FAKULTI TEKNOLOGI MAKLUMAT DAN KOMUNIKASI

SEMESTER 1 2023/2024

(BITI 3523)

BITI

PROJECT REPORT

PROJECT TITLE:

Thyroid Detection System

GROUP :

G

PREPARED BY:

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PREPARED FOR:

DR. BURHANUDDIN

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INITIATING PROCESS

i) BUSINESS RULES

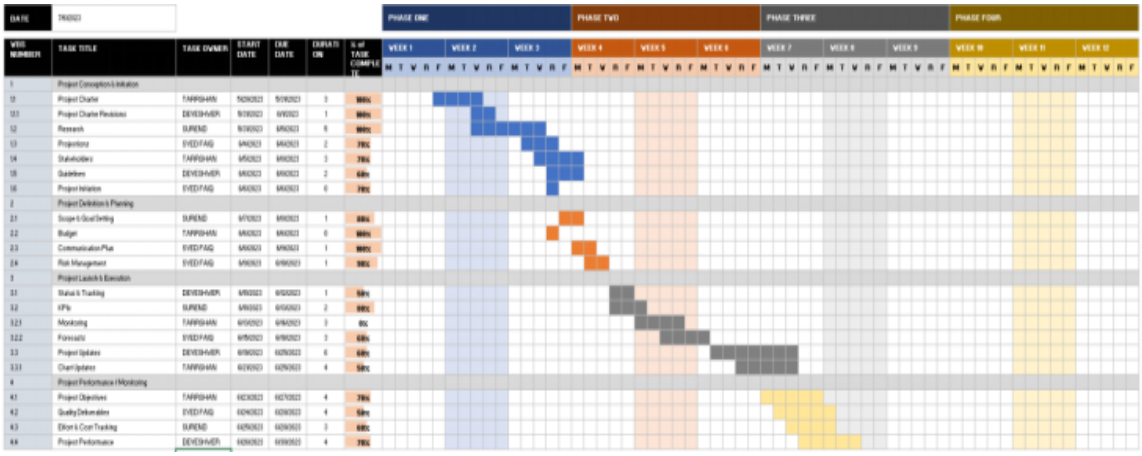
Executive Summary	The prevalence of thyroid problems and their major effects on general health make them common worldwide. Traditional thyroid detection techniques rely on expert medical analysis of numerous diagnostic procedures and judgmental interpretations. It is crucial to create automatic and precise detection systems because this procedure can be time-consuming and prone to mistakes. This project's goal is to employ a multiclass multilayer neural network to determine a patient's likelihood of having hypothyroidism based on their medical history and symptoms.
Problem statements	1. Challenges in Thyroid Disease because existing methods for diagnosing thyroid diseases face limitations in terms of accuracy and timeliness. 2. Subtle and Overlapping Symptoms as thyroid disorders often present with subtle symptoms that can be easily overlooked which may lead to misdiagnosis. 3. Need for Automated and Objective Solutions where there is a growing need for automated systems that can provide objective and consistent results in thyroid disease diagnosis.
Benefits	**Improved Accuracy and Timeliness:** Traditional methods are often time-consuming and prone to errors. The multiclass multilayer neural network offers a more precise and automated approach. **Enhanced Detection of Subtle Symptoms:** Thyroid disorders have subtle and overlapping symptoms. Traditional diagnostic methods may overlook these symptoms. The neural network analyses medical history comprehensively. **Objective and Consistent Diagnosis:** The project addresses the need for automated and objective solutions. Automated systems, like the neural network, provide consistent results.
Costs and Expected Return of Investment :	Budget of **RM 94900** only Expected ROI: To **gain with a 20%** of return in the third year which is approximately **RM 18980.**

ii) PROJECT CHARTER

Project Name : THYROID DISEASE DETECTION USING MULTICLASS MULTILAYER NEURAL NETWORK		
Project Description	The prevalence of thyroid problems and their major effects on general health make them common worldwide. Traditional thyroid detection techniques rely on expert medical analysis of numerous diagnostic procedures and judgmental interpretations. It is crucial to create automatic and precise detection systems because this procedure can be time-consuming and prone to mistakes. This project's goal is to employ a multiclass multilayer neural network to determine a patient's likelihood of having hypothyroidism based on their medical history and symptoms. This case study's main goal is to develop and put into use a neural network-based thyroid detection system.	
Project Objectives	i. Enhance accuracy of thyroid diagnosis by utilizing neural network skills, which are excellent at pattern recognition and classification activities. ii. Reduce the time needed for diagnosis by developing an automated system that can quickly process diagnostic data and deliver accurate results. iii. Assist medical professionals: Give them a tool that will help them make better judgements and increase the effectiveness of thyroid screening and diagnosis as a whole.	
Success Criteria	i. Accuracy Improvement: Achieve a minimum of 90% accuracy in thyroid disease detection using the developed multiclass multilayer neural network. This criterion ensures that the model is reliable and effective in recognizing different thyroid conditions. ii. Reduced Diagnosis Time: Implement a system that significantly reduces the time required for thyroid diagnosis compared to traditional methods. Aim for a reduction of at least 50% in the overall diagnostic process time. This would indicate the practical applicability and efficiency of the automated system. iii. User-Friendly Interface: Develop an intuitive and user-friendly interface for medical professionals to interact with the system. Ensure that healthcare professionals, regardless of their technical expertise, can easily interpret the results and utilize the tool effectively.	
Project Participants	Role	Name
	Project Manager : Assistant Manager : Programmer : Interface Designer :	Deveshwer Naganthiran Tarrshan Tamilarasu Surend Esvaran Tuan Syed Faiq
Budget	Budget of RM100000	
Deliverables	i. User Manual & Training Materials ii. System Documentation iii. Testing and Quality Assurance Reports iv. Technical Support	
Milestone	i. System Design and development completed by end of Week 8 ii. User acceptance testing completed by end of Week 10 iii. System Implementation and Rollout completed by end of week 12	
Potential Risks	i. Data Quality and Quantity: Inadequate or biased data may lead to a model that performs well in controlled environments but fails when faced with real-world variations. Ensuring a diverse and representative dataset is crucial to address this risk.	
	ii. Ethical Concerns and Patient Privacy: Implementing a system in the healthcare domain involves handling sensitive patient information. There is a risk of breaching privacy regulations or unintentionally exposing patient data. Incorporate robust security measures and adhere to healthcare data protection standards to mitigate this risk. iii. Integration with Current Healthcare Systems: The successful adoption of the system depends on its seamless integration into existing healthcare practices. Compatibility issues or resistance from healthcare professionals might pose a risk. Collaborate with medical practitioners during the development phase to address these concerns and ensure smooth integration into clinical workflows.	
Approval	Name and Signature	
	Investor : Sime Darby Sdn.Bhd 	Date : 15/1/2024
	Project Manager : Deveshwer Naganthiran 	Date : 15/1/2024

PLANNING PROCESS

i) WBS



ii) SCOPE STATEMENT

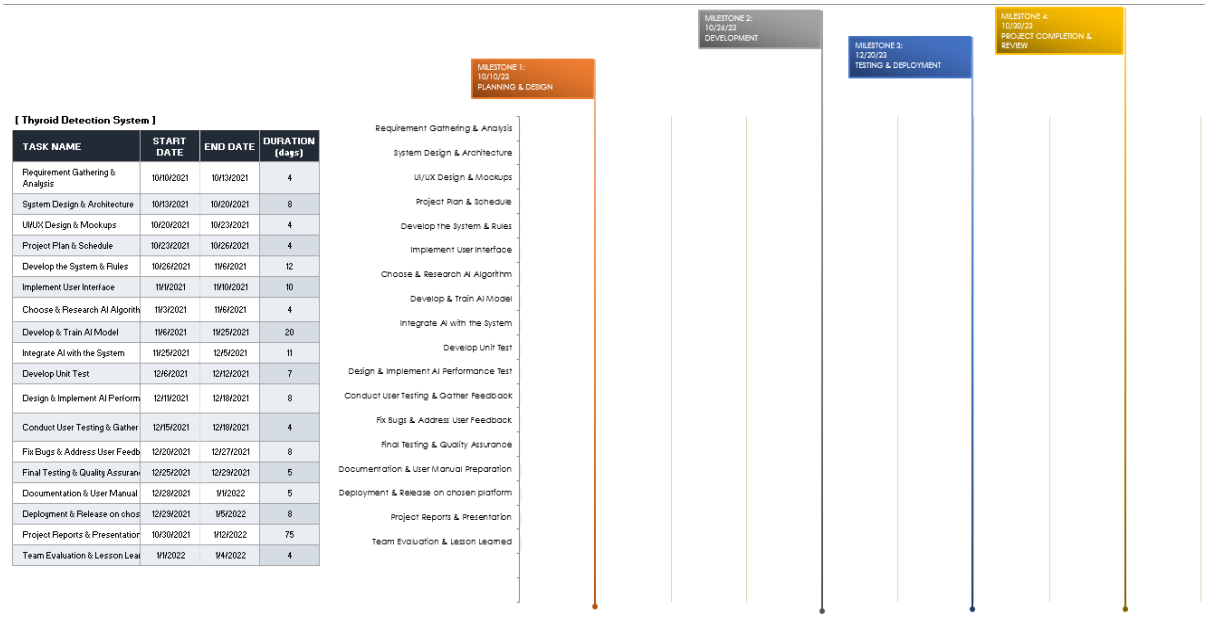
	Scope Statement
Project Title	Thyroid Disease Detection System
Project Manager	Deveshwer Naganthiran
Project Objectives	a. Enhance Accuracy of thyroid diagnosis by utilising neural network skills, which are excellent at pattern recognition and classification activities. b. Reduce the time needed for diagnosis by developing an automated system that can quickly process diagnostic data and deliver accurate results. c. Assists medical professionals: Give them a tool that will help them make better judgements and increase the effectiveness of thyroid screening & diagnosis as a whole
Project Deliverables	a. User Manual & Training Materials b. System Documentation c. Testing and Quality Assurance Reports d. Technical Support

Milestones	a. System Design and development completed by end of Week 8 b. User acceptance testing completed by end of Week 10 c. System Implementation and Rollout completed by end of week 12
Project Constraints	a. Budget of RM100000 b. Completion date of January 4, 2022
Assumptions	a. Availability of qualified development and testing resources b. Timely Approval of Project deliverables c. Availability of necessary hardware and software resources d. No major changes to project requirements or objectives

iii) PROJECT SCHEDULE

[Thyroid Detection System]

TASK NAME	START DATE	END DATE	DURATION (days)
Requirement Gathering & Analysis	10/10/2021	10/13/2021	4
System Design & Architecture	10/13/2021	10/20/2021	8
UI/UX Design & Mockups	10/20/2021	10/23/2021	4
Project Plan & Schedule	10/23/2021	10/26/2021	4
Develop the System & Rules	10/26/2021	11/6/2021	12
Implement User Interface	11/1/2021	11/10/2021	10
Choose & Research AI Algorith	11/3/2021	11/6/2021	4
Develop & Train AI Model	11/6/2021	11/25/2021	20
Integrate AI with the System	11/25/2021	12/5/2021	11
Develop Unit Test	12/6/2021	12/12/2021	7
Design & Implement AI Perform	12/11/2021	12/19/2021	8
Conduct User Testing & Gather	12/15/2021	12/19/2021	4
Fix Bugs & Address User Feedb	12/20/2021	12/27/2021	8
Final Testing & Quality Assuran	12/25/2021	12/29/2021	5
Documentation & User Manual	12/28/2021	1/1/2022	5
Deployment & Release on chos	12/29/2021	1/5/2022	8
Project Reports & Presentation	10/30/2021	1/12/2022	75
Team Evaluation & Lesson Lea	1/1/2022	1/4/2022	4



iv) COST ESTIMATE

	#Units/Hrs.	Cost/Unit/Hrs.	Subtotal	WBS Level 1 Totals (RM)	% of Total
WBS Items					
1.Project Management				**106000**	**20**
Project Manager Salary	**12**	**7500**	**90000**		
Project Management Software	**2**	**3500**	**7000**		
Contingency			**9000**		
2.Hardware				**275000**	**10**
Medical Imaging Equipment	**30**	**5000**	**150000**		
Servers & Storage	**10**	**8000**	**80000**		
Networking Infrastructure	**5**	**4000**	**20000**		
Contingency			**25000**		
3.Software				**88000**	**15**
Development of Detection Algorithm	**3**	**10000**	**30000**		
Integration with Existing	**5**	**10000**	**50000**		

Health System					
Contingency			**8000**		
4.Testing				**88000**	**15**
Data Collection & Annotation	**3**	**10000**	**30000**		
Clinical Testing & Validation	**5**	**10000**	**50000**		
Contingency			**6500**		
5.Training & Support				**61500**	**20**
Healthcare Professionals Training	**3**	**5000**	**15000**		
Technical Support Staff	**4**	**10000**	**40000**		
Contingency			**6500**		
6.Reserves				**50000**	**15**
Risk Management	**5**	**10000**	**50000**		
Total Estimate				**94900**	

EXECUTING PROCESS

1. Data Collection and Preparation

To guarantee the accuracy and usefulness of the dataset, a thorough and methodical approach must be used during the data collecting and preparation phase for a dataset on thyroid disorders. Initially, scientists or medical experts would create a planned strategy for gathering organised data, specifying the precise data required to investigate disorders related to the thyroid. Typically, this plan includes information about the patient's symptoms, medical history, and test results that are pertinent to thyroid function. Clinicians can employ standardised questionnaires or perform interviews to collect patient symptoms. Information on common thyroid-related symptoms, like fatigue, mood swings, weight fluctuations, and skin or hair changes, can be methodically recorded. The medical history is an important component that includes information regarding drugs, lifestyle variables that may exacerbate thyroid diseases, pre-existing ailments, and past thyroid-related issues.

2. Training

The provided dataset serves as the basis for training a neural network to identify and understand the complex relationships and patterns present in thyroid-related data throughout the training phase. In order for the network to be able to classify or predict things intelligently based on fresh, unobserved data, this procedure is essential. The dataset is the neural network's input, and each item in the dataset represents a distinct set of test findings, symptoms, medical history, and patient data. Training data for supervised learning, which is frequently used in medical data analysis, contains instances of paired input and output. When it comes to thyroid disorders, the desired output would usually be the diagnosis or a certain health result, while the input data would be a patient's symptoms, medical history, and test results. The neural network examines these input-output pairs repeatedly, using a technique called backpropagation to modify its internal parameters in an effort to reduce the discrepancy between the target outputs and its predictions.

3. Testing and Validation

In the testing and validation stage, it is essential to evaluate the neural network's performance using a new set of data once it has been trained on the prepared dataset. This is a crucial stage in evaluating how well the network can generalise and forecast future occurrences. An independent dataset, different from the training dataset, is utilised to assess how well the model

classifies thyroid diseases. In testing, test results, medical history, and patient symptoms are fed into the neural network to process the fresh data. Next, the actual results or diagnoses included in the test dataset are compared to the model's predictions or classifications. Through this assessment, academics and practitioners can determine the precision, recall, accuracy, and other performance parameters of the neural network. This phase also includes validation, where the model's parameters and hyperparameters are adjusted one more time to maximise performance. A validation dataset, which is distinct from the training and testing datasets, is frequently used to do this. Overfitting, in which a model performs very well on training data but is unable to generalise adequately to new, unknown data, is avoided with the aid of the validation process.

4. Iteration and Improvement

After the neural network has been tested and validated, the iteration and improvement phase begins. During this step, different components of the model are refined depending on the evaluation's insights. The objective of this iterative procedure is to improve the neural network's overall performance and efficacy in the classification of thyroid diseases. A critical component of enhancement might be going back and reviewing the dataset design. This can mean adding more pertinent features, removing superfluous or unnecessary information, or fixing any errors found throughout the testing process. A neural network's effectiveness is largely dependent on its parameters, which are commonly adjusted during the iteration process to maximise the accuracy of the model. To find configurations that work better, researchers may experiment with other architectures, activation functions, learning rates, or other hyperparameters. The input from the testing and validation stages serves as a guide for this process, enabling a more focused and educated modification of the model.

MONITORING & CONTROLLING PROCESS

Data Quality Monitoring:

A methodical strategy is used in the comprehensive review of thyroid disease data to ensure its accuracy and precision. Regular checks, carried out on predetermined schedules, make use of automated validation tools to analyse the data to ensure that it complies with specified formats and acceptable ranges. The goal of this comprehensive monitoring approach is to rapidly identify any defects or inconsistencies in the dataset. Working together with medical specialists is essential to this process because their clinical knowledge helps validate the data against predicted patterns and identify any inconsistencies. A strong foundation for maintaining the quality and integrity of thyroid disease data is ensured by the integration of data validation innovations and cooperation with healthcare professionals. This is crucial for research projects and well-informed medical decision-making.

User Feedback Analysis

A systematic feedback gathering procedure among healthcare professionals is launched to collect useful insights into the performance of the thyroid disease system, focusing on elements of usability, interpretability, and overall efficacy. This includes gathering comments on the system's interface design, simplicity of use, and the understandability of the thyroid disease information. The intent of actively engaging healthcare professionals is to exploit their personal experiences and skills, ensuring that the system fits smoothly with their workflow and satisfies the intricate requirements of thyroid-related treatment. Moreover, a dynamic feedback loop is established, encouraging continuous communication with users. This iterative approach identifies possibilities for improvement, whether in the system's functionality or user interface. As a result, updates are sent out in an organised way, including user ideas to improve the system's functioning and solve issues. By prioritising user feedback and implementing user-centric improvements, the thyroid disease system can evolve continuously, staying responsive to the evolving needs of healthcare professionals and optimising its overall efficacy in supporting thyroid disease diagnosis and management.

Model Performance Monitoring:

The proper approach to evaluating the performance of the thyroid disease detection model includes constant analysis of important metrics such as accuracy, sensitivity, and specificity, applied to both the training and testing datasets. This regular evaluation is essential for determining the model's performance in properly detecting cases of thyroid disease. In response to these findings, an innovative technique which is retraining the model has been employed using current data. This procedure not only keeps the model current with new trends in thyroid disease data, but it also assists in resolving any errors or shifts in the dataset's distribution. Additionally, model adjustments, such as fine-tuning the architecture or experimenting with ensemble methodologies, are explored to optimise its prediction capabilities. This dynamic and iterative approach to model evaluation, retraining, and improvement creates a key loop that improves the resilience and reliability of the thyroid disease detection model, allowing it to provide more accurate and clinically relevant outcomes.

Training and Testing Set Evaluation:

It is essential to analyse the distribution of thyroid disease cases on a regular basis to guarantee the representativeness of these cases in both the training and testing sets. Imbalances in the dataset, where certain types or severities of thyroid diseases are overrepresented or underrepresented, can lead to biased model performance. To overcome this issue, the dataset splitting technique should be carefully reevaluated. This may need changing the stratification approach to ensure that different thyroid disease types are represented proportionally in both groups. Furthermore, gathering more data on underrepresented situations might assist to diversify the dataset and assure the model's capacity to generalise across different contexts.

CLOSING

1. INTRODUCTION

The prevalence of thyroid problems and their major effects on general health make them common worldwide. Traditional thyroid detection techniques rely on expert medical analysis of numerous diagnostic procedures and judgmental interpretations. It is crucial to create automatic and precise detection systems because this procedure can be time-consuming and prone to mistakes. This project's goal is to employ a multiclass multilayer neural network to determine a patient's likelihood of having hypothyroidism based on their medical history and symptoms.

2. PROJECT BACKGROUND

The project's aim is to construct an autonomous and efficient thyroid detection system using a multiclass multilayer neural network to address the prevalent issue of thyroid issues and their influence on health. Traditional detection methods are inefficient and time-consuming, seeking a more efficient approach. The primary goals are to improve accuracy, reduce diagnostic time, and assist medical professionals in thyroid monitoring. The training and testing dataset contains 21 characteristics, including continuous and binary features, and three classifications for thyroid diseases. Data loading, preprocessing, model construction, architectural design, training, assessment, and prediction on fresh data are all part of the project's step-by-step procedure. In identifying thyroid ailments, the neural network obtains an excellent accuracy of 98.51%, indicating its efficacy in multiclass classification. The approach holds promise for improving thyroid screening and diagnosis, offering a valuable tool for healthcare professionals.

3. CASE STUDY DETAILS

Community Overview:

The research focuses on different kinds of patients who regularly visit a local healthcare centre due to thyroid disease. The community includes individuals with varying risk factors and symptoms related to thyroid diseases. The initiative aims to minimise the obstacles that healthcare professionals experience in quickly detecting thyroid diseases.

Community Engagement:
A collaborative approach is used to ensure that the system serves the actual needs of both patients and healthcare professionals. Community participation includes organising thyroid health awareness campaigns, conducting seminars with healthcare professionals, and gathering patient feedback through surveys. This participative strategy aims to get insights into the community's specific requirements and expectations.

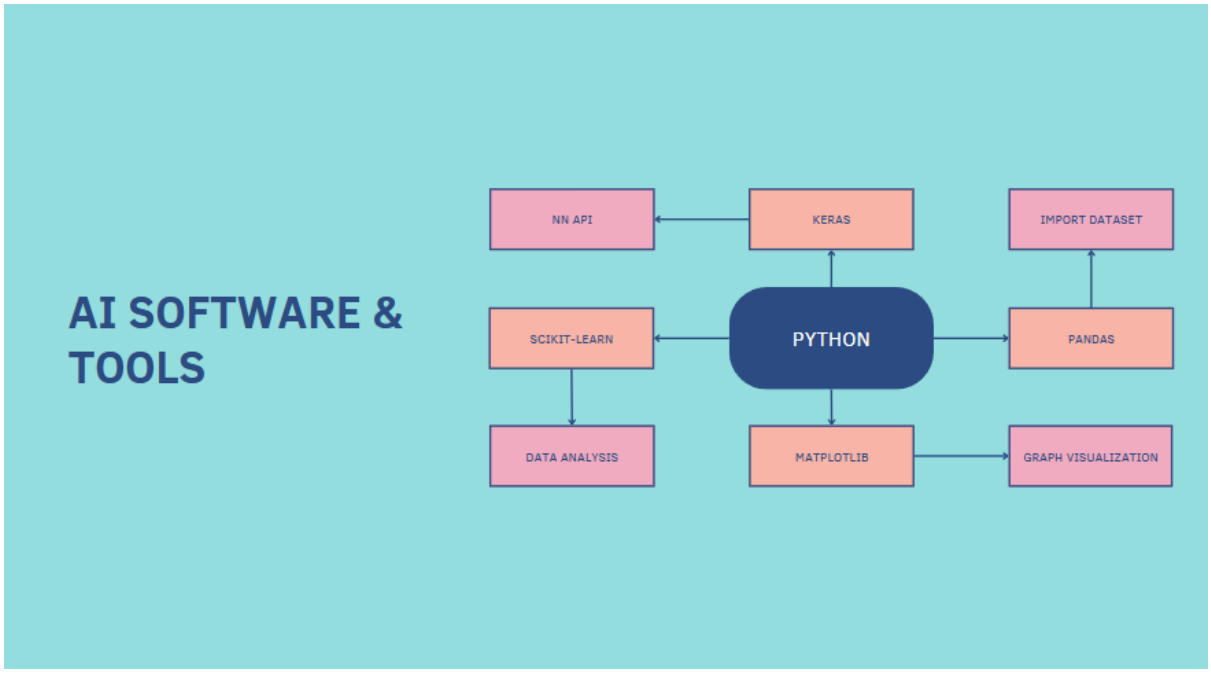
Technological Intervention:
For exact and early detection, the Thyroid Disease Detection System combines effective machine learning algorithms and medical imaging techniques. To deliver complete information, the system analyses thyroid function tests, ultrasound pictures, and patient history data. It highlights real-time processing to provide quick and accurate findings, increasing healthcare professionals' efficiency in identifying thyroid-related diseases.

Implementation and Testing:
Pilot implementations are conducted at the healthcare centre, involving patients with suspected thyroid conditions and collaborating healthcare professionals. The system's performance is rigorously tested against traditional diagnostic methods to evaluate its accuracy, sensitivity, and specificity. Feedback from healthcare providers and patients during this phase is crucial for refining the system and addressing any usability concerns.

Outcomes:
The Thyroid Disease Detection System shows significant improvements in effectiveness of thyroid disease diagnosis. Early results show that this technology is more accurate than traditional methods, which enables faster response and tailored treatment programmes. Patients are more confident in the diagnosis process, and healthcare professionals are excited about the system's ability to expedite processes while improving diagnostic accuracy.

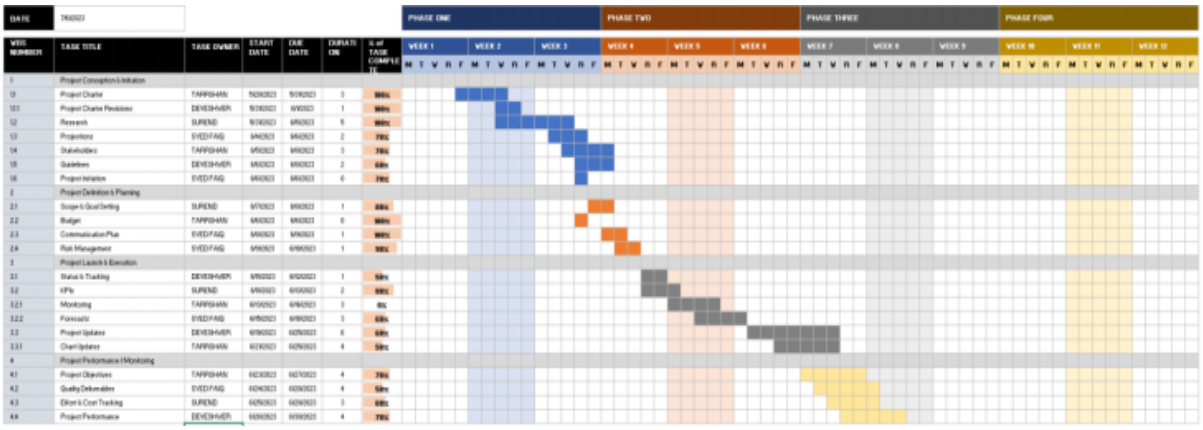
Lessons Learned:
This case study shows the significance of community involvement in the development of healthcare developments. The collaborative approach not only indicates that the system fits every need of patients and healthcare professionals, but it also increases the system's usage and efficacy in a real-world healthcare situation. The study also highlights the potential of machine learning and medical imaging in revolutionising thyroid disease diagnosis, paving the way for future advancements in technology-assisted healthcare solutions.

DETAILS ABOUT SOFTWARE USED



DETAILS ON AI PROJECT MANAGEMENT

I)WBS



II)BUDGET & COSTING

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WBS Items					
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Project Manager Salary	**12**	**7500**	**90000**		
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Contingency			**9000**		
2.Hardware				**275000**	**10**
Medical Imaging Equipment	**30**	**5000**	**150000**		
Servers & Storage	**10**	**8000**	**80000**		
Networking Infrastructure	**5**	**4000**	**20000**		
Contingency			**25000**		
3.Software				**88000**	**15**
Development of Detection Algorithm	**3**	**10000**	**30000**		
Integration with Existing	**5**	**10000**	**50000**		

Health System					
Contingency			**8000**		
4.Testing				**88000**	**15**
Data Collection & Annotation	**3**	**10000**	**30000**		
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Contingency			**6500**		
5.Training & Support				**61500**	**20**
Healthcare Professionals Training	**3**	**5000**	**15000**		
Technical Support Staff	**4**	**10000**	**40000**		
Contingency			**6500**		
6.Reserves				**50000**	**15**
Risk Management	**5**	**10000**	**50000**		
Total Estimate				**94900**	

III)TIME MANAGEMENT

[Thyroid Detection System]

TASK NAME	START DATE	END DATE	DURATION (days)
Requirement Gathering & Analysis	10/10/2021	10/13/2021	4
System Design & Architecture	10/13/2021	10/20/2021	8
UI/UX Design & Mockups	10/20/2021	10/23/2021	4
Project Plan & Schedule	10/23/2021	10/26/2021	4
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Choose & Research AI Algorith	11/3/2021	11/6/2021	4
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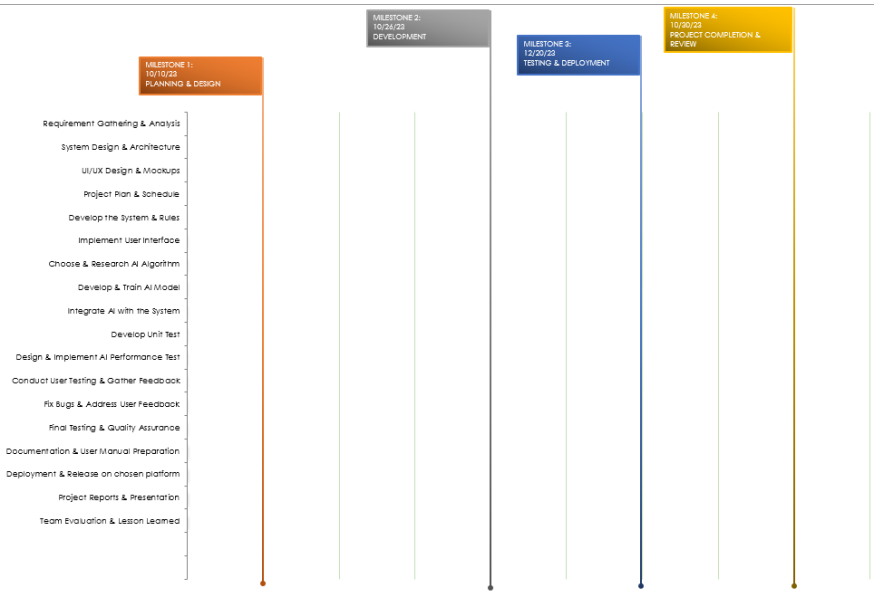
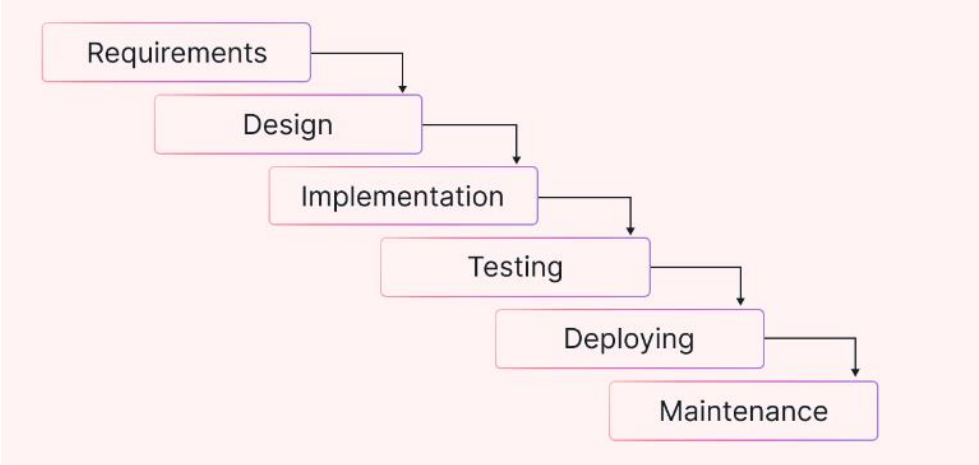


FLOW



ALGORITHM

The algorithm for Thyroid Disease Detection using a Multiclass Multilayer Neural Network involves a multi-layered architecture that processes input features through hidden layers, applying weighted sums and activation functions to capture complex patterns and relationships within the data. The input layer represents the features of the thyroid-related dataset, while the hidden layers enable the network to learn abstract representations. During training, the model adjusts its weights and biases through backpropagation, minimising a chosen loss function. Activation functions like 'relu' introduce non-linearity, enhancing the network's ability to learn nonlinear patterns. The output layer, typically using 'softmax' activation for multiclass classification, produces probabilities for each disease class. Once trained, the model can

efficiently predict thyroid disease classes for new data, making it a valuable tool for accurate diagnosis by leveraging the neural network's capacity for automatic pattern recognition and classification.

PROBLEM SOLVING

Data Quality and Quantity:

The quality and quantity of the training data poses a possible risk to the thyroid illness detection system. A partial or skewed dataset could make it more difficult for the algorithm to identify thyroid issues. Curating a large, varied dataset that captures the diversity of the target population is crucial to reducing this risk. To ensure that the model is trained on representative and trustworthy data, imbalances or biases in the dataset can be addressed with the use of data augmentation techniques and comprehensive preprocessing.

Privacy Risks and Ethical Issues:

Managing sensitive medical data raises privacy issues and ethical issues. Inappropriate patient information management could have negative effects on one's reputation and legal standing, which would make patients and medical professionals less trusting of the system. It is essential to have strong data encryption and security measures in place to reduce this danger. The system can be made to function morally and uphold the highest standards of patient privacy by adhering to pertinent healthcare data protection rules, such as HIPAA, and enlisting legal professionals throughout the development phase.

Integration with Current Healthcare Systems:

The thyroid illness detection system's acceptance is reliant on how well it integrates with the current healthcare systems. Difficulties could arise from medical practitioners' opposition or compatibility issues. Working closely with healthcare professionals is crucial to addressing this risk. Comprehending their workflow, thoroughly testing for compatibility, and offering sufficient training and support can all help to ensure a smooth integration process and increase the chances that the new technology will be effectively used within the healthcare ecosystem.

PROJECT IMPLEMENTATION

A methodical and stepwise approach is taken in the implementation of a multiclass multilayer neural network project for the identification of thyroid illness. The first step is to specify the precise thyroid disorders that need to be identified and categorised, as well as the project's goals and parameters. Then, a large dataset is collected that includes pertinent patient data such as test results, medical history, and symptoms. The dataset is then subjected to thorough preparation, which fixes problems like missing values and harmonises formats to guarantee data quality.

The neural network architecture design is the fundamental component of the project. This entails figuring out the neurons' kinds, number of layers, and activation mechanisms. The network is a multiclass classifier since it is set up to handle several types of thyroid illnesses. A careful balance between the intricacy of the model and its generalizability is achieved.

The prepared dataset is used to train the model after the architecture has been established. The network discovers the underlying correlations and patterns in the data during training. After that, the model's accuracy and generalisation skills are evaluated through testing and validation stages utilising different datasets. Iteration and improvement, such as modifying the dataset, adjusting parameters, or investigating more complex approaches like ensemble methods, might be required in light of the results.

Ethical issues, privacy concerns, and regulatory compliance are taken into account at every stage of the implementation process, particularly when handling sensitive medical data. The ultimate objective of this project is to create a strong and trustworthy neural network that can correctly categorise thyroid disorders, enhancing medical diagnostic capabilities.

OUTPUT

```
Epoch 100/100
378/378 [==============================] - 0s 1ms/step - loss: 0.0143 - accuracy: 0.9971
108/108 [==============================] - 0s 953us/step
[[  64    8    1]
 [   3  158   16]
 [   8   24 3146]]
Accuracy of the Test Set:98.25
Frequency of  the 3 Classes in the array:
[[   1    2    3]
 [  73  177 3178]]
1/1 [==============================] - 0s 19ms/step
Expected Output:1
Predicted Output:1
1/1 [==============================] - 0s 24ms/step
Expected Output:2
Predicted Output:3
1/1 [==============================] - 0s 16ms/step
Expected Output:3
Predicted Output:3

Process finished with exit code 0
```

Based on this dataset, the system can predict if a patient has thyroid disease or not.

CONCLUSION

In conclusion, the deployment of a multiclass multilayer neural network for thyroid disease detection marks a significant stride in the application of artificial intelligence to healthcare project management. The successful development and implementation of this model showcase the potential to streamline diagnostic processes, allowing for efficient and less cost categorization of thyroid health states.

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a) ***Project budget template*. Vertex42.com. (n.d.). https://www.vertex42.com/ExcelTemplates/project-budget.html**

b) ***SEM 1 - 2023/2024*. Log in to the site. (n.d.). https://ulearn-ictm.utem.edu.my/sem1202324/course/view.php?id=1685**

c) **https://www.projectmanager.com/blog/project-charter**

d) **https://www.projectmanager.com/blog/how-to-write-a-business-case**

e) **Gupta, P., Rustam, F., Kanwal, K. *et al.* Detecting Thyroid Disease Using Optimized Machine Learning Model Based on Differential Evolution. *Int J Comput Intell Syst* 17, 3 (2024). https://doi.org/10.1007/s44196-023-00388-2**

f) **Razia, S., Kumar, P. S., & Rao, A. S. Machine learning techniques for Thyroid disease diagnosis: A systematic review. Modern Approaches in Machine Learning and Cognitive Science: A Walkthrough, 203–212 (2020). https://link.springer.com/chapter/10.1007/978-3-030-38445-6_15**

APPENDICES

THYROID DISEASE DETECTION

INTRODUCTION

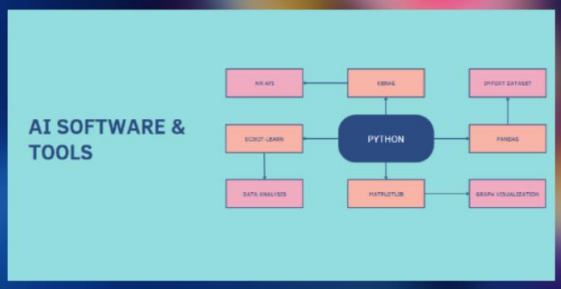
The prevalence of thyroid problems and their major effects on general health make them common worldwide. Traditional thyroid detection techniques rely on expert medical analysis of numerous diagnostic procedures and judgmental interpretations. It is crucial to create automatic and precise detection systems because this procedure can be time-consuming and prone to mistakes. This project's goal is to employ a multiclass multilayer neural network to determine a patient's likelihood of having hypothyroidism based on their medical history and symptoms.

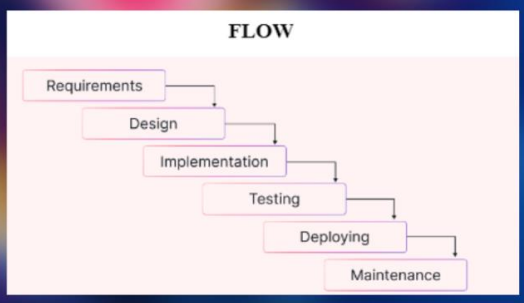
PROBLEM STATEMENT

- **Challenges in Thyroid Disease Diagnosis**
- **Subtle and Overlapping Symptoms**
- **Need for Automated and Objective Solutions:**

OBJECTIVES

- **Enhance accuracy of thyroid diagnosis**
- **Reduce the time needed for diagnosis**
- **Provide medical professionals**





CONCLUSION

In conclusion, the deployment of a multiclass multilayer neural network for thyroid disease detection marks a significant stride in the application of artificial intelligence to healthcare project management. The successful development and implementation of this model showcase the potential to streamline diagnostic processes, allowing for efficient and less cost categorization of thyroid health states.