

**Project ID:**

24-25J-012

1. Topic (12 words max)

Elephant-Care: Wearable IoT – Enabled Belt for Elephant protection &amp; Emergency identification.

2. Research group the project belongs to

**Software Systems & Technologies (SST)**

3. Research area the project belongs to

**Internet of Things (IoT)**

4. If a continuation of a previous project:

Project ID	
Year	

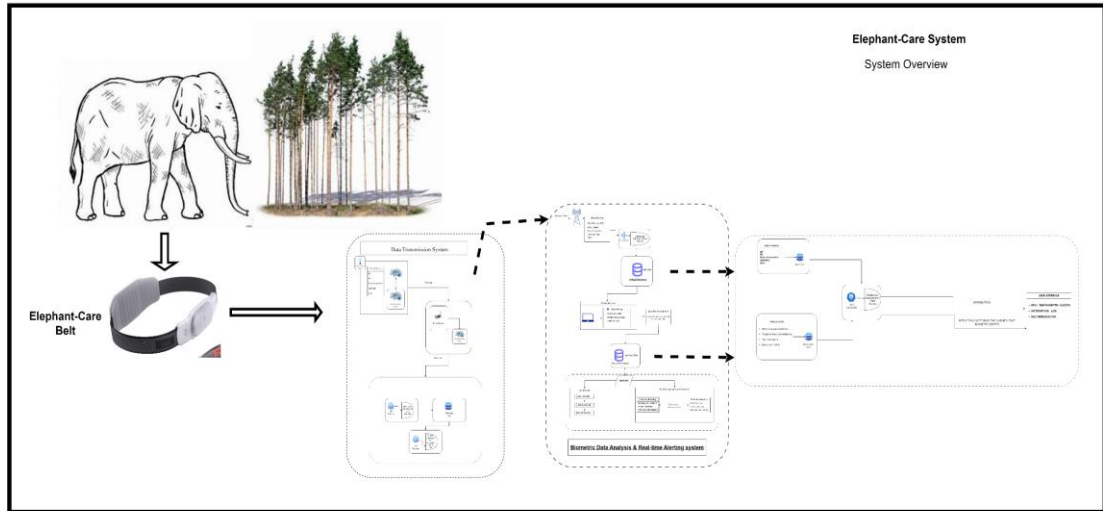
5. Brief description of the research problem including references (200 – 500 words max)  
– references not included in word count.

Elephants are endangered and play a vital role in maintaining the balance of their ecosystems. However, they frequently face significant threats from human activities, particularly collisions with trains. In India alone, approximately 150 elephants are killed annually due to such accidents (Gamage & Wijesundara, 2014).[1] These collisions not only diminish elephant populations but also pose severe risks to human safety and result in substantial economic losses due to property damage. To address this critical issue, implementing effective solutions like Elephant-Care is essential. Elephant-Care aims to leverage IoT technology to create a safer environment for both elephants and humans by preventing collisions through advanced detection, monitoring, and alert systems. This innovative approach integrates data transmission systems, biometric storage, data analysis, and an effective user interface to monitor elephant movements and predict potential collision hotspots. By utilizing a combination of real-time data collection, machine learning algorithms, and seamless communication networks, Elephant-Care can provide timely alerts to authorities, enabling preventive measures and promoting coexistence. And our system can detect detailed behavioral differences in elephants, such as distinguishing between lying down and walking. This capability allows for more accurate monitoring and tailored interventions. Overall, this multidisciplinary strategy offers a promising solution to a pressing conservation challenge, significantly reducing the incidence of collisions and supporting both wildlife conservation and human safety efforts.

#### References

[1] <https://consensus.app/papers/solution-elephanthuman-conflict>

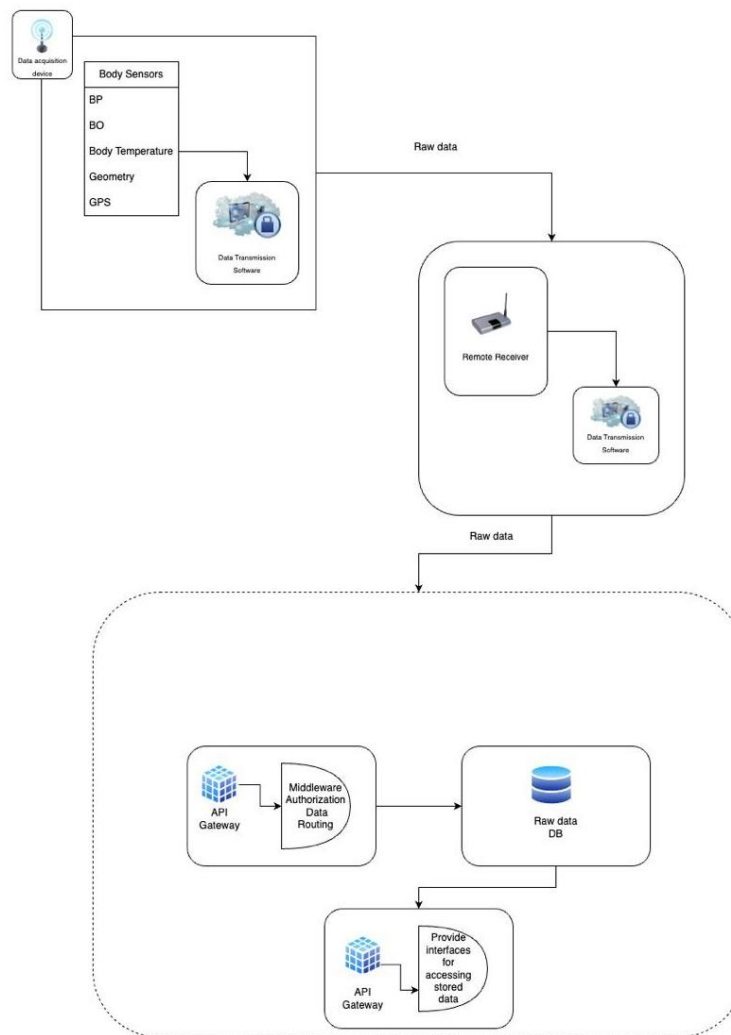
6. Brief description of the nature of the solution including a conceptual diagram (250 words max)



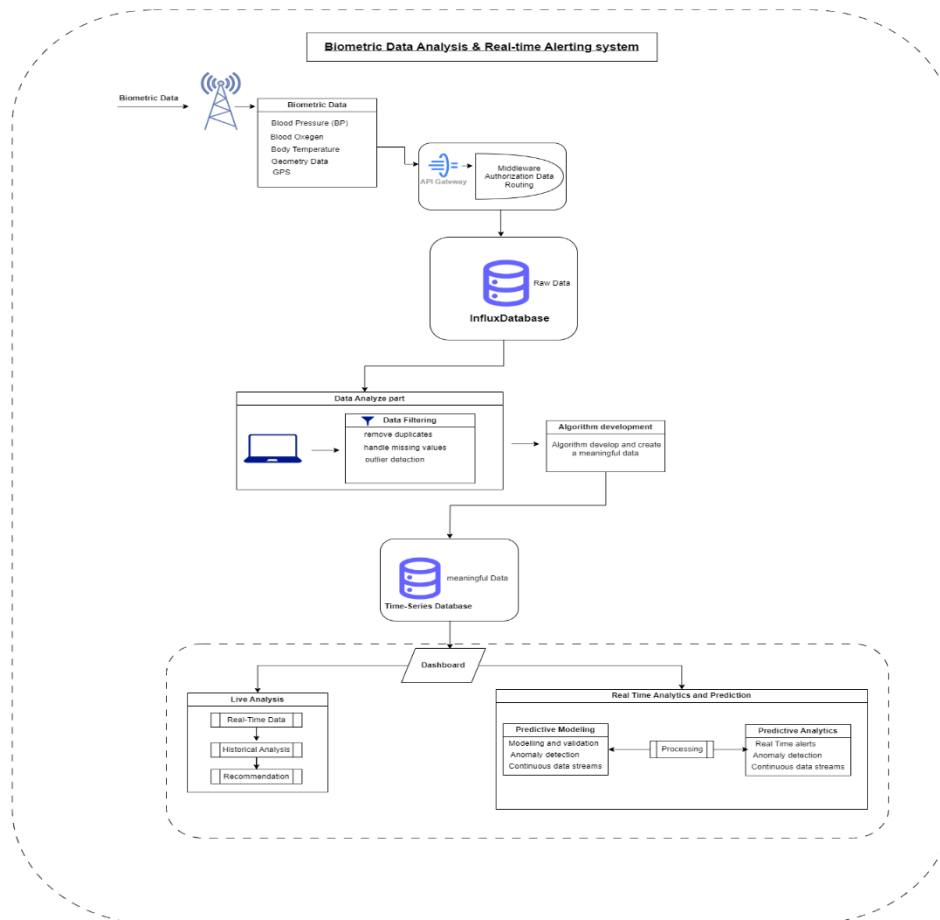
The provided solution is designed to handle the comprehensive process of collecting, transmitting, storing, analyzing, and visualizing biometric data. This system integrates various subsystems to ensure efficient data flow and processing from initial data collection to final user presentation. Below is a detailed description of each subsystem and their interactions, illustrated in the accompanying conceptual diagram.

## CONCEPTUAL DIAGRAMS FOR INDIVIDUAL COMPONENTS

### 1. Data Transmission System: D.M.R.B.Dissanayaka - IT21293962



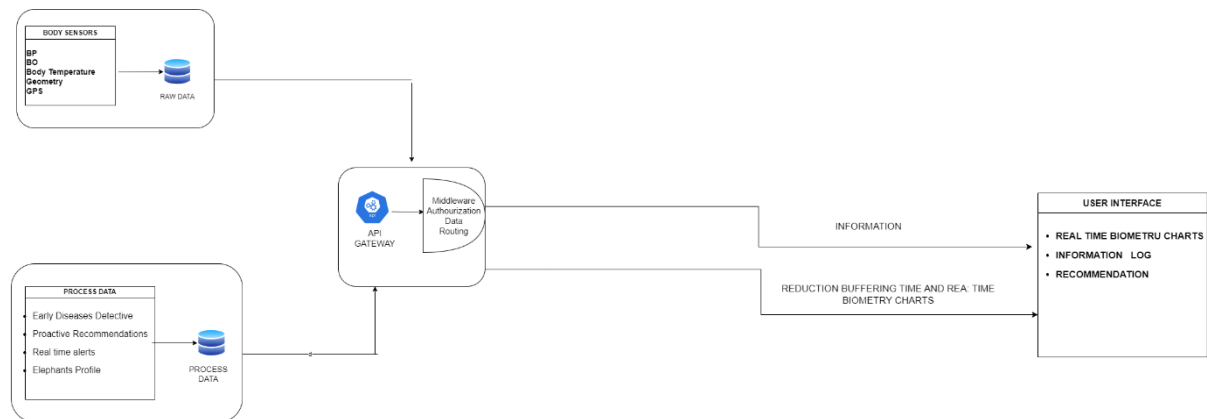
The Data Transmission System is a critical component designed to facilitate the reliable and secure transfer of data collected from elephant body sensors to a remote receiver using a SIM card. This module leverages Arduino technology to create a robust system suitable for rural and remote areas with weak network signals, ensuring comprehensive and uninterrupted data flow.

**2. Biometric Data Analysis & Real-Time Alerting System: Perera B.A.D.K.S – IT21202254**


The system begins with IoT devices collecting vital animal health data, such as heart rate, temperature, and activity levels, and sending it to the API Gateway for validation. The API Gateway ensures the data's authenticity and correct format before routing it to the Time-Series Database for organized storage with precise timestamps. Post-storage, the data undergoes filtering to remove duplicates and noise, enhancing its quality for analysis. Advanced algorithms then analyze the refined data in real-time, identifying patterns and predicting future health conditions. These predictions generate real-time alerts and proactive recommendations for caretakers or veterinarians. User interaction is facilitated through a Live Analysis dashboard that displays current health status, historical trends, and recommendations in an intuitive format. Continuous security monitoring through Intrusion Detection Management safeguards the system and sensitive data, ensuring reliable health monitoring. This integrated approach provides a comprehensive and proactive solution for animal health management, delivering accurate and actionable insights through real-time data collection, advanced analytics, and robust security measures.

#### 4. Reduction of buffering time and emergency identification:

De Silva L.M.C - IT21301704



The biodata BPI and also all the raw data stored in the sensor's database, which was captured from the elephant's care belt, Next, we use raw data processed into meaningful data and get output as information that stores in another database. By using that database, we can identify emergency situations using the information database, and the system will send notifications under the relevant elephant's ID in the system. By using that information, we will be able to identify situations or anything that happens to elephants. We can identify those situations by receiving notification under the relevant elephant's ID in the system. In my component, all the elephant's data show as live charts and identify emergency situations. In an emergency situation, when identifying the data, there can be a delay in getting the data; hence, we can't identify if anything happens to the elephant. We can reduce data repetitions as a solution to the above problem. It helps reduce buffering time and increase the efficiency of the information.

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

**Specialized Domain Expertise**

- *Wildlife Biology and Ecology:* Understanding the behavior, movement patterns, and ecological significance of elephants is crucial. Experts in wildlife biology and ecology will provide insights into elephant habitats, migratory routes, and interaction with human environments. This knowledge is essential for designing effective monitoring and intervention strategies.
- *IoT and Sensor Technology:* Specialists in IoT and sensor technology are needed to develop and implement the data transmission system. Their expertise will ensure the reliable detection of elephants through various sensors such as GPS, PIR sensors, and acoustic sensors. Knowledge in low-power and long-range communication technologies like Lora and GSM is also essential for maintaining real-time data transmission.
- *Data Science and Machine Learning:* Expertise in data analysis and machine learning is required to process and interpret the vast amounts of data collected. Data scientists will develop algorithms to predict elephant movements and identify collision hotspots. Machine learning models will enhance the accuracy of elephant detection and generate actionable insights from the data.
- *Software Development and API Integration:* Software developers are needed to create the biometric storing system and integrate APIs for seamless data retrieval and communication between different components. They will also develop the user interface, ensuring it is user-friendly and provides real-time alerts and monitoring capabilities.
- *Conservation Management:* Conservationists and environmental scientists will ensure that the solutions align with conservation goals and ethical considerations. Their expertise will guide the implementation of non-invasive monitoring techniques and strategies that prioritize the welfare of elephants and other wildlife.

**Knowledge Requirements**

- *Elephant Behavior and Ecology:* Comprehensive understanding of elephant behavior, habitat use, and movement patterns. Knowledge of factors influencing human-elephant conflicts and strategies for mitigating such conflicts.
- *IoT Technologies and Network Protocols:* In-depth knowledge of IoT devices, sensors, and communication protocols such as Lora, GSM, and wireless sensor networks. Understanding of how to deploy and maintain these technologies in remote and challenging environments.

- *Data Analysis and Predictive Modeling:* Proficiency in statistical analysis, data mining, and machine learning techniques. Ability to develop predictive models that can accurately forecast elephant movements and potential collision scenarios.
- *Software Development and Integration:* Skills in software development, particularly in creating robust APIs and integrating various software components. Experience in developing user interfaces and mobile applications that provide real-time data visualization and alerts.
- *Conservation Strategies and Ethical Considerations:* Knowledge of conservation principles and ethical guidelines for wildlife monitoring and intervention. Understanding of policies and regulations related to wildlife protection and human-wildlife conflict management.

#### **Data Requirements**

- *Real-Time Sensor Data:* Continuous data from GPS collars, PIR sensors, acoustic sensors, and cameras. This data should include location coordinates, timestamps, and sensor-specific readings such as movement, sound, and temperature.
- *Biometric Data:* Information on individual elephants, including their physiological parameters (e.g., heart rate, body temperature), movement patterns, and health status. This data will help in identifying and monitoring individual elephants.
- *Environmental and Geographic Data:* Data on the geographic features of elephant habitats, including vegetation types, water sources, and human infrastructure (e.g., roads, railways). Environmental data such as weather conditions and seasonal changes that affect elephant movements.
- *Historical Data on Human-Elephant Conflicts:* Records of past incidents of elephant collisions, crop raiding, and other conflicts. This data will help in identifying high-risk areas and times, informing the development of predictive models and intervention strategies.
- *Conservation and Wildlife Management Data:* Information on existing conservation efforts, protected areas, and wildlife corridors. Data on the effectiveness of previous interventions and current policies related to human-elephant conflict management.

**8. Objectives and Novelty**
**Main Objective**

The primary objective of the Elephant-Care system is to protect and mitigate wild elephants from collisions, through the implementation of an IoT-based solution. This system aims to mitigate human-elephant conflicts, reduce the mortality rate of elephants due to such accidents, and promote coexistence between humans and wildlife by leveraging advanced detection, monitoring, and alert technologies.

Member Name	Sub Objective	Tasks	Novelty
Perera B.A.D.K.S IT21202254	To analyze real-time and historical data to forecast animal health conditions and provide actionable recommendations for proactive health management.	1. Store time-stamped data in a Time-Series Database.  2. Smooth out irregularities and reduce noise in the data.  3. Develop and validate predictive models using historical data.  4. Continuously analyze data streams to detect anomalies and predict health issues.  5. Generate real-time alerts and proactive recommendations.	It's integrated approach that combines advanced time-series forecasting, historical data analysis, and real-time data processing to accurately predict elephants' health conditions and provide specific, actionable recommendations for proactive health management, enhancing early detection and intervention capabilities.



		6. Provide security to the system via intrusion detection system.	
D.M.R.B.Dissanayaka IT21293962	To facilitate the reliable, secure, and efficient transmission of physiological and location data from animal body sensors to a remote receiver.	1.Ensure Reliable Data Transmission.  2.Optimize Data Transmission for Rural Areas.  3.Collect physiological and location data from animal body sensors.	The system's reliance on mobile networks for data transmission, the need for a stable power supply, potential data latency in weak signal conditions, and the requirement for regular maintenance of hardware components such as sensors and Arduino boards, highlight the novelty of optimizing data transmission for rural and remote areas where network coverage and power sources may be inconsistent, and maintenance can be resource intensive.
De Silva L.M.C IT21301704	To reduce the delay of real-time analysis.	1.Show the Elephant's bio data, BPI, GPS and about accidents what animal faced, via in user interface.	Reducing the data buffering time and add data repetition to it.

**9. Supervisor checklist**

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

Yes	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>
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- b) Does the proposed topic exhibit novelty?

Yes	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>
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- c) Do you believe they have the capability to successfully execute the proposed project?

Yes	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>
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- d) Do the proposed sub-objectives reflect the students' areas of specialization?

Yes	<input checked="" type="checkbox"/>	No	<input type="checkbox"/>
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- e) Supervisor's Evaluation and Recommendation for the Research topic:

*This is accepted to proceed*

**10. Supervisor details**

	Title	First Name	Last Name	Signature
Supervisor	Prof.	Anuradha	Jaykody	
Co-Supervisor	Ms.	Uthpala	Samarakoon	
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

The Review Panel Details

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.