IT4010 – Research Project - 2023

Topic Assessment Form

Project ID : TMP-2023-24-117

Important instructions to students:

1. **According to the comments given by the supervisor, make the necessary modifications and finally, get the approval from the Supervisor and the co-supervisor.**
2. **If the project topic is rejected, identify a new topic, and follow the process as before.**
3. **The approved form must be submitted to the folder (will be notified later) on or before 10th July 2023.**

(Students should ensure that they complete all sections ranging from 1 to 7. Then, download the form and email to your supervisor before 26th June 2023. Please note that the corresponding supervisor of the project is responsible for completing sections 8 to 10.)

1. Topic (12 words max)

"Revolutionizing Vehicle Assistance: AI-Powered Solutions for Breakdown Challenges"

2. Research area the project belongs to

Computing for Inclusive and Equitable Society (CIEC)

3. Team member details

Student Name	Student ID	Specialization
Leader: Perera B.N.H.	IT20096434	IT
Member 2: Sirimanna D.J.T.K.	IT20038328	IT
Member 3: Madhubhashana A.G.K.	IT20038182	IT
Member 4: Vijerathna A.G.V.K.M.	IT20644826	IT

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

The problem described difficulties and inconveniences faced by individuals when their vehicle breaks down in an unfamiliar area. This situation is particularly challenging for people with limited knowledge about vehicles, as they struggle to identify the problem and determine the appropriate course of action. The lack of easily accessible information and resources exacerbates the issue, making it difficult to find mechanics, spare part shops, and obtain maintenance advice.

When a vehicle breaks down, it is crucial to quickly identify the problem and make informed decisions. However, without sufficient knowledge, individuals may be unsure whether to continue driving or stop immediately, potentially exacerbating the issue or putting themselves in danger. The absence of readily available chatbots or platforms to discuss such matters means that people are unable to seek quick solutions to their questions, leading to wasted time and money.

Another significant challenge is finding a reliable mechanic in an unfamiliar area. Locating a trustworthy and skilled professional to repair the vehicle can be a daunting task, especially when time is of the essence. This lack of accessibility to reliable mechanics further hinders the resolution of the issue and prolongs the inconvenience faced by the vehicle owner.

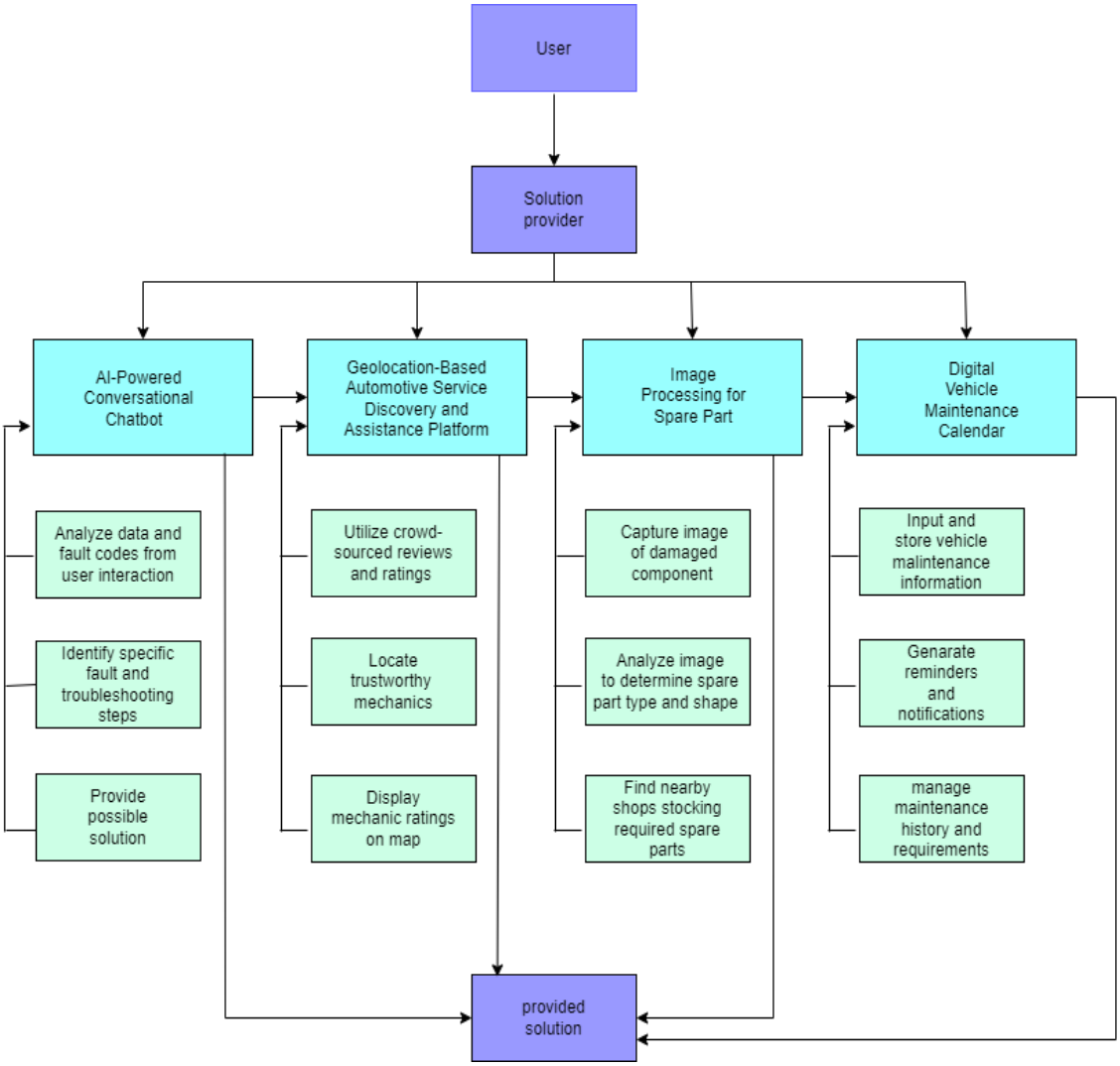
Furthermore, the unavailability of an effective method to quickly find spare part shops compounds the problem. Even if individuals manage to locate a mechanic, there is no easy way to find nearby shops that stock the necessary spare parts. Additionally, individuals with limited vehicle knowledge may struggle to identify the specific spare part required and determine its shape, making it even more challenging to locate the appropriate item.

In many cases, inadequate maintenance of the vehicle is the root cause of breakdowns. However, there is currently no effective way to inform vehicle owners about necessary maintenance tasks. Without timely reminders or notifications, individuals may neglect essential maintenance work, increasing the likelihood of breakdowns and associated inconveniences.

In summary, the major problem is that people who experience vehicle breakdowns in unfamiliar areas have no way of getting immediate and accurate information for themselves. The absence of quick and reliable solutions to identify and address mechanical issues, find trustworthy mechanics and spare part shops, and receive maintenance reminders creates significant inconveniences, waste time and money, and poses potential risks to the vehicle owners.

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

   The proposed solutions aim to alleviate the challenges faced by individuals when their vehicle breaks down in unfamiliar areas. One solution involves the development of an AI-powered conversational chatbot that allows vehicle owners to interact and provide information about the issue. Using advanced algorithms, the chatbot analyzes the data to identify the specific fault and provides possible solutions or troubleshooting steps. This provides quick and accessible assistance for individuals with limited vehicle knowledge. The second solution utilizes a Google map-based system integrated with a rating system to help users locate trustworthy mechanics. By leveraging crowd-sourced reviews and ratings, individuals can make informed choices, reducing the risk of encountering unskilled or unreliable professionals. To address the difficulty of finding spare parts, the third solution employs image processing technology. Users can take a picture of the damaged component, and the system analyzes the image to determine the type and shape of the required spare part. Location-based services are utilized to find nearby shops that stock the part, streamlining the process of obtaining necessary components. Finally, a digital calendar is developed specifically for vehicle maintenance. Users can input their vehicle's maintenance history, and the calendar stores and manages this information. Based on maintenance intervals and requirements, the calendar generates reminders and notifications, ensuring timely maintenance tasks are performed and reducing the likelihood of unexpected breakdowns. Overall, these solutions leverage technology and AI to offer quick problem identification, reliable mechanic selection, efficient spare part sourcing, and proactive maintenance management. By addressing these challenges, the solutions aim to enhance the overall experience and convenience for vehicle owners, especially in unfamiliar areas.



conceptual diagram

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

In the case of the conversational chatbot solution, domain expertise in automotive mechanics and troubleshooting is necessary. The developers need to understand the various components and systems of vehicles, common faults, and appropriate solutions. This expertise helps in designing the algorithms and machine learning models that power the chatbot's fault identification and troubleshooting capabilities. Additionally, knowledge of natural language processing (NLP) and conversational AI is required to create an interactive and user-friendly chatbot interface.

For the Google map-based system and mechanic rating solution, domain expertise in automotive services and mechanics is crucial. Understanding the qualities of reliable mechanics is important for developing an effective rating system. Access to mechanic information and user reviews is needed to populate the system and generate meaningful recommendations. The spare part identification system relies on expertise in computer vision and machine learning. Developers must train models to recognize different spare parts from images and extract shapes accurately. A dataset of labeled images of spare parts is necessary for effective model training. In the case of the digital calendar for vehicle maintenance, domain expertise in automotive maintenance schedules and requirements is required. Knowledge of recommended maintenance intervals for different vehicle components is crucial. Access to reliable maintenance guidelines is necessary to populate the calendar with accurate reminders. To implement these solutions successfully, access to relevant data sources such as mechanic databases, spare part information, and maintenance guidelines is vital. Additionally, expertise in automotive mechanics, automotive services, computer vision, machine learning, and maintenance schedules is necessary. Overall, the specialized domain expertise, knowledge, and data requirements for these solutions encompass automotive mechanics, automotive services, computer vision, machine learning, NLP, and maintenance schedules. Access to accurate and comprehensive data sources is crucial for the development and deployment of these solutions to effectively address vehicle breakdown challenges in unfamiliar areas.

7. Objectives and Novelty

Main Objective

Our main objective is to provide a comprehensive solution for electric vehicle users, enhancing their ability to handle breakdown situations effectively, improving safety and efficiency on the road. This will be achieved through four key components.Firstly, we will develop a conversational AI chatbot specifically for vehicle breakdown assistance. This chatbot will promptly provide users with accurate information about the fault in their vehicle, enabling them to make informed decisions quickly. Secondly, a location-based method will help users find the nearest garage or mechanic, along with real-time availability and approximate repair costs. This empowers users to select the most efficient option for repairs. We aim to address the challenge of locating and procuring the required spare parts. Users will be able to capture an image of the spare part, which will undergo image processing to accurately identify it. The system will provide precise information about the spare part and, guiding users to the nearest spare part shop according to its availability.Lastly, our solution will monitor and store service records, inform users about future repairs, capture bill details through OCR, and provide vehicle current valuation based on maintenance history. This will ensure that users service their vehicles at the right time, preventing frequent breakdowns.

Member Name	Sub Objective	Tasks	Novelty
Perera B.N.H.	Develop a conversational AI chatbot for vehicle breakdown assistance. Manufacturer provided datasets are used to develop AI model. Through text-based communication, the bot will gather information from drivers about breakdown, analyze the problem and suggest relevant solutions. This chatbot aims to empower drivers by providing real-time assistance, leveraging extensive data and keeping up to date with the latest electric models. The objective is to enhance drivers' ability to effectively handle breakdown situations, improving safety and efficiency on the road.	• Identify scope and requirements including specific faults able to identify and level of details should provide in response. • Gather and preprocess data. Collect relevant datasets from manufacturer. Preprocess the data to extract useful information and structure in a way that can be utilized by AI model. • Design conversional flow between chatbot and driver. • Train the AI model. Use gathered datasets and designed conversational flow to train NLP model. Utilize ML to train model on collected data. Fine-tune the model to improve performance and accuracy. • Develop mobile app to use AI chatbot.	The proposed system utilizes conversational AI to identify electric vehicle faults and provide solutions. It gathers details from drivers, trains an AI model using manufacturer datasets, and builds a knowledge base. The chatbot engages in dialogue, offers solutions, and continuously improves through knowledge base updates. This innovative approach enables drivers to diagnose and resolve vehicle issues

		• Test and evaluate the chatbot. Conduct user acceptance testing to gather feedback and make necessary improvements. • Deploy and monitor chatbot.	effectively, even without specialized technical knowledge.
Sirimanna D.J.T.K.	Solution includes integrating with geolocation APIs to determine the user's location. Utilize a comprehensive database of garages and mechanics, providing real-time availability and recommendations based on factors like specialization and user reviews. An ML algorithm is employed to estimate the approximate cost of repairs using historical data. The search function allows users to filter options based on proximity, ratings, and cost estimates. An intelligent routing system considers real-time traffic for efficient navigation. Users can schedule appointments, and feedback helps improve the recommendation algorithm. This comprehensive solution empowers users with real-time assistance, approximate cost estimation, and efficient garage or mechanic selection, enhancing their ability to handle breakdown situations effectively.	• Research and select a suitable geolocation API provider that can accurately determine the user's location. • Design and develop a database schema to store information about garages and mechanics, including details such as location, specialization, availability, and user reviews. • Integrate the selected geolocation API with the solution to fetch the user's real-time location. • Collect and curate a comprehensive database of garages and mechanics, including their specialization and user reviews. • Implement an ML algorithm that utilizes historical data to estimate the approximate cost of repairs based on various factors such as the type of repair, location, and past repair records. • Develop a search function that allows users to filter garages and mechanics based on proximity, ratings, and cost estimates. • Implement an intelligent routing system that considers real-time traffic data to provide efficient navigation from the user's location to the selected garage or mechanic.	The novelty of this solution lies in its integration of geolocation APIs with a comprehensive database of garages and mechanics, providing real-time availability and personalized recommendations based on the user's current location. Additionally, the use of an ML algorithm for estimating repair costs, an intelligent routing system considering real-time traffic, and the ability to filter options based on proximity, ratings, and cost estimates further enhance the uniqueness of this project. The inclusion of a feedback system for continuous algorithm improvement and the comprehensive nature of the solution, combining multiple features into a single tool, make it stand out from other similar

		• Create user interfaces that allows users to schedule appointments with garages or mechanics based on their availability. • Implement a feedback system that allows users to provide ratings and reviews, which will be used to improve the recommendation algorithm. • Continuously monitor and update the database with the latest information about garages and mechanics, including their availability and any changes in specialization.	solutions in the market.
Madhubhashana A.G.K.	After finding a mechanic, vehicle owner should find the expected type of spare parts or spare parts in the required condition.so that, I will be experimenting a solution using Image processing through training machine learning models and mapping of the shape of a spare part with datasets. In this case Real time camera is used to get a photo of the part and then the system will display all details (manufacture details, price, available shops, available quantity contact numbers, etc.) of spare part and the nearest available shops. For that spare parts shops owners must register their shops early.	• Collection of images of different spare parts and categorize them. • Pre-processing of the collected images, such as resizing and normalization. • Splitting the data into training, validation, and testing sets. • Training a machine learning model using pre-processed image data. • Evaluating the model on the validation set to identify areas of improvement. • Collecting and processing large amounts of image data from various geographical areas to map the shape of the spare parts. • Fine-tuning the model based on the evaluation results. • Testing the final model on the testing set to measure its accuracy and robustness. • Implementing the model in a software application for practical use.	Users will be able to capture an image of the part, which will undergo image processing to accurately identify it. Using image processing and computer vision techniques to map and track the shape of spare parts in large number of spare part's images. The system will provide precise information about the part and, guiding users to the nearest spare part shop according to its availability.

Vijerathna A.G.V.K.M.	This objective implements a comprehensive approach to vehicle maintenance by monitoring and informing users about future repairs, managing service records, capturing bill details using OCR, and identifying common vehicle issues. Users input vehicle details and update mileage periodically. An algorithm calculates and notifies users about upcoming services. Service records are stored in a database, and bill details are extracted from user-uploaded photos. A digital monitoring calendar system displays service reminders and tracks maintenance expenses.	• research and gather information on vehicle maintenance and spare parts. Collect data on spare part durability, recommended usage. • Develop an interface where users can add their vehicle details. • Create a database to store all service records. Implement a model using optical character recognition (OCR) technology to extract the relevant maintenance details from the bill photo. • Develop algorithms to calculate and predict the optimal replacement time for each spare part, an algorithm that utilizes the vehicle's current mileage and historical service records to calculate and inform the user about the next services and prioritize maintenance tasks and an algorithm to identify common issues in each vehicle model training historical data and relevant factors. • Design the digital monitoring calendar system, allowing users to input and track maintenance activities, spare part replacements, relevant data and notify upcoming service remainders. • Conduct user testing to assess the usability and effectiveness. • Implementing the model in a software application for practical use.	on service history. The algorithm calculates upcoming service reminders, the OCR model simplifies adding service records, and the online calendar system tracks expenses for a period. This integrated approach enhances efficiency, simplifies record-keeping, and empowers users with informed decision-making.

8. Supervisor checklist (supervisors should fill sections from 8 to 10)

1. Is this research problem valid?

Yes		No	

2. Is the proposed research group, correct?

Yes		No	

3. Is the proposed research area, correct?

Yes		No	

4. Do the proposed sub-objectives match the students' specialization?

Yes		No	

5. Is the required domain expertise, knowledge, and the data available either through the supervisor or external supervisor?

Yes		No	

6. Is the scope of the solution practical?

Yes		No	

7. Do all sub-objectives have sufficient novelty?

Yes		No	

9. Your final decision:

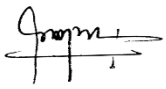
Acceptable: Mark/Select as necessary

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

* Detailed comments given below

Comments

10. Supervisor details

	Title	First Name	Last Name	Signature
Supervisor	Assistant Professor	Sanika	Wijayasekara	
Co-Supervisor	Assistant Lecturer	Sasini	Hathurusinghe	
External Supervisor				
Summary of external supervisor's (if any) experience and expertise				