Temporary ID: **2021-162**

# Sri Lanka Institute of Information Technology

## Project Topic Assessment – 2021

### Topic

Dogodo: IOT based enhanced Mobile application to provide essential health services to dogs

### Abstract (200 Words Max):

Today having a pet dog in the house has become a new normal thing all around the world. Regards the purpose of the owner, most houses have a dog as a pet. The bond between humans and dogs runs to early years without leaving traces to find out a visible root. Hence the connection between humans and dog and the love among them still grows and won't be changed soon. However, still even to 2021, there are no proper E-Service for pet dog related issues among the society. To find out an answer, we gathered all the pet dog related issues into one table and came up with a mobile app solution which covers most of the related areas that the community requires.

This research project is a fully fledged "one stop solution" for all the pet dogs and for their owners. As a team, we were able to identify that there is no single mobile or either web application which can provide answers to the all-pet dogs related issues at one stop as a service. Even though there are couple of distributed web services in international domains, those service has been particularly targeted only one specific area or either it has been stopped due to lack of functionalities. Furthermore, the major concern is there are no any solutions for the Sri Lankan industry in any term. Due to that, we would like to take the opportunity and come up with the best application which can answer all the questions which pet owners have.

Research Area/Group: Select the area by referring to the document uploaded to the Courseweb

**Software Engineering**

**Supervisor should fill this part**

Supervisor: I certify here that co-supervisor and myself can guide this students to acquire required knowledge skills and attitudes pertaining to above sub domains of his/her specialization.

Supervisor: **Ms. Disni Charuka Sriyarathna** Signature

Continuation of Previous Year Project? ☐

If yes, state the Project ID

and year

Co-Supervisor: **Ms. Shalini Rupasinghe** Signature

External Supervisor Name

Team Members:

| Student Name | Student ID | Specialization |
|---|---|---|
| Leader: L.V.I.S Thilakarathne | IT18502466 | IT |
| Member 2: Wijethilaka M.G.R | IT18062816 | IT |
| Member 3: Salay M.S. | IT18006858 | IT |
| Member 4: T.S Chethana Fernando | IT18001730 | IT |

## Research Problem:

When asked what type of a pet do you have? One of the most common answers is "it's a pet Dog!". Even though many kind-hearted people love pet dogs and are willing to have a one, most people **lack the proper knowledge to maintain and take care of them**. Therefore, dogs are victims of physical and mental disabilities.

Many countries have developed new IoT-based devices and mobile applications for dogs for their well-being and dog owners' convenience. Furthermore, obtaining such equipment from other countries and accessing services through the mobile app is difficult and in worse case it doesn't support relevant services which necessary. And also, some services are limited in some regions and may cost more than caring for dogs. In some cases, dog owners abandon the dog based on their health and on behavioral issues without knowing how to react to their behaviors, breeding, and specific disease-related issues. The number of stray dogs has increased gradually due to the repeated action of people abandoning dogs. We can see a lot of such problems in recent times.

When considered all of these issues, it appears that, these issues are caused due to lack of awareness and difficulty of the pet doctor visits. But these issues can be overtaken and solved easily by a system that can give both the app and an IOT device which can be easily used for health analysis, behavioral issues (smart translator), breeding, and detection of dog skin diseases.

Therefore, the Pet owner can be aware of their **pet dog in a second from their mobile phone and take necessary actions accordingly.**

Also, attention should be paid to the following issues.

- There are enough systems in the market to calculate Body temperature, BMI, respiratory levels in humans. But there are only limited systems for animals which has been built to do the same thing. But still those devices don't deliver the necessary factors such as by using sensor values to predict and analyze health related issues in dogs. Therefore, one of our primary targets (Smart Health Analyzer) is to use sensor values to predict and analyze data to suggest necessary actions that needed to take by owners for their dogs (time series analysis of body temperature and use of history data values to identify health patterns, same predictions and analysis will be used for heart rate sensor values and calorie related statuses). According to the studies, there has been some products which has been published, without any advance technologies [3] However this component will mainly tackle down all the other areas which hasn't been answered by the industry as of now.
- Dogs are sensitive and loyal animals to their human owners. Unlike experienced dog owners, amateur dog owners don't have a good idea what their dog is trying to communicate. There are only a few cases where machine-learning techniques have been used in behavioral research,[4] A research that was done previously has no practical implementations. It has only focused on how machine learning algorithm models will work in behavioral science. How can a dog barking pattern can be analyzed to understand what it is really trying to say? [6] When different dogs are breeding, what the result is, and the medical routines and food routines?

- [8] How to Identify the skin diseases, what are the treatment used? In some areas, veterinary services are not available 24 hours a day. So that, the Lack of alternative treatments directly affects the dog owner and the dog.

The conclusion from these facts is, the existing ways used to adopt or looking for pets' dogs are inefficient and not systematic.

## Solution proposed:

The proposed system will mainly cover the relevant areas that supposed to be covered in order to full fill the pet owners' expectations by providing the necessary services (Such as Internal Health (what are the issues and what actions should be taken), Voice Recognition and translations, external issues such as skin diseases, and breeding patterns and breeding outcomes). Team priority is to emphasize necessary services that should be included in the mobile application and provide fluid services with less interruptions. And also, a service that has been never issued perfectly and solely to the Dog owners in a one go. Finally, this service will provide both the IOT devices and the supportive eye-catching mobile app to the market.

The app works as a personal assistant, especially for new dog owners. The mobile has four main components. Each component assesses four different areas that dog owner might face when having a pet dog. The first component is a health tracker which gather dog's health related information. This will help the owner to monitor the dog's health in real-time and find out whether the dog is suffering any illnesses. If there is any abnormality, the app will analyze previous data and let the user know what actions to take. [5] The second component is a pet translator which is a real-time dog sound monitor. With the use of the microphone attached to the dog's collar, the app will gather data and analyze the data. Then it will output the mental state of the dog, whether it is happy or sad.

When it comes to dog breeding finding a suitable breed is not an easy task. The third component helps the owner to find the most suitable nearest dog breed. [7] Also, it helps the owner to predict the breed. [8] Dogs are highly vulnerable to skin diseases such as wounds, allergies, and infections. The last component helps the user to understand which skin disease the dog is suffering from**.** The owner must take a photo of the disease and let the app analyze the image after predicted the disease as a minor or major issue. [9] Based on image observations, the app will output the skin-related disease**.**

References:

[1] Punit Gupta, Deepika Agrawal, Jasmeet Chhabra, Pulkit Kumar Dhir "IOT based smart Healthcare Kit", 2016.

[2] Robert L. Hollis, "Dog Behavior Monitoring and training Apparatus", 2002.

[3] "MeasureON! Harness - VetMeasure", *VetMeasure*, 2021. [Online]. Available: https://vetmeasure.com/product/measureon-harness/. [Accessed: 12- Feb- 2021]

[4Molnár, Csaba Kaplan, Frédéric Roy, Pierre Pachet, François Pongrácz, Péter Dóka, Antal

Miklósi, Ádám,“ Classification of dog barks: A machine learning approach”,2008

[5] Luque, Joaquín Larios, Diego F.Personal, Enrique Barbancho, Julio León, Carlos ,“Evaluation of MPEG-7-Based Audio Descriptors for Animal Voice Recognition over Wireless Acoustic Sensor Networks”, 2016

[6] Danika Bannasch ,Noa Safra,Amy Young,Nili Karmi,R. S. Schaible,G. V. Ling, “Mutations in the SLC2A9 Gene Cause Hyperuricosuria and Hyperuricemia in the Dog ”, 2008

[7] Rakesh Kumar, Manish Sharma, Kritika Dhawale , Gaurav Singal ” Identification of Dog Breeds Using Deep Learning ” 2018

[8] "Dogs | Healthy Pets, Healthy People | CDC", *Cdc.gov*, 2021. [Online]. Available: https://www.cdc.gov/healthypets/pets/dogs.html. [Accessed: 12- Feb- 2021]

[9] R. Sumithra, M. Suhil and D. Guru, "Segmentation and Classification of Skin Lesions for Disease Diagnosis", *Procedia Computer Science*, vol. 45, pp. 76-85, 2015.

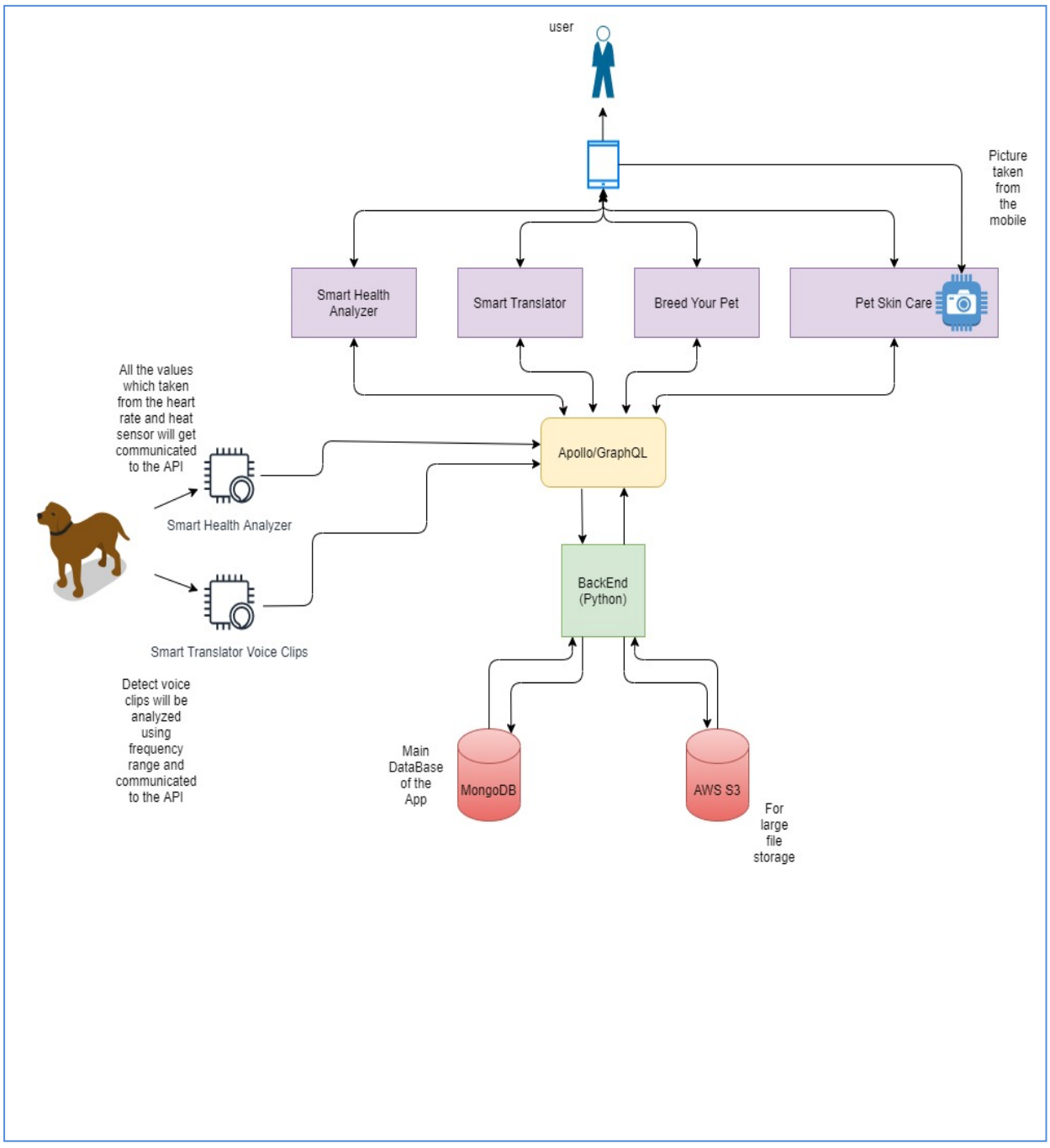
[10] Ori Shemla, Joachim Behar, "PhysioZoo - mammalian NSR database", 2019

[11] "Pet guide-pet breeds 2021. [Online].Available: https://www.petguide.com/breeds/dog/labrador-retriever/.[Accessed: 10- Feb- 2021]

[12] "Dog time -dog breeds 2021. [Online].Available: https://dogtime.com/dog-breeds/ [Accessed: 02- Feb- 2021]

System Overview Diagram for the solution proposed. Recommended to draw using draw.io. Note: This is not an activity/flow (UML) diagram

1. **Man components including the data sources, stakeholders, interaction among the stakeholders, etc.**
2. **Interconnection among the components**
3. **Major SW and HW components**



Objectives (1 main objective and 4 sub objectives):

**Main Objective**

Our main goal is to create an **innovative mobile app with IOT devices** that allows users to easily access a wide range of services for their pet dogs in one place, with giving the features such as IOT devices to track dog Internal health statuses (with Predictions and suggestions) and voice recognition. And also, to track down skin related issues and find breeding partners and breeding patterns and outcomes with necessary information's.

**Sub Objectives**

1) IOT device for diagnosing health conditions with supporting app component. this device will be consisting of, analyzing abnormal body temperatures and heart rates, ambient levels, Calculating BMI rates from the analyzer results, Pulse rate calculator, Calories tracker and exercise suggestions. Health analyzer will identify the health patterns. And also using the sensor information's from the IOT device, app will predict the health statuses accordingly to the data patterns and if the pattern directs in a harmful way to the dog, then what actions should be taken as suggestions. And also, with IOT device data, weekly and monthly status reports which can be shared with doctors and drug stores.

2) An IOT based device for capturing the test subject's sound clips to better understand the subject and its mental state. This will help the owner to a get better idea of the pet's mental and physical idea. Specially for owners who are armatures in dog's cognitive behavior the IoT device will help to capture the pet sound, Identify and analyze different barking patterns and movements; for those occasions, the app lets the owner know what can be done for the pet, Identify and analyze weekly barking patterns, analyze whether the pet needs any special attention using analyzed barking pattern.

3) Identify partners for their pets, Identify and analyze all the necessary details (breed/weight/age) about the partner, Identify Partner suggestions using the app, and analyze and provide a reliable statement about the breed, Analyze and provide the necessary treatments, medical routines, and food routines for newborn pets. The advance part of the component is this component will use biological data of selected dogs and use it to predict new outcomes of different breed crossings. As of now there are no any application in the industry to predict crossing outcomes of different breeding in an innovative way. And also, there will be another feature where app will suggest diet plans and medicine plans for new born babies according to their breeds. Therefor this app will provide unique meals plans and medicines which goes with sri Lankan climates which suitable for new born dog pets.

4) Train image models using the decision tree algorithm, predict them by image processing, Analyze and provide details about their pet's disease based on image results; for minor issues, train a model and predicting the most popular products in the market is generating product through the app, Future prediction for the possibility of recurrence of the skin diseases. This component will use preprocess images from reliable resources to compare device upload photo to predict skin related disease in an accurate way. Therefor the component will come in handy for users where they have to use only the mobile camera for identifying skin issue.

Task divided among the members

Member 1: **Smart Health Analyzer**

This is an Innovative IOT device which will surpass most of the functionalities which every pet health tracking device would commonly provide in the market. Most of the Health tracking devices would cover ([3] **Pet body temperature, heart rate, respiratory rate, activity level and ambient conditions**). But those IOT devices doesn't use the device analyzed information's in a way **to predict and analyze dog's health state in advance**, to come up with **diagnosis reports** which can directly share with doctors and drug stores for necessary actions. And also, this app will suggest different kind of activities for the dog as exercises depending on the data that device shows. App will use Custom made IOT device data to evaluate with pre-processed data [10] and to come up with innovative and valuable suggestions to use for dog health purposes. And also, following prediction will mainly cover the areas such as suggesting different kind of activities based on evaluated data (data such as temperature, heart rate, steps taken, respiratory levels (integer values, float values and strings)) heart rate patterns during the week and what can be suggested for the upcoming week depending on the dog activity level, using history data, app can be able to predict body temperature evaluation and different unusual levels. therefor this device will bring up the solution to the untapped area. And also, IOT device will have a fully supported android mobile app component which will sync with the device and elaborate IOT device information's in a useful and eye-catching way to the users. This device data will be analyzed using machine learning algorithms to identify patterns which can predict pet's health statuses to identify and report information's in an innovative way. And also, main intention behind this research component is to provide an IOT device as well as the Mobile app both in a reasonable value to the customers. The device will be tested on few selected dogs among the neighborhood which the permission which has granted from the owners. And also, these tests will be conducted under the influence and guidance of well experienced dog trainers.

Member 2: **Smart Translator**

The IOT device with an active noise cancellation microphone which is attached to the test subject will be recording soundtrack clips. These sound clips will be transmitted through the Arduino board to the mobile phone's REST API. Then the data will be captured from the API. The API will upload the data to the server. In the server, the raw data will be converted using an FFT mathematical algorithm to constituent frequencies. FFT algorithms are used to preprocess data for noise cancellation filtering and data normalization. Processed data will store in the database server for future analysis. When data is required for analysis it will extract the data from the database and it will be sent into a model to identify sound patterns. To train the machine learning model barking clips will be recorded from many pet dogs in different environmental, mental, and physical conditions. Then they will be classified so the model can learn from it. Around 1000 clips will be used under different categories such as Play, Fight, Alone, Stranger, Walk, Sad. This kind of labeled data will train the model. Once the model is trained it will analyze incoming sound clips from the microphone and identify what the subject is trying to say. Gathered data will be analyzed by this model for sound patterns. This analyzed data will output the mental state of the dog working as a pet translator. The processed data will be then re-transmitted to the API of the mobile app. The component will output the processed information to the owner. This device will be tested with guidance of few dog owners and with their experience that their dogs has delivered time to time. And also, with careful attachment of the device to dogs. Sound clips will be recorded with the guidance the owners.

Member 3: **Breed your Pet**

This component provides several advanced features such as biological outcomes of new breeding and new data patterns that can predict the outcome of different breeds and also what food suggestion and ambient solutions that can be provided to the newborn pets. No app gives the result of different dog breeding. Using this component, the user can identify and analyze new breeds. Using machine learning algorithms to identify internal and external characteristics and external characteristics of new breeds. The training model will be trained using different data resources. [11],[12] which has data on different dog breeds will be the main resource to build the classification model. The data will be labeled accordingly. height, weight, dog group, fur type, life span are the features that will be classified. Once the model is trained (using data such as Dog breed, weight, height, color, density of fur and eye color (integer, float, strings)) the it will predict the dog breed result. If the owner is willing to providing the location the most suitable nearest dog and the owner will be suggested to the owner. Assuming handful of constant lineaments facts and building up few possible ways of outcome of new breeds. Also using this component, we can get the food recipe and medical treatment for your pet. It is recommended for one year. After analyzing if cannot find an answer app will recommend a neared doctor in your location. And also, we can find a partner for your dog using this app. For that thing pet owner should register on the app. This component will be tested with the guidance and advices of well reputed and experienced doctors who works at (Air force Pet Hospital Dematagoda, Pet 4 care wellampitya, Animal Clinic Nittambuwa and Negombo). All the breed related, Food related and medicine related knowledge will be gathered from above mentioned hospitals and from the doctors who works at those hospitals.

Member 4: **Pet Skin Care**

As mentioned previously, pet skincare is another key component that allows users to identify pet dog skin diseases. Since there is no proper existing solution to identify pet dog skin diseases through a mobile vision-based technique, this is a great solution to help dog owners to identify skin diseases easily. The user has to take a photo of the disease, allowing the app to analyze the image by uploading it via the mobile app. A Machine Learning model that can identify the skin disease will be trained using different skin disease images. Necessary images will be collected with the assistance of two veterinarians from the Animal Hospital, Negombo and the Animal Clinic, Nittambuwa. Furthermore, the mobile app will generate descriptive information about the severity of the skin disease. Skin issues are categorized in two ways, severe issues and minor issues. If it is a severe issue, the user is informed that their pet dog needs medical treatment. Moreover, if it is a minor issue that can be healed by popular products in the market, the product suggestion will pop up through the mobile app. (for example, powders for swollen skin resulted from tick bites, dog shampoos for dry skin, rash creams, Etc.). It also provides future predictions for the possibility of recurrence of these minor skin diseases. Since skin related issue component need to have extra care when it comes testing, all the skin related issue information's and testing sample data will be gathered from under the permission of (Air force Pet Hospital Dematagoda, Pet 4 care wellampitya, Animal Clinic Nittambuwa and Negombo) following hospitals. and also testing photo sample will be taken from those hospital databases.

Technologies to be used:

Tech Stack to be used:

- React Native
- Apollo/GraphQL
- Apollo
- Python
- Mongo DB
- AWS S3 Service
- Arduino
- OpenCV
- TensorFlow

If supervisor States that this year is a continuation of previous work, state the further work the students should do compared to the previous years.
(NOTE: This part has to be filled by the supervisor)

**<u>This part will be filled by the Topic Screening Panel members</u>**

Acceptable: Mark/select as necessary

| Acceptance/ Rejection | Correction State | |
|---|---|---|
| | Minor Correction | Major Corrections |
| Accepted | ☐ | ☐ |
| Resubmit | ☐ | ☐ |
| Rejected | ☐ | |

Corrections (if necessary)

- Lack of Innovativeness.
- M1, M3 – No research components.
- M2 – How to manage data to accomplish the task with a considerable accuracy.
- M1 – There are already developed sensors to gather data such as heart rate, body temperature and so on…
- Lack of research components.

Look at the similar researches already done and the make sure not repeat the same. Revisit and redefine all the objectives and tasks of all the members with sufficient research depth and novel product features. Describe how the other users connect to the network of this system and interact.

Major changes proposed:

_____

_____

_____

_____

Any other Comments:

_____

_____

_____

Approved by the review panel:

**Panel 01:**

| Member's Name | Signature |
|---|---|
| Mr.Samantha Rajapaksha | |
| Mr. Nelum Chathuranga Amarasena | |
| Ms. Dinuka Wijendra | |

**Panel 02:**

| Member's Name | Signature |
|---|---|
| Prof . Koliya Pulasinghe | |
| Dr. Pradeepa Samarasinghe | |
| Mr. Nalaka Dissanayake | |

**Important**:

1. According to the comments given by the panel, do the necessary modifications and get the approval by the **same panel**.
2. If the project topic is rejected, find out a new topic and inform the CDAP Group for a new topic pre-assessment.
3. A form approved by the panel must be attached to the **Project Charter Form**.

# Appendix:

1. Appendix 1

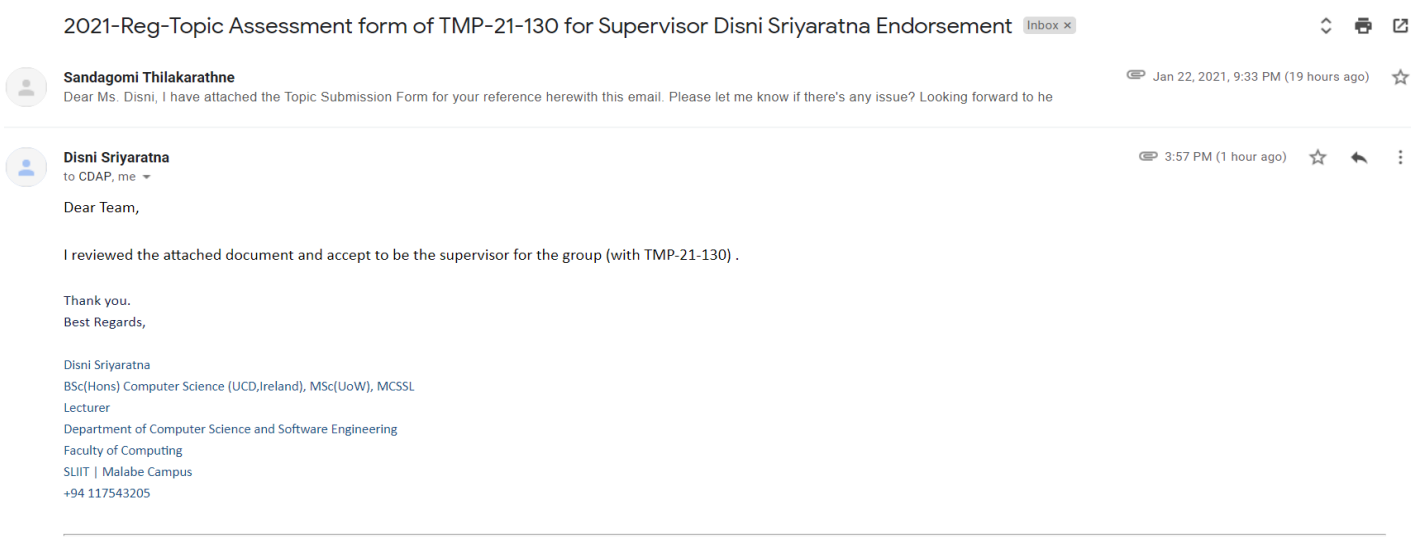
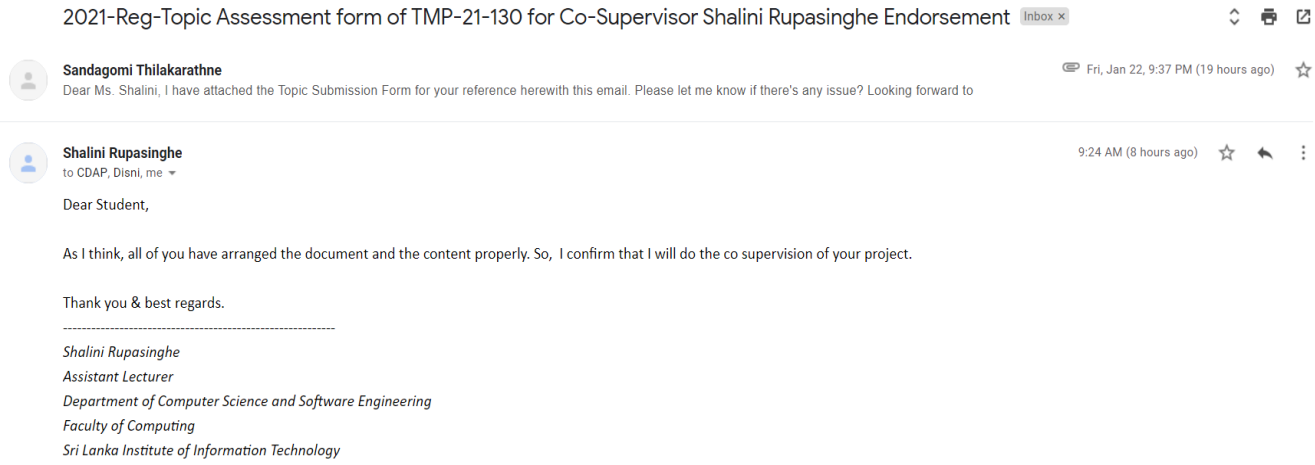



Figure 1 - Reply Email from Supervisor

2. Appendix 2



2021-Reg-Topic Assessment form of TMP-21-130 for Co-Supervisor Shalini Rupasinghe Endorsement Inbox ×

**Sandagomi Thilakarathne** Fri, Jan 22, 9:37 PM (19 hours ago)
Dear Ms. Shalini, I have attached the Topic Submission Form for your reference herewith this email. Please let me know if there's any issue? Looking forward to

**Shalini Rupasinghe** 9:24 AM (8 hours ago)
to CDAP, Disni, me

Dear Student,

As I think, all of you have arranged the document and the content properly. So, I confirm that I will do the co supervision of your project.

Thank you & best regards.

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*Shalini Rupasinghe*
*Assistant Lecturer*
*Department of Computer Science and Software Engineering*
*Faculty of Computing*
*Sri Lanka Institute of Information Technology*

Figure 2 – Reply Email from Co Supervisor