ELEVATING EFFICIENCY AND SUSTAINABILITY IN LARGE-SCALE COCONUT OIL MANUFACTURING THROUGH PROGRESSIVE STRATEGIES (COCOCLARITY MOBILE APP)

R24-059

Project Proposal Report

A. Maleesha Dewmini

B.Sc. (Hons) Degree in Information Technology Specialized in Information Technology

Department of Information Technology

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DECLARATION

I declare that this is my own work, and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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Date 28/02/2024 ……………………………………

ABSTRACT

The Coconut Oil Yield Prediction System aims to improve forecasts of coconut oil production using artificial intelligence. Inaccurate predictions have previously impacted supply chain planning and investment choices in this industry.

The system would analyze extensive data on factors like past yields, weather, soil quality, and logistics across regions and seasons. Advanced machine learning algorithms would identify patterns affecting productivity.

Accurate future yield predictions can stabilize output volumes and align production capacity with predicted demand. This data-driven approach seeks to support long-term coconut oil industry growth amid rising global popularity.

Overall, the proposal advocates using AI and predictive analytics to gain insights that can optimize cultivation, planning, and distribution processes. More precise yield forecasts are expected to benefit coconut oil supply chain management and investment decisions.

Table of Contents

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

Abbreviation	Description
AI	Artificial Intelligence
ML	Machine Learning
ANN	Artificial Neural Networks
RNN	Recurrent Neural Networks
DL	Deep Learning
DS	Data Science
AL	Active Learning
FE	Feature Engineering
DT	Decision Trees Network

1.INTRODUCTION

1.1 Background & Literature survey

The thriving coconut industry in Sri Lanka plays a pivotal role in the livelihoods of over 1 million small-scale farmers, as these individuals are heavily reliant on it. Across expansive plantations that cover an area of 395,797 hectares, more than three billion coconuts are yielded annually for production. In fact, copra manufacturing hit an impressive high point in 2020 at approximately 552153 tons (MT). The positive impact this sector has on agriculture and overall economy is significant within Sri Lanka's community.

Sri Lanka's economy greatly relies on coconuts, not only as a source of livelihood but also for generating export revenues. Due to its longstanding association with coconut agriculture, Sri Lanka has emerged as a major player in the global coconut market.

Using machine learning to forecast coconut oil yields can boost productivity, reduce waste, and promote sustainability in Sri Lanka's coconut oil industry. An advanced prediction model incorporating weather, soil conditions, and historical yields could provide reliable quarterly projections.

With these forecasts, farmers and producers can optimize production to better balance supply and demand while making wise investments to meet rising demand.

Figure 1 showcases expected coconut oil production patterns by 2023. It highlights major factories and influencers generating output from substantial copra levels. This underscores the need to adopt tactics ensuring long-term, eco-friendly industry growth..

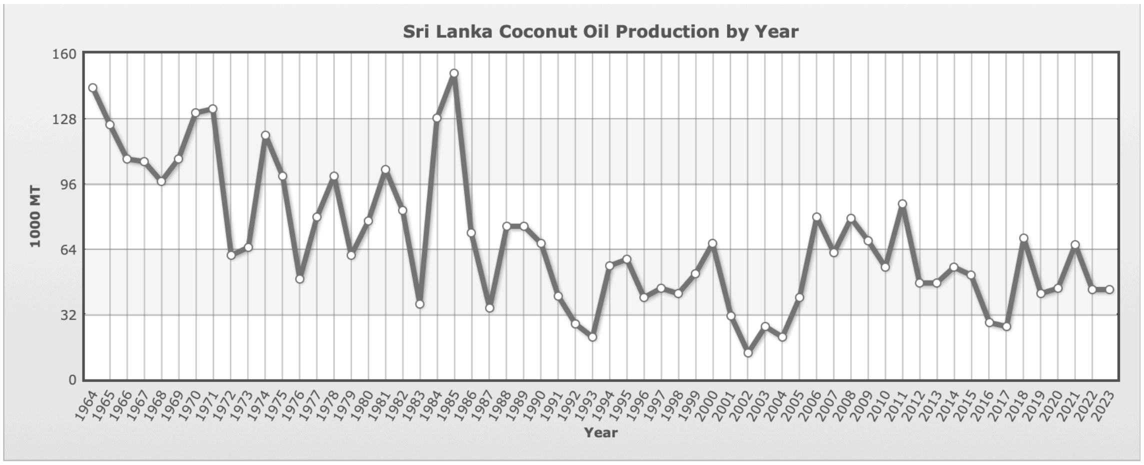

Figure 1: Coconut oil production 1964-2023(MT)

Sri Lanka combines modern technologies and sustainable solutions with traditional methods to advance its coconut industry and ensure public welfare. The goal is to boost productivity and profitability for all by unifying innovation with environmental protection and cultural heritage.

Sri Lanka's commitment to progress, eco-friendliness, and economic growth is evident in efforts to develop efficiency and longevity in coconut oil production through teamwork. By establishing a sustainable future, the flourishing coconut trees will provide nourishment and opportunities for generations.

The industry is supported by over one million smallholder farmers managing 395,797 hectares of land. Their collective three billion annual nuts drive copra output to meet global coconut oil export demand. In 2020, Sri Lanka produced 233,660 metric tons of premium quality coconut oil, ranking fourth among top producers worldwide. This contributed LKR160 billion to GDP.

Despite the sector's economic importance, sustainable practices are urgently needed to enable continued growth and profitability while preserving precious natural resources and commercial viability.

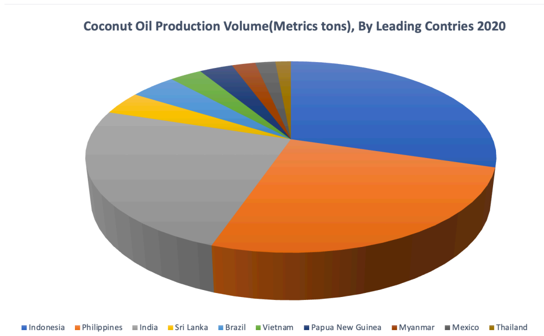

Figure 2 : Top 10 coconut oil producing countries 2020.

Sri Lanka's average 5-6% coconut oil extraction rate from copra lags behind India's 7%+ rates. This shows considerable room for improvement. However, multiple obstacles impede yield enhancement like inconsistent nut maturity checks, inadequate copra drying and storage, inefficient machinery, and process wastage. Upgrading practices like standardized drying protocols, better equipment, improved storage to cut wastage require prompt implementation to heighten productivity and output.

Environmental factors significantly impact copra quality and oil yields. For 30 years, declining rainfall due to climate change has challenged consistent copra quality and yields in Sri Lanka. However, data is limited on how specific factors affect supply chain productivity. [11]Enhancing collection methods and analyzing environmental impacts could improve coconut oil production processes while managing yield changes.

Statistics-based forecasting has proven ineffective at modeling complex interactions influencing oil yields. Conversely, machine learning techniques offer superior predictive capabilities over traditional approaches. But studies on advanced ML tailored to project Sri Lanka's coconut oil yields based on historical data and supply chain specifics remain lacking. Implementing cutting-edge ML and predictive analytics considering external factors like weather could profoundly transform industry practices for higher sustainability and profitability.

Including copra quality (figure 3), drying techniques, rainfall patterns, and milling metrics can boost prediction accuracy, as proven for palm oil using ML with geospatial data.[12]

Collectively analyzing these factors can develop a reliable coconut oil yield forecasting system. By linking individual coconut profiles with past crop yields and external factors like soil and weather, this approach enables efficient yield estimates based on available resources. As feasibility for such advancements increases, so do Sri Lankan growth opportunities around coconut oil through achieving sustainability and profitability.

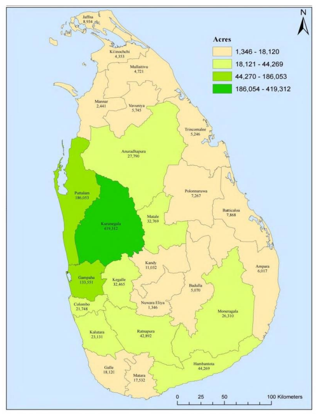

Figure 3: Coconut cultivation areas in Sri Lanka

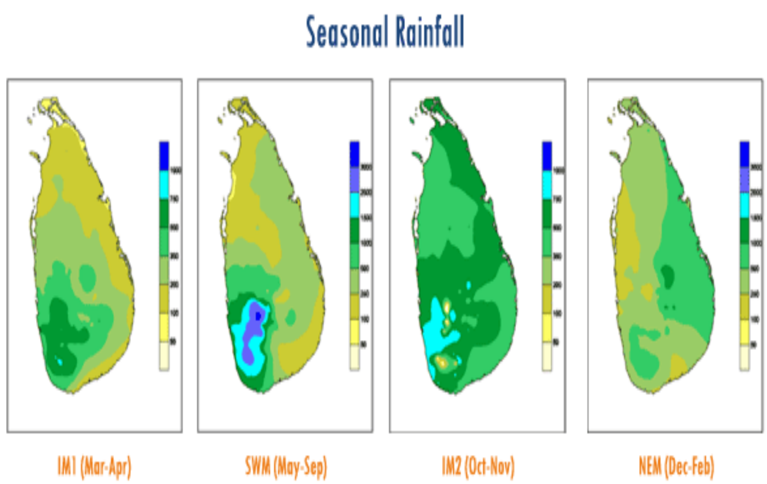

Figure 4: Seasonal rainfall patterns

Effectively implementing these measures can positively impact the environment by promoting efficient energy use, effective waste disposal, and reduced emissions[13].

Sustainability not only benefits local ecology but also ensures long-term economic prosperity for residents.

The coconut oil sustainability ensures both ecological and economic viability for Sri Lanka through energy and resource conservation coupled with responsible waste and pollution management. This allows for continued growth of this vital industry.

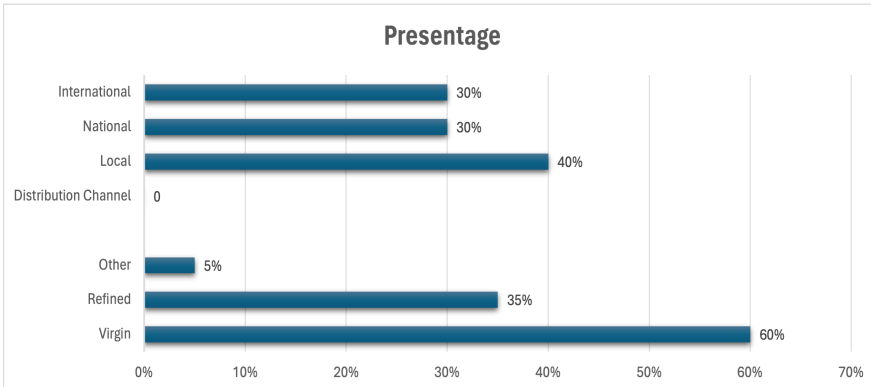

Figure 5 : Coconut oil production flow diagram

This study aims to develop a custom forecasting system for Sri Lanka's coconut oil industry using copra supply and oil mill production data. It seeks to improve on traditional statistical techniques by applying advanced analytics, optimization strategies, and sustainable solutions.

By combining historical records with multivariate analysis, this innovative approach can enhance the accuracy of coconut oil output projections. It also enables integrating efficient, eco-friendly methods into industry operations.

1.2 Research Gap

Sri Lanka's vital coconut industry covers extensive land area, but boosting production while accurately forecasting oil yields is challenging. To address this, advanced machine learning algorithms could be combined with past yield data and external factors like weather, soil conditions, and growth trends to create a precise predictive model for forecasting.

By linking distinct coconut profiles to historical yield data while accounting for external factors, the astute system recommends optimal methods for forecasting oil output based on available resources and contextual conditions. This allows for reduced waste, increased output, while also promoting enduring sustainability as well as profitability in the industry.

To satisfy the increasing worldwide demand for coconuts and prevent detrimental effects on operational effectiveness, resource efficiency, and environmental preservation due to imprecise predictions, it is imperative to adopt sophisticated foretelling methodologies customized for coconut supply chain dynamics.

Research Gap 1: Limited integration of modern predictive modeling

Research "A" [1] Although this study user conventional statistical methods such as multivariate regression to predict coconut oil yield, it overlooks the use of sophisticated machine learning techniques. These advanced methodologies can reveal intricate nonlinear connections in past information which can bolster forecast accuracy within the coconut supply chain.

Research “B” [2] Although the potential of AI in agriculture is highlighted by this research, it reveals that deep learning techniques with high complexity have undergone minimal testing and implementation for agricultural yield prediction. This highlights a significant shortfall in utilizing contemporary neural networks to identify underlying factors impacting crop production.

Research “C” [3] According to the study, Long Short-Term Memory (LSTM) networks - a type of deep learning algorithm capable of detecting predictive patterns in spatial-temporal crop data - have proven to be effective. Although not directly aimed at evaluating coconut supply chains, this indicates potential for further research that could tailor LSTM techniques and enhance forecasts concerning coconut oil production.

Researchers can utilize advanced deep learning techniques to reveal comprehensive factors that influence coconut yield through harvest data. This will greatly improve the accuracy of predictions for oil production. By utilizing cutting-edge machine-learning algorithms and historical documents, experts have the ability to develop a ground-breaking system capable of accurately forecasting future yields. Remarkably, these advancements not only optimize industrial processes but also strengthen sustainability and profitability in operations.

Research Gap 2: Fragmented supply chain data infrastructure

Research “D” [4] Developing predictive models that incorporate storage, transportation and extraction factors in cultivation data can enhance the accuracy of estimated oil product yield. A comprehensive approach considering every stage in the coconut oil supply chain enables scientists to build more robust predictive systems capable of optimizing industrial processes while promoting sustainability and profitability across the industry.

Research “E” [5] A key point is that having a thorough data network integrated across all stages including cultivation, handling and processing is vital for complete observation and analysis. However, the investigation excludes the coconut oil supply chain which provides an opportunity to explore advanced learning strategies for more accurate predictions on oil output via further research.

The lack of connection between data systems for pre-harvest, post-harvest, and production is hindering effective predictive techniques to evaluate coconut oil yields. The shortage of holistic supply chain knowledge also obstructs informed analysis by researchers and industry members, contributing to impractical forecasting models. This fosters suboptimal resource distribution and unsound practices [5].

To address this, scholars need to establish a thorough data system integrating complex information from all supply chain phases. Advanced analytics tools are necessary to efficiently sift through the extensive database. IoT sensors and trackers should also monitor performance throughout production for real-time updates.

Incorporating sustainability KPIs into operations, along with these strategies, can accelerate accurate predictions to inform decision-making for eco-optimization of methods and yields. Ultimately this data-driven, sustainable approach will enhance productivity and profitability in coconut oil.

	Research [A]	Research [B]	Research [C]	Research [D]	Research [E]	Proposed System
Uses advanced ML for dynamic learning	✓	✗	✗	✗	✗	✓
The entire supply chain is comprehensively integrated	✗	✗	✗	✗	✗	✓
Simultaneously optimizes for both profitability and sustainability	✗	✗	✗	✗	✗	✓
Tailors state of the art predictive analytics to the coconut oil production industry	✗	✗	✗	✗	✗	✓
Uniquely combines blockchain traceability data with predictive analytics	✗	✗	✗	✗	✗	✓

Table 1 : Comparison of former researches

The absence of comprehensive data integration systems that encompass pre-harvest, post-harvest and production factors creates an adverse effect on the dependability and durability of predictive methods for coconut oil output. This shortfall constrains effective decision-making processes to efficiently assign resources while embracing sustainable practices in this field.

1.3 Research Problem

The coconut oil industry has struggled with unreliable and erratic crop forecasts. Traditional methods based on limited data analysis and guesswork have average error margins around 25-30%. Such flawed approaches undermine resource planning, causing missed profits from underutilized production capacity. They can also lead to over or understocking, resulting in financial mismanagement [14].

Producing accurate predictions faces a major barrier due to the riskiness of the data [15]. Additionally, global warming-induced unpredictable climate shifts result in irregular changes in atmospheric features that obstruct our capacity to identify consistent patterns on crop yield (see Figure 6), further add to this difficulty [16].

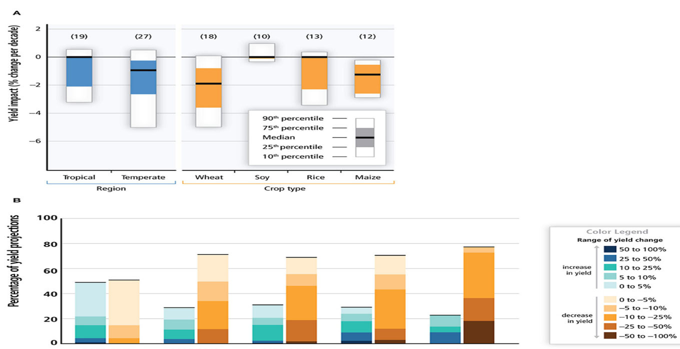

Figure 6 : Rising weather variability with climate change makes yield patterns less

Smallholder coconut farmers' limited resources and skills create an obstacle for the implementation of precision agriculture, leading to a greater likelihood of yield variations. On the other hand, distinguished producers typically rely on instinct or basic calculations instead of advanced analytics, which hinders their ability to improve efficiency and productivity.. As seen in Figure 7, production capabilities are not fully utilized. Therefore, this situation results in wasted assets and missed opportunities that go uncompensated.

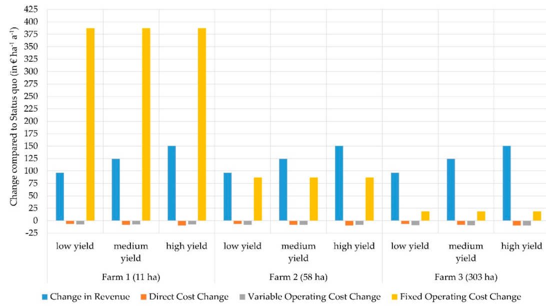

Figure 7 : Implications of inaccurate coconut oil yield predictions:

The integration of advanced predictive analytics with precision agriculture systems can effectively improve the accuracy and precision of coconut oil production forecasts. Advanced machine learning models enable the detection of complex data link that traditional methods may have missed, there by boosting precision in yield forecasting. This method offers a remarkable chance to create dependable forecasting algorithms by integrating noticable contributions from all stages of the coconut oil supply chain. Through these advanced algorithms, industries can improve their processes and minimize waste production while supporting ecologically sustainable practices that result in greater profitability [17]

By utilizing historical data and a variety of methodologies, the objective of this progress is to generate accurate forecasts for coconut oil production. These specific forecast will assist with resource allocation, optimize operations efficiency, drive profits and play a key role in reach sustainability goals within the successfully coconut industry.

2. OBJECTIVES

2.1 Main Objectives

We aim to develop an advanced predictive modeling system that can accurately predict coconut oil production with a high degree of precision and minimal margin for error. Utilizing advanced techniques in machine learning, such as neural networks, random forests and gradient boosting among others, we can reveal complex patterns hidden within data.

The system will ingest and process extensive historical data on past coconut cultivation yields across different regions and seasons. By analyzing long-term yield trends, production variability and data relationships, the algorithms can effectively predict future yields.

Accurate forecasts will enable growers and manufacturers to optimize planning for cultivated coconut supply, oil production capacity, inventory volumes etc. Enhanced visibility into future yields will lead to data-driven decisions, boosting efficiency, sustainability, and profitability across the coconut oil value chain.

2.2 Specific Objectives

There are four specific objectives that must be reached to achieve the overall objective described above.

Analyze historical yields data.

- To enhance predictions on coconut oil yield, a thorough process includes gathering comprehensive data from various regions. This is coupled with trend analysis and the identification of factors influencing fluctuations in yields for baseline forecasting through time series analysis. Equally important, machine learning models are utilized to quantify historical trends related to yield while striving towards optimizing production processes that minimize waste and enrich sustainability initiatives within the industry's profitability outlooks.

Data pipelines should be enriched regularly.

- Expanding the database with up-to-date yield data through APIs and batch updates is vital for improving predictions of coconut oil production. Analysis can be improved by integrating insights from external data sources like weather and soil data. Refining data collection and integration processes enables more consistent and clean information. This consistency allows for better forecasting capabilities and increased accuracy in optimizing coconut oil production procedures.

Retrain models dynamically.

- Accurate coconut oil production forecasts demand regularly updating the database with current yield data through APIs and batch updates. Incorporating external resources like weather and soil information can also enhance the analysis.It's imperative to refine the collection and integration processes of data for maintaining clean, uniform information that allows regular appraisals along with retraining from fresh facts & optimization techniques - leading to perpetual enhancements in modeling accuracy.

Offer user-friendly yield insights.

- To equip users with accurate and user-friendly tools, create instinctive displays presenting comprehensive, clear yield predictions. These displays fuse past and anticipated harvest data to provide interactive visualizations and analyses. By using machine learning models trained on expansive datasets, cultivators can receive practical insights into their crops' performance that steer strategic business choices while maximizing production efficiency.

3. METHODOLOGY

To enhance coconut oil yield predictions, a sophisticated machine learning-based approach will be utilized. Historical yield data from various regions and seasons will be collected and stored in a central data repository. Advanced regression models like Random Forests and Gradient Boosting Machines will be trained to predict oil yield accurately based on input parameters. These models will undergo rigorous validation before deployment. Real-time yield forecasts will be generated by integrating IoT sensor data into cloud-hosted model APIs. Results will be visualized through interactive geospatial dashboards for easy interpretation. Continuous model updates with new data will ensure ongoing accuracy, aiming to map farm states to expected oil outputs efficiently, ultimately improving sustainability and profitability in coconut oil production.

3.1 System Architecture

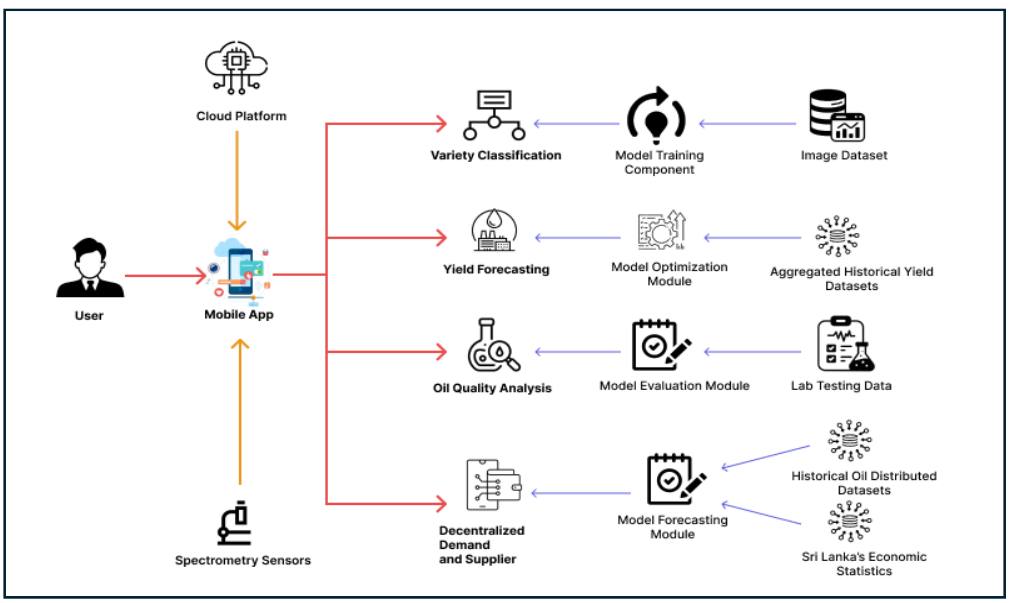

Figure 8 : CocoClarity Mobile App System Architecture

The system is designed to help coconut oil factory owners and producers in multiple ways by using advanced technology. First, the Coconut Variety Assistant uses a machine learning model called random forest to identify different varieties of coconuts based on their characteristics. This helps farmers select the best seeds to plant. Next, the Oil Product Estimator looks at how much coconut oil past crops have yielded and uses that data to predict how much oil a user can expect from their current crop. It gets smarter over time. The Live Coconut Quality Measurement uses a camera and artificial intelligence to analyze images of coconut oil and predict its quality. This helps set fair prices. Finally, the Decentralized Platform connects coconut oil buyers and sellers directly using blockchain technology for transparency. This gives coconut oil factory owners more power in the supply chain. The different components work together to provide personalized and reliable services to coconut farmers based on their specific needs. The advanced technology aims to help the coconut industry in Sri Lanka become more efficient, sustainable and empower local communities. (See Figure 8)

Using advanced data science, the coconut oil yield prediction system provides precise forecasts of oil output from coconut raw materials. By minimizing waste and improving sustainability while enhancing profitability for industrial manufacturers through accurate estimated yields. This is made possible by a machine learning model that examines extensive historical production figures to reveal complex patterns with key inputs covering everything from moisture levels and kernel-to-shell ratios to various preprocessing techniques used in extraction methods - all influencing how much usable product can be extracted per metric tons (MT) of either copra or whole coconuts kernels processed using multivariate regression analyses within this predictive toolset.

The web dashboard inputs newly procured coconut specifications. Leveraging insights from analyzing previous data, the machine learning model rapidly studies chosen batch parameters and processing techniques to predict coconut oil yield for those inputs within seconds, along with a confidence level.

Regular efficiency evaluations maintain accuracy by comparing predicted versus actual oil production after each cycle. Any inconsistencies add relevant data to continually enhance decisions. This adaptive method strengthens precision confidence by accounting for varying crop quality, manufacturing changes, or environmental conditions.

The system enables manufacturers to enhance their efficiency by using data-driven predictions of season yields, which in turn assists them with strategies for raw material procurement, production planning and inventory management. By removing unsure factors, they can reduce waste, consistently meet demand and increase profitability by making precise predictions. Figure 9 illustrates how AI-powered insights can aid in the evaluation of process bottlenecks and exploration of yield improvement mechanisms for sustainable advantages.

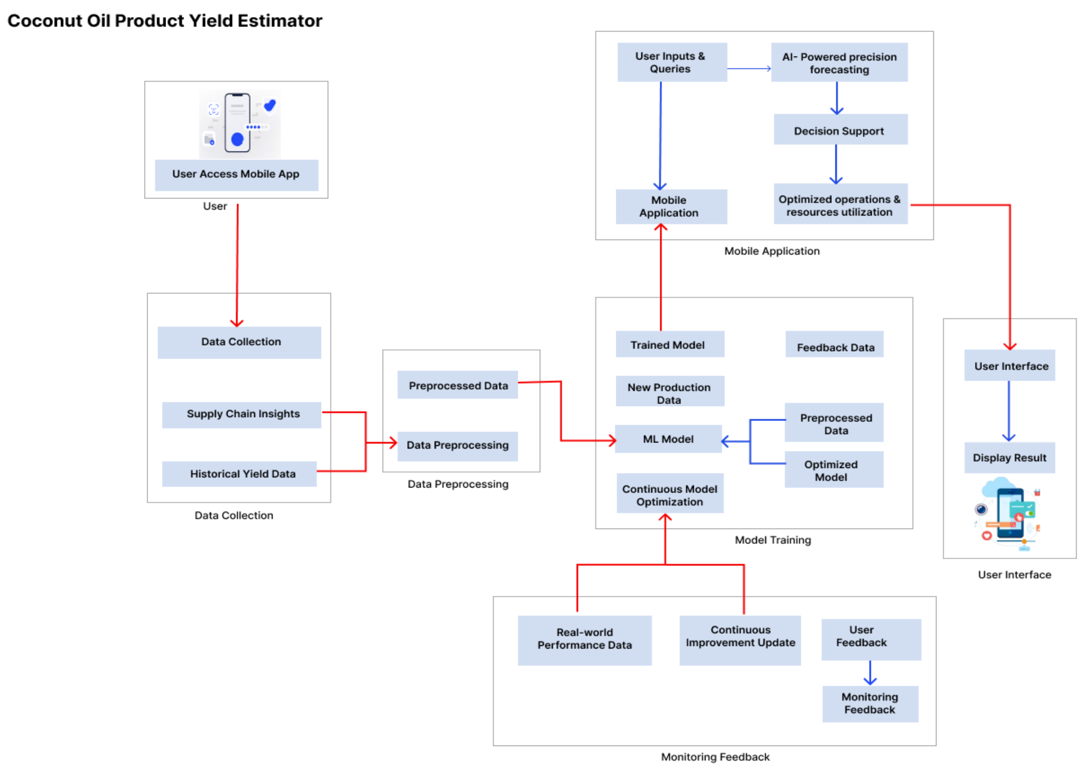

Figure 9 : Coconut Oil Product Yield Estimator Architecture

The technologies, techniques, architectures and algorithms involved in categorizing the Coconut Oil Product Yield Estimator are demonstrated in the table.

Technologies	Python, TensorFlow, Cloud Services (AWS)
Techniques	Multivariate Regression, Neural Networks, Random Forests
Algorithms	Linear Regression, Time Series (ARIMA), Regression Trees
Architectures	Cloud APIs, MongoDB

Table 2 : Technologies, Techniques, Architectures and Algorithms used

3.1.1 Software solution

The structured process of software creation, testing, and launch is referred to as the Software Development Life Cycle (SDLC). The app creation and deployment process involves multiple stages including planning, analysis, design implementation, and thorough testing. This systematic approach aims to meet customer specifications while minimizing malfunctions throughout the entire development cycle. The use of SDLC can enhance the levels of quality assurance, reduce developmental costs and shorten product time-to-market in relation to your company's needs.As you may refer from Figure 10 it highlights six essential processes included within agile methodology.

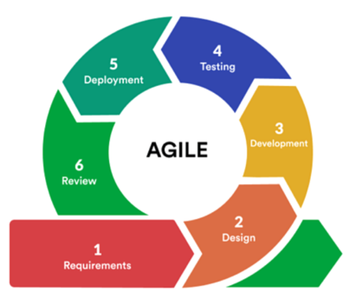

Figure 10 : Agile Methodology

1. **Requirement gathering**

Collecting Data

- We will collect coconut yield data from previous harvest across different seasons. This will include production volumes of copra and oil.
- Compile granular data on cultivation practices – planting density etc.
- Source data from both governmental databases as well as private coconut oil factories.

Data gathering

- Approach various stakeholders along the coconut supply chain including farmers, intermediaries, oil mills.
- Understand their oil yield forecasting processes and data collection mechanisms via interviews.
- Request their historical yield data while ensuring confidentiality with non-disclosure agreements.
- Gather all data in standardized digital formats for ease of analysis.

Conducting Surveys

- Design questionnaires to gain qualitative perspectives from key stakeholders.
- Ask insightful questions to uncover yield trends, production challenges and information gaps.
- Keep surveys brief with mostly close-ended questions for convenient respondent participation.
- Survey size and distribution will ensure sufficient representation across customer segments.

- Analyze survey responses to supplement quantitative data and guide predictive modeling.

2. Feasibility Study

- **Data Feasibility**

  To assess data feasibility, we will need to evaluate if we have access to enough historical data to build a robust model. This includes closely analyzing datasets related to coconut yield collection from sources like the government and private sector - the volume, variety, spatiotemporal coverage, and quality of these datasets. We need to ensure that we have several years of granular yield data, production volumes, harvest timings, geographical coverage etc. for multiple coconut cultivars. The datasets also require thorough cleaning, preprocessing, and standardization to transform them into usable formats. Overall, we need to determine if we have sufficient good quality input data for modeling.

- **Technical Feasibility**

  Evaluating technical feasibility involves determining the skillset, infrastructure, platforms etc. required to develop this system. We need to analyze whether we have a technical team with adequate data science and machine learning skills to build complex predictive models and deploy them into production reliably. The organizational and cloud infrastructure should also support requirements of large data storage, high compute for modeling, flexible tools etc. Any gaps identified in people skills or required tools/platforms need to be filled before the project can be deemed technically feasible. Availability of external data science expertise should also be considered.

3. Design

After the planning phase, system design will include a model pipeline showing the sequence of data ingestion, preprocessing, model building, testing, and deployment. Use case diagrams will capture key interactions between users and the predictive analytics platform to inform dashboard and interface functionality.

Sequence Diagram

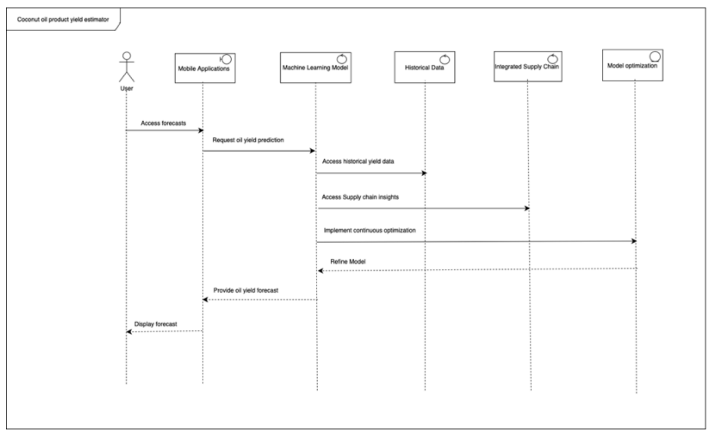

Figure 11 : Sequence Diagram of Coconut Oil Product Yield Estimator Component

Use Case Diagram

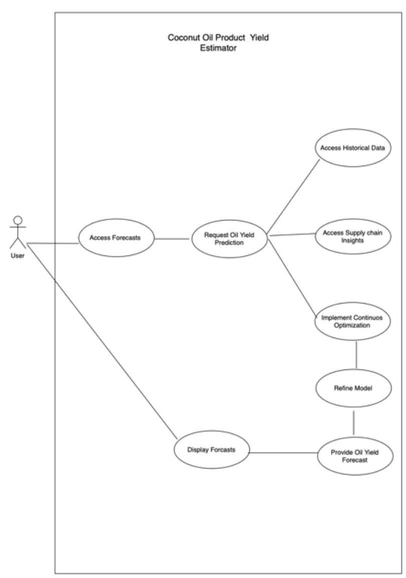

Figure 12 : Use Case Diagram of Coconut Oil Product Yield Estimator Component

4. Implementation (Development)

The implementation process, as discussed in the methodology, includes the development of below functionalities to satisfy user requirements providing the ultimate solution with high accuracy and reliability. We will develop a cloud-based end-to-end machine learning platform leveraging leading technologies like.

React Native will be used as the development framework to build the mobile application for this identification system, enabling cross platform compatibility.

We will build the core forecasting engine leveraging artificial intelligence algorithms that can detect complex patterns from data. Machine learning models will be trained on historical yield data to identify key correlating parameters that impact productivity. These models will statistically learn to predict outputs without explicitly coding relationships. We will employ ML algorithms like regression, simulation, and time-series analysis for dynamic and accurate insights.

Advanced neural network architectures will enable deeper analysis, capturing nonlinear data relationships. Long-Short Term Memory Networks (LSTMs) and Convolutional Neural Networks (CNNs), powered by deep learning, will provide temporal and spatial modeling of seasonal, cyclical, and regional yield variability. These deep learning techniques can uncover latent yield-influencing factors that traditional methods may miss.

Recurrent neural networks (RNNs) have feedback architecture suitable for analyzing time-dependent data. We will leverage RNNs and LSTM networks to understand cyclical and temporal effects like weather patterns on coconut yield. This will effectively capture repetitive annual seasonal changes in a context-based manner for the predictive model.

Our system must dynamically adapt as more data comes in, so we will incorporate active learning principles. This allows continuous model re-training by intelligently selecting useful new data points for labeling. Additionally, employing good feature engineering strategies will prepare raw data for facilitating actionable insights - transforming it into meaningful input features for the model.

5. **Testing**

In the testing phase, the software is evaluated thoroughly to identify flaws and uncover gaps compared to original requirements. A progressive series of unit, integration, system, and user acceptance tests are conducted to reveal issues at different levels. These testing stages focus both on software quality assurance and confirming that the product meets user needs before final deployment in real world scenarios. Rigorous testing helps build more robust software by detecting defects, inconsistencies, crashes etc. early for timely remediation.

3.1.2 Commercialization

This oil yield prediction tool is designed to help coconut oil companies enhance their production planning and efficiency. The technology will be licensed to enterprises across the coconut oil supply chain from plantations to processing plants to traders.

Features and ideal customer segments for three subscription packages catered towards commercializing the oil yield forecasting technology - a basic plan, a standard plan and a premium pro plan. [Figure ***3.1.2.1***].

For an annual fee of LKR 20000, the basic package provides fundamental yield prediction features with claimed accuracy of 80%. This plan is tailored for small coconut plantations and comes equipped with an analytics dashboard as well as email support.

For an annual fee of LKR 50000, the standard package offers mid-sized coconut oil producers access to advanced forecasting that boasts a 90% accuracy rate. Real-time monitoring, custom reporting options and priority customer support via email and chat are additional capabilities included in this option. Meanwhile, at a yearly cost of LKR 100000 is the premium pro plan which caters specifically to larger enterprises seeking granular insights backed by over 95% precision levels for scenario testing purposes as well as dedicated account management support services.

In general, the product's tiered subscriptions provide to customers with different levels of analytics expertise and financial resources while providing a fair amount of benefits.

The descriptions also surface how the plans have been intentionally designed factoring predictive accuracy, features, and analytics depth to serve specific persona needs from smallholder farms to commodities giants. This multi-tier strategy optimizes monetization and product-market fit across coconut oil industry stakeholders enabling widespread adoption.

	Basic Subscription	Standard Subscription	Pro Subscription
Features	Basic yield forecasts	Advanced predictions	Granular insights
Prediction Accuracy	80%	90%	95%
Analytics Dashboard	✓		✓
Yield Influencing Factors			✓
Scenario Testing Capabilities			✓
Real-time Alerts & Monitoring		✓	✓
Custom Reporting		✓	✓
Support Level	Email support	Priority email + Chat support	Priority email, Chat + Dedicated account manager
Ideal Customer	Small plantations	Mid-sized producers	Large coconut oil enterprises
Pricing	LKR 20000	LKR 50000	LKR 100000

Figure 13 : Future scope

4. PROJECT REQUIREMENTS

4.1 Functional requirements

- Analyze historical yield data across different regions and time periods.
- Develop machine learning models to predict future oil yield.
- Optimize models to improve precision and accuracy of predictions.
- Create user-friendly dashboards for growers and production managers.
- Generate recommendations for optimizing production capacity and efficiency.
- Track sustainability KPIs like resource utilization, wastage reduction, etc.

4.2 Non-functional requirements

- Predictions must have over 85% accuracy
- Model training and prediction latency should be under 5 minutes.
- Platform must be able to handle large datasets with millions of datapoints.
- Solution should be scalable to incorporate new regions and datasets.
- Intuitive visualization and exports for sharing insights and reports.
- Secure access controls and data encryption for privacy and security.
- Flexible deployment supporting on-premises or cloud infrastructure.

4.3 System requirements

The purpose of software requirements is to define the software resources that must be enforced on a system for the proposed system to function properly. The software specifications requirements for this proposed component are as follows.

- Cloud infrastructure leverages remote servers to store data and execute applications, enabling enhanced flexibility and scalability.
- MongoDB Database can store data in a versatile format with documents, effectively managing various types of information.

- Programming languages Python, Node.js and React are utilized for distinct objectives - data analysis is accomplished through Python, server-side applications via Node.js and user interfaces construction with the aid of React.
- The utilization of Graphics Processing Units (GPUs) enables efficient handling of complex calculations, thus accelerating machine learning tasks. These GPU nodes are essential for conducting ML experiments.
- Infrastructure as Code Templates are predefined templates that automate the setup of infrastructure components, such as servers and networks. They ensure standardization and effortless deployment across all systems.
- Systems and tools that enable the recording of activities, tracking performance metrics, and notifying users about significant events or issues in real-time are referred to as Monitoring, Logging, and Alerting Capabilities.

4.4 User requirements

This mobile application will be developed for three types of users.

- Dashboards with customizable visualizations facilitate intuitive and visually oriented analysis of information by providing customized data displays.

- The model building system that has self-service capability enables business users to create predictive models seamlessly, even without advanced technical skills. It comes with a user-friendly workflow designed exclusively for them, empowering them to take charge of the process.

- To enhance user comprehension and interaction, the system provides Contextual Help Documentation along with Tooltips. These aids assist in efficiently utilizing multiple features.

- Our assistance includes uploading data and mapping it precisely in the system to facilitate easy assimilation of information, ultimately leading to effortless analysis.

- Notifications will be sent to keep users up-to-date and involved with significant alerts, upcoming assignments, or fresh findings within the system. These could include New Insights, Alerts and Tasks.

- An accessible user interface that conforms to established standards, ensuring people with disabilities can efficiently and effectively interact.

4.5 Wireframes

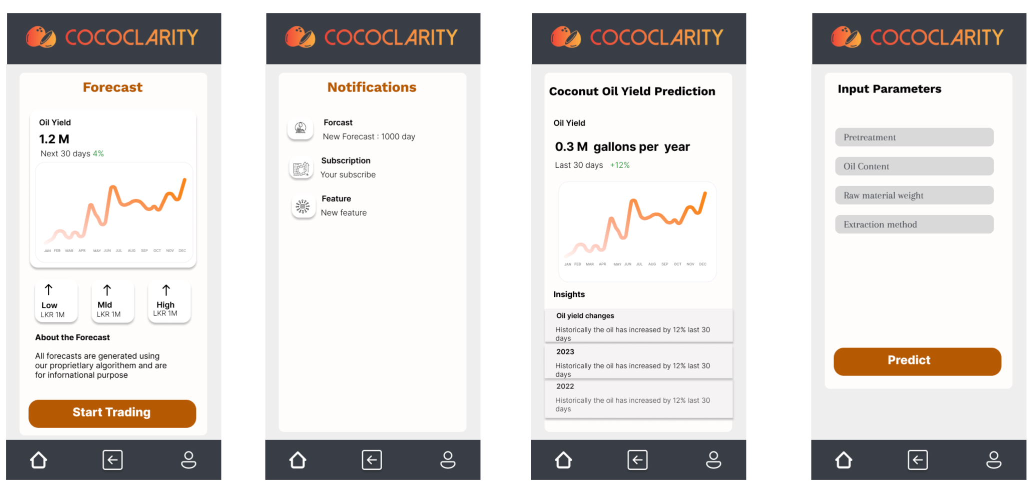

Figure 14 : Wireframe of Coconut Oil Product Yield Estimator process

5.GANTT CHART

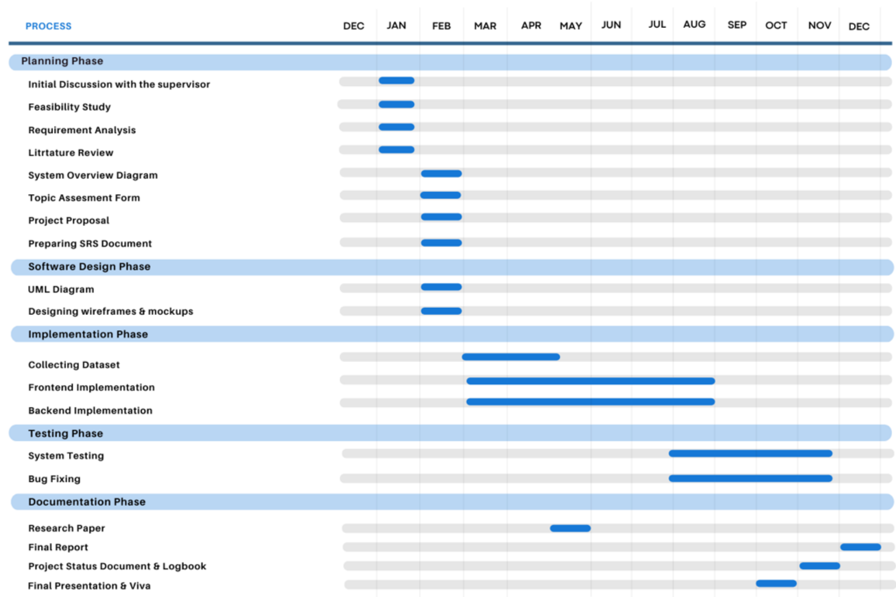

Figure 15 : Gantt Chart

5.1 Work Breakdown Structure (WBS)

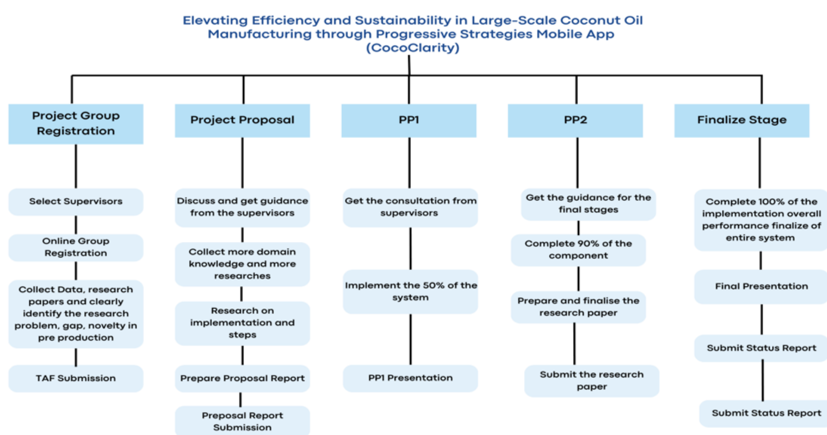

Figure 16 : Work Breakdown Chart of CocoClarity

6. BUDGET AND BUGET JUSTIFICATION

Table 3 below illustrates the complete budget of the proposed system.

	Price
Deployment Cost	LKR 8000/ month
Mobile App -Hosting on App Store	LKR 7754 / publish an app
Mobile App -Hosting on Play Store	LKR 30700/ Annual

Table 3 : Expenses for the proposed system

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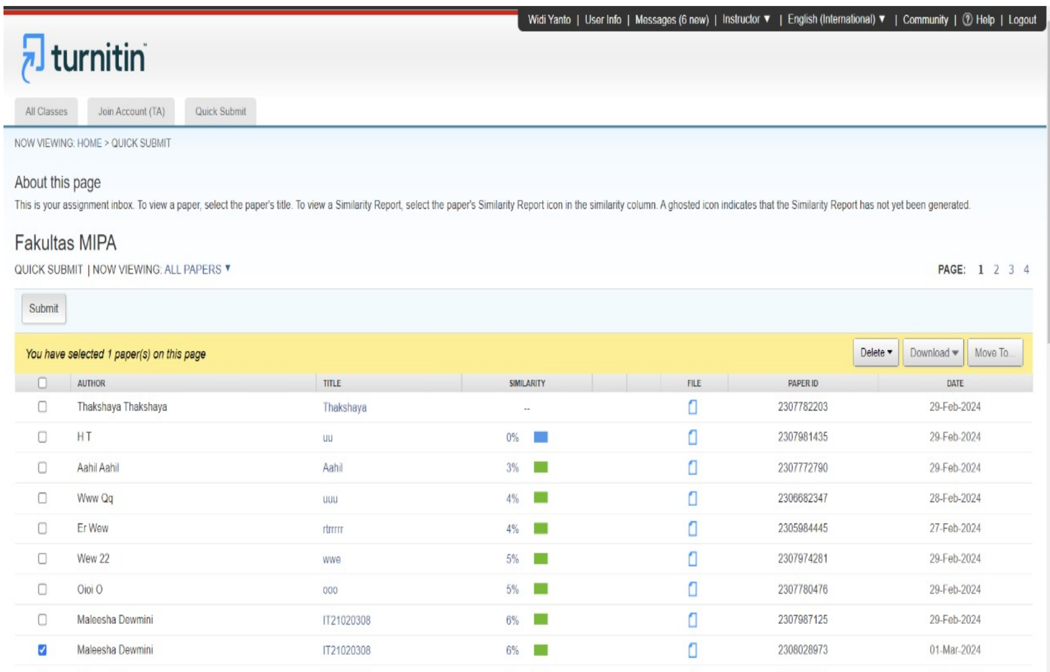
APPENDICES

Plagiarism Report



Appendix 1 : Plagiarism report

Sample Questionnaire

https://docs.google.com/forms/d/e/1FAIpQLSf_JzscOYiurojaybyUYpX8-DGe6mvBYQllhfeN6MT8d72RgQ/viewform?usp=sf_link

Appendix 2 : Sample Questionnaire