.058049	83.370118	7.073454	251.055000	31	rice
6	69	55	38	22.708838	82.639414	5.700806	271.324860	30	rice
7	94	53	40	20.277744	82.894086	5.718627	241.974195	25	rice

Fig -5.6: User View Data Set1



	N	Phosphorous	Potassium	Ph	Soil_Moisture	CEC	SEASON	Suitable_Label
0	90	42	43	6.502985	5.5	44	Kharif	rice,musknelon,mango
1	85	58	41	7.038096	5.5	42	Kharif	maize,grapes,blackgram
2	60	55	44	7.840207	5.5	33	Kharif	chickpea,kidneybeans
3	74	35	40	6.980401	5.5	32	Whole Year	pigeonpeas,apple,coffee
4	78	42	42	7.628473	5.5	35	Whole Year	banana,mothbeans,mungbean
5	69	37	42	7.073454	5.5	31	Whole Year	lentil,pomegranate,watermelon

Fig -5.7: User View Data Set2



S.NO	Algorithm	accuracy	precission	f1_score	recall
1	Decision Tree	0.9045454545454545	0.937277063620877	0.8751313911311567	0.9045454545454545
2	Naive Bayes	0.990909090909091	0.9920454545454546	0.9905627705627705	0.990909090909091
3	SVM	0.9772727272727273	0.979335833126204	0.9775966215937418	0.9772727272727273
4	Logistic Regression	0.9568181818181818	0.9575712165514796	0.9574690596647709	0.9568181818181818
5	Random Forest	0.9886363636363636	0.9899064171122994	0.9889789612516886	0.9886363636363636

Fig -5.8: ML Results

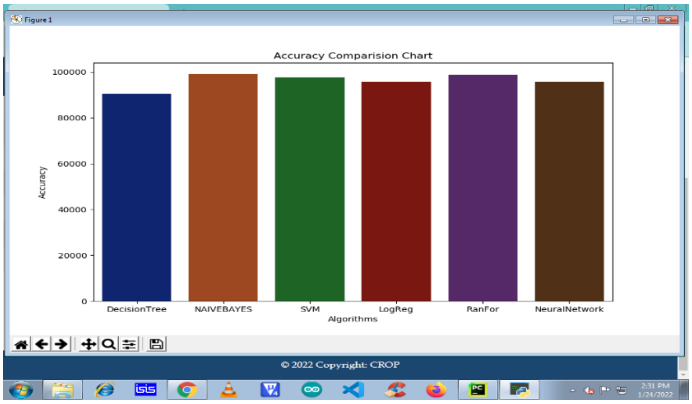


Fig -5.9: ML Final Results

Fig -5.10: Admin Home Page

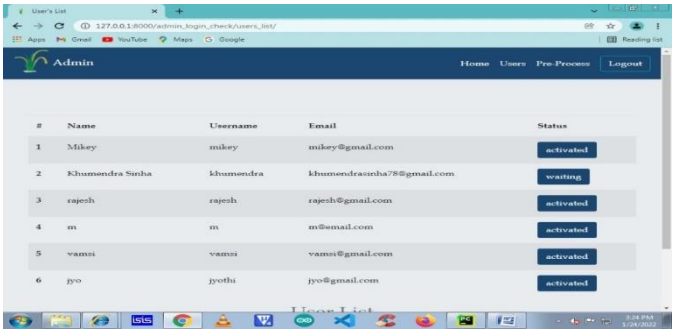


Fig -5.11: Admin Activate Users

6. CONCLUSION

The suggested approach helps farmers choose the most productive plants by providing them with access to information that is typically not available to them. Additionally, it protects their assets. The nation's millions of farmers will soon have access to growth advice thanks to attempts to combine a web interface with a mobile application.

Improvement Required

Keep in mind that when it comes to actual farm work, the promise of sustainable farming that benefits the world and the community frequently falls short. Not everyone wants to deal with farming's poor potential for income and high production costs. Recent investigations into the upstate New York ranch employees who feed the renowned Greenmarkets in New York City have revealed widespread underpayment and poor working conditions. Undocumented workers make up a large portion of this workforce, and many of them are afraid of being deported if they voice their complaints. When farmers are faced with high input costs and low consumer prices, they frequently lower their remuneration. Environmentally conscious consumers shouldn't be hesitant to spend a little bit extra to guarantee that employees receive a fair wage and have access to secure working conditions.

Long-Term Improvement to Farming

Several strategies can be referred to as "lasting" in this context. It's crucial to assist farmers as they navigate the difficult transition from conventional, chemical-based farming to more sustainable practises, but it's also crucial to uphold the standards set for these practises, including the USDA Organic label, emerging third-party certifications, and the brand-new Regenerative Organic Certified label, which is currently in pilot.

This might be as simple as switching certain farmers' crops from genetically modified to non-GM ones or creating prairie barrier strips. These changes may seem small from the outside, but for farmers in places where all of their neighbours grow solely GM crops and also ranch every available acre, they are just the beginning.

To wean themselves off pesticides and transition to more environmentally friendly farming practises, many farmers are embracing IPM practises. A strategy known as integrated pest management (IPM) emphasises prevention over the application of insecticides. Observation and identification are the first steps in controlling a parasite, followed by manual removal (using weeding or traps) and chemical pesticides in the second and third stages.

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