

**Project**

24-25J-274

**ID:**

1. Topic (12 words max)

Personalized Health Care system

2. Research group the project belongs to

**Software Systems & Technologies (SST)**

3. Research area the project belongs to

**Machine Learning (ML)**

4. If a continuation of a previous project:

Project ID	
Year	

5. Brief description of the research problem including references (200 – 500 words max)
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- references not included in word count.

The rising prevalence of chronic diseases and the increasing demand for personalized healthcare solutions underscore the need for innovative approaches in medical care. Traditional healthcare systems often adopt a one-size-fits-all methodology, which fails to account for the unique health profiles and needs of individual patients. This research aims to address this gap by developing a personalized healthcare system leveraging machine learning to tailor healthcare recommendations, monitor health status, and provide timely warnings to users.

Personalized healthcare involves creating individualized treatment and preventive care plans based on an integration of diverse data sources. These sources include electronic health records (EHRs), wearable device data, family history, lifestyle factors, and genetic information. The integration of such varied data sources allows for a comprehensive view of an individual's health status and potential risks, thereby facilitating more precise and effective healthcare interventions.

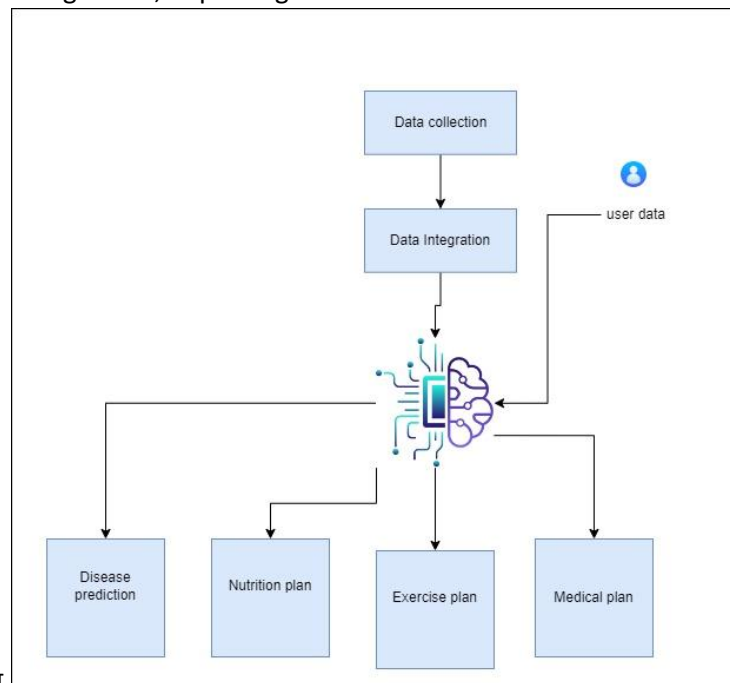
Key challenges in developing such a system include data collection and integration, ensuring data privacy and security, and creating robust machine learning models capable of delivering accurate predictions and recommendations. Data must be meticulously collected from EHRs, wearable devices, and patient inputs, then cleaned and integrated into a cohesive dataset. The system must incorporate stringent data privacy measures, such as encryption and access controls, to protect sensitive health information.

Machine learning models form the core of this personalized healthcare system. These models analyze the integrated data to provide predictive insights and recommendations across various aspects of healthcare. For instance, predictive models can forecast future disease risks based on

In summary, the proposed personalized healthcare system aims to enhance individual health management and preventive care through advanced machine learning techniques. By providing tailored recommendations and continuous health monitoring, the system seeks to improve health outcomes and overall well-being, addressing the limitations of traditional healthcare approaches.

6. Brief description of the nature of the solution including a conceptual diagram (250 words max)

The proposed personalized healthcare system delivers comprehensive, data-driven health management through an integrated approach. It features an **Integrated Predictive Health Dashboard** that provides a holistic view of an individual's health data and uses machine learning to predict potential future health issues, offering early warnings and actionable recommendations. The **Telemedicine Platform with Real-Time Health Data Integration** enhances remote diagnoses by analyzing continuous data from wearables, ensuring accurate and personalized virtual consultations. **Personalized Dietary Plans** are created and adapted based on individual health data, preferences, and genetic information, providing tailored nutritional guidance. The system also includes **Dynamic Exercise Adaptation Based on Multi-source Data Integration**, which adjusts exercise routines in real-time by incorporating data from wearables, historical health records, genetic predispositions, and environmental factors. This integrated solution empowers users with personalized insights and proactive health management, improving overall health outcomes.



Data Collection includes EHRs, wearable device data, genetic information, and lifestyle factors.

Data Integration ensures all collected data is consolidated into a unified dataset.

Predictive Analysis uses machine learning models to forecast health risks and needs.

Personalized Recommendations offer tailored dietary, exercise, and medical plans.

Continuous Monitoring and Alerts provide real-time updates and reminders to users.

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7. Brief description of specialized domain expertise, knowledge, and data requirements (300 words max)

Developing a personalized healthcare system leveraging machine learning involves a multidisciplinary approach, requiring specialized domain expertise, extensive knowledge, and comprehensive data. The project necessitates healthcare and medical knowledge, including clinical insights to ensure accurate and beneficial recommendations, and expertise in epidemiology and public health for understanding disease patterns and prevention strategies. Additionally, genomics and bioinformatics expertise are crucial for integrating genetic data into personalized health interventions.

Data science and machine learning are at the core of this system. Skills in data analysis, preprocessing, and the design and validation of machine learning models are essential. Bioinformatics tools are used to interpret genetic data accurately. Nutrition and exercise science knowledge is also critical, with dietitians and exercise physiologists providing the expertise needed to develop personalized dietary and workout plans based on individual health data.

Cybersecurity and data privacy are paramount to protect sensitive health information. Implementing robust encryption methods and ensuring regulatory compliance with standards such as HIPAA and GDPR are essential tasks.

Interdisciplinary collaboration is necessary, integrating insights from medical professionals, data scientists, bioinformaticians, nutritionists, and fitness experts. Advanced machine learning techniques are leveraged for accurate predictions and recommendations, while user experience (UX) design ensures a user-friendly interface for seamless interaction.

Comprehensive data requirements include electronic health records (EHRs) for detailed medical history and diagnostic information, wearable device data for continuous monitoring, genetic information for identifying predispositions, and lifestyle and behavioral data to capture diet, exercise habits, and other factors impacting health. Patient-reported outcomes provide a complete view of the individual's health status and needs.

By integrating diverse data sources and leveraging specialized knowledge, the personalized healthcare system aims to deliver precise, relevant, and actionable health interventions, significantly enhancing individual health management and preventive care through advanced machine learning techniques.

## 8. Objectives and Novelty

**Main Objective**

The main purpose of this research is to create a system that uses machine learning algorithms to properly predict and calculate various diseases a patient might get and take the necessary steps to prevent those diseases from occurring or mitigating the effects by providing an effective health plan for the user to follow completed with the necessary nutrition, exercise and medical advice and recommendations.

Member Name	Sub Objective	Tasks	Novelty
T.Y.R Dolawatta (IT21101274)	Create a comprehensive health dashboard using machine learning to predict cardiovascular risks and provide personalized health insights and proactive recommendations.	<ul style="list-style-type: none"> <li>Develop a user-friendly form for patients to input their health information, including gender, age, education level, smoking habits, blood pressure medication, history of stroke and hypertension, diabetes status, cholesterol levels, blood pressure readings, BMI, heart rate, glucose level, and ten-year cardiovascular risk.</li> <li>Aggregate and integrate the collected data into the health dashboard to provide</li> </ul>	<ul style="list-style-type: none"> <li>The use of sophisticated machine learning techniques to analyze and predict cardiovascular risk based on a comprehensive dataset and multiple health factors sets this system apart from traditional risk assessment methods.</li> <li>Integrating various health aspects, such as cardiovascular, nutritional, exercise, and mental health data,</li> </ul>

		<p>a holistic view of the patient's health status.</p> <ul style="list-style-type: none"> <li>• Use the dataset to train machine learning models for predicting cardiovascular risk.</li> <li>• Apply the trained machine learning models to predict the risk of cardiovascular disease for individual patients based on their input data.</li> <li>• Design and develop the health dashboard to display the predicted risk factors, overall cardiovascular health status, and personalized health recommendations.</li> </ul>	<p>offers a holistic view of the patient's health, enabling more informed decision-making and better health outcomes.</p> <ul style="list-style-type: none"> <li>• Using a wider variety of data in the dataset and strive to get a higher level of accuracy</li> </ul>
Samarasinghe P.D.P - IT21054372	Create personalized dietary plans based on individual health data, dietary preferences, and nutritional needs.	<ul style="list-style-type: none"> <li>• Develop a user-friendly form for patients to input their dietary preferences, allergies, and nutritional goals, and gather relevant health data such as age, gender, weight, height, metabolic rate,</li> </ul>	<ul style="list-style-type: none"> <li>• Utilization of machine learning to generate and adapt personalized dietary plans.</li> <li>• Integration of real-time user feedback to continuously improve dietary recommendations.</li> </ul>

		<p>and genetic predispositions.</p> <ul style="list-style-type: none"> <li>Analyze the collected health and dietary data to identify nutritional needs and deficiencies, and evaluate the impact of medical conditions (e.g., diabetes, hypertension) on dietary requirements.</li> <li>Utilize machine learning algorithms to generate personalized meal plans that meet individual nutritional needs and preferences and integrate real-time feedback mechanisms to adjust meal plans based on user input and changing health conditions.</li> <li>Provide detailed recipes and ingredient lists for each meal and suggest alternative ingredients for dietary restrictions or preferences.</li> </ul>	<ul style="list-style-type: none"> <li>Consideration of genetic and metabolic data to tailor nutrition plans further.</li> <li>Use cardiovascular data to obtain a healthy diet for user.</li> </ul>
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		<ul style="list-style-type: none"> <li>• Monitor adherence to dietary plans and track progress towards nutritional goals, and adjust plans based on progress, feedback, and changes in health status.</li> <li>• Offer educational resources on nutrition, healthy eating habits, and the impact of diet on health, and provide tips and strategies for maintaining a healthy diet.</li> </ul>	
Anjana E.K.C IT20641542	Develop a system that dynamically adjusts exercise routines using real-time health data, historical records, and environmental factors for optimal fitness.	<input type="checkbox"/> Gather user-specific health data such as fitness level, medical conditions, exercise preferences, and goals, and collect real-time data from wearable devices (e.g., heart rate, activity levels) and environmental factors (e.g., weather conditions). Also use historical data to analyze the users health and physical condition. <input type="checkbox"/> Develop machine learning	<ul style="list-style-type: none"> <li>• Dynamic adjustment of exercise plans based on real-time monitoring data.</li> <li>• Personalized routines that consider individual health conditions and fitness goals plus using data from cardiovascular risk prediction to</li> </ul>



		<p>models to generate personalized exercise routines based on the collected data and create initial exercise plans that align with users' fitness levels, medical conditions, and goals.</p> <p><input type="checkbox"/> Continuously monitor users' performance and health metrics through connected wearables, and track progress while identifying any deviations or potential issues during exercise routines.</p> <p><input type="checkbox"/> Adjust exercise plans in real-time based on ongoing health data, ensuring they remain safe and effective, and incorporate feedback from users to refine and improve exercise routines.</p> <p><input type="checkbox"/> Provide detailed reports on users' fitness progress, including metrics such as endurance, strength, and flexibility, and highlight achievements and areas for improvement to motivate users and guide them towards their goals.</p>	<p>analyze the level of exercise that is safe for the user.</p>
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Perera W.N.D.N.D IT21312458	Create a monitoring system with Real-Time Health Data Integration for Cardiovascular Diseases	<p>Establish connections with wearable devices and IoT health gadgets to collect real-time cardiovascular data such as heart rate, blood pressure, ECG, activity levels, and sleep patterns, while also gathering data on environmental factors like air quality and weather conditions.</p> <p><input type="checkbox"/> Develop a secure centralized database to aggregate and store collected data, ensuring patient privacy and data security, and implement seamless synchronization of data from multiple devices and sources.</p> <p><input type="checkbox"/> Create and train machine learning models to analyze continuous data streams, focusing on identifying patterns, anomalies, and potential cardiovascular issues, and extract relevant features such as heart rate variability and blood pressure</p>	<ul style="list-style-type: none"> <li>• The integration and analysis of real-time cardiovascular data from wearable devices and IoT gadgets provides a continuous and up-to-date picture of patients' heart health, which is more dynamic and immediate compared to traditional methods.</li> <li>• Employing advanced machine learning algorithms to interpret continuous cardiovascular data streams allows for the detection of subtle health changes and patterns that might be missed in periodic check-ups, offering a more proactive approach to cardiovascular</li> </ul>
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		<p>trends.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Use predictive analytics to forecast potential cardiovascular events like arrhythmias or hypertension episodes, and generate actionable insights and recommendations, including medication adjustments, lifestyle changes, and follow-up appointments.</li> <li><input type="checkbox"/> Develop a system for real-time alerts to notify healthcare providers and patients of significant health changes or risks, and send notifications for critical metrics, medication reminders, and upcoming virtual consultations.</li> </ul>	healthcare.
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**9. Supervisor checklist**

- a) Does the chosen research topic possess a comprehensive scope suitable for a final-year project?

Yes		No	
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- b) Does the proposed topic exhibit novelty?

Yes		No	
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- c) Do you believe they have the capability to successfully execute the proposed project?

Yes		No	
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- d) Do the proposed sub-objectives reflect the students' areas of specialization?

Yes		No	
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- e) Supervisor's Evaluation and Recommendation for the Research topic:

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**10. Supervisor details**

	Title	First Name	Last Name	Signature
Supervisor	Ms	Thamali	Dassanyake	
Co-Supervisor				
External Supervisor				
Summary of external supervisor's (if any) experience and expertise				

**This part is to be filled by the Topic Screening Panel members.**

Acceptable: Mark/Select as necessary

Topic Assessment Accepted	
Topic Assessment Accepted with minor changes (should be followed up by the supervisor)*	
Topic Assessment to be Resubmitted with major changes*	
Topic Assessment Rejected. Topic must be changed	

\* Detailed comments given below

Comments

Member's Name	Signature

**\*Important:**

1. According to the comments given by the panel, make the necessary modifications and get the approval by the **Supervisor** or the **Same Panel**.

2. If the project topic is rejected, identify a new topic, and follow the same procedure until the topic is approved by the assessment panel.