Sri Lanka Institute of Information Technology

PROJECT REGISTRATION FORM

(This form should be completed and uploaded to the Cloud space on or before XXXXXXXXX)

The purpose of this form is to allow final-year students of the B.Sc. (Hon) degree program to enlist in the final-year project group. Enlisting in a project entails specifying the project title and the details of four members in the group, the internal supervisor (compulsory), the external supervisor (may be from the industry), and indicating a brief description of the project. The description of the project entered on this form will not be considered as the formal project proposal. It should however indicate the scope of the project and provide the main potential outcome.

PROJECT TITLE (As per the accepted Topic Assessment Form)	BloomQuest - Personalized Learning System Based on Knowledge Graphs and Bloom's Taxonomy.
RESEARCH AREA (As per the Topic Assessment Form)	Natural Language Processing (NLP)
PROJECT NUMBER	TMP-23-035 (Will be assigned by the RP Team)

PROJECT GROUP MEMBER DETAILS: (Please start with the group leader's details)

	STUDENT NAME	STUDENT NO.	CONTACT NO.	EMAIL ADDRESS
1	Wijayasena W.D.N.D.T	IT20133368	071 155 0273	it20133368@my.sliit.lk
2	Senaweera T.I.S	IT20123468	076 920 8933	it20123468@my.sliit.lk
3	Weerasekara N.N	IT20133504	071 581 0884	it20133504@my.sliit.lk
4	Colambage K.G	IT20126438	075 211 6335	it20126438@my.sliit.lk

SUPERVISOR, CO_ SUPERVISOR Details

SUPERVISOR Name	CO-SUPERVISOR Name
Mr. Prasanna Sumathipala	Mr. Sathira Hettiarachchi

EXTERNAL SUPERVISOR Details (if any, may be from the industry)				
				Attach the email as Appendix 3
Name	Affiliation	Contact Address	Contact Numbers	Signature/Date

ACCEPTANCE BY CDAP MEMBER (This part will be filled by the RP team)		
Name	Signature	Date

PROJECT DETAILS

Brief Description of your Research Problem: (extract from the topic assessment form)

It is crucial to create balanced and high-quality exams for undergraduates that caters to various cognitive levels. As a result, lecturers rely on **Bloom's taxonomy** cognitive domain, a popular framework developed to assess students' intellectual abilities and skills [1]. Despite its widespread use, many students are not aware of Bloom's Taxonomy and how it affects their learning experience. This lack of understanding can lead to students missing important opportunities for growth and development in their academic pursuits. To address this issue, **a personalized self-learning system** that helps students understand and apply Bloom's Taxonomy in their own learning process can be implemented. And by personalizing the system according to the student may help them learn from the type and level of the content they seem to fit in [2].

Many undergraduate students find it difficult to advance above the lower levels of the taxonomy (such Remembering and Understanding) and into the higher levels (such as Analyzing, Evaluating, and Creating). This means that instead of exhibiting a deeper comprehension of the subject and its ramifications, how they approach exams may be limited to mere memory and description.

Therefore, this presents a research problem as it raises questions about how the undergraduate students can identify and understand their cognitive level as classified by Bloom's Taxonomy, and how they can develop the skills they need to advance to the higher levels. By addressing this research problem, we can create educational environments that better support student learning and development, leading to more effective and efficient learning outcomes.

Main References:

[1] R. P. Vadhera, “Impact of Training of Teachers in Bloom’s Taxonomy on Question-Paper Setting,” International Journal of Science and Research, vol. 10, no. 9, Sep. 2021, doi: 0.21275/SR21919043527.

[2] V. Pant, S. Bhasin and S. Jain, "Self-learning system for personalized e-learning," 2017 International Conference on Emerging Trends in Computing and Communication Technologies (ICETCCT), Dehradun, India, 2017, pp. 1-6, doi: 10.1109/ICETCCT.2017.8280344.

[3] H. Ali, Y. Chali, and S. A. Hasan, “Automatic Question Generation from Sentences,” 2011.

[4] A. Saha, V. Pahuja, M. M. Khapra, K. Sankaranarayanan, and S. Chandar, “Complex Sequential Question Answering: Towards Learning to Converse Over Linked Question nswer Pairs with a Knowledge Graph,” 2018. [Online]. Available: www.aaai.org.

[5] M. Peer, I. K. Brunec, N. S. Newcombe, and R. A. Epstein, “Structuring Knowledge with Cognitive Maps and Cognitive Graphs,” 2020.

[6] V. Bradáč, P. Smolka, M. Kotyrba, and T. Průdek, "Design of an Intelligent Tutoring System to Create a Personalized Study Plan Using Expert Systems," Applied Sciences (Switzerland), vol. 12, no. 12, Jun. 2022, doi: 10.3390/app12126236.

[7] G. Sedrakyan, J. Malmberg, K. Verbert, S. Järvelä, and P. A. Kirschner, "Linking learning behavior analytics and learning science concepts: Designing a learning analytics dashboard for feedback to support learning regulation," Comput Human Behav, vol. 107, Jun. 2020, doi: 10.1016/j.chb.2018.05.004.

[8] M. Mohammedid and N. Omar, "Question classification based on Bloom's taxonomy cognitive domain using modified TF-IDF and word2vec," PLoS One, vol. 15, no. 3, 2020, doi: 10.1371/journal.pone.0230442.

[9] S. Ullrich and M. Geierhos, "Using Bloom's Taxonomy to Classify Question Complexity," 2021.

Main expected outcomes of the project: (extract from the topic assessment form)

For students to understand their current level in terms of Bloom's Taxonomy and work toward fulfilling the benchmark expectations, a personalized self-learning system can be quite beneficial. A system like this would offer a customized educational experience that takes into consideration each student's learning preferences, shortcomings, and abilities.
The system may take a student's study material then constructs a knowledge graph by extracting named entities and relations between the entities from material. Knowledge graphs are an extension of semantic nets, which represent knowledge in the form of interconnected nodes and arcs, where nodes represent 'objects' or 'concepts' and the arcs or edges represent the interaction or relations between them.
Then the system will utilize this knowledge to,

1. Generate a set of questions and answers using the knowledge graph and categorize them according to bloom's taxonomy [3], [4],
2. Create a comprehensive mind map which changes dynamically according to the performance level [5],
3. Provide online extra study resources related to the upload study material. [6],
4. Analyze the performance level to adjust the learning experience accordingly and create a dashboard using learning analytics [7].

Because of this, students can become more self-directed and motivated learners, and they can produce high-quality work that meets and exceeds university expectations.
As explained, it is expected to consolidate all the above-mentioned functionalities under a single platform and to present an effective solution that is equipped to fulfill the mentioned research gap.

WORKLOAD ALLOCATION (**extract from the topic assessment form after correcting the suggestions given by the topic assessment panel.**)

(Please provide a brief description of the workload allocation)

MEMBER 1	Weerasekara N.N IT20133504

Generate a knowledge graph from the study material provided by the student:

- The knowledge graph would represent the concepts, ideas, and relationships between them in the study material.
- This could be done using Natural Language Processing (NLP) techniques like Named Entity Recognition (NER), Dependency Parsing, and Coreference Resolution to extract relevant entities and their relationships from the text.

Identify the key knowledge that needs to be summarized and represented in the mind map:

- This could be done by analyzing the graph to identify the most important concepts and relationships between them.
- The key knowledge could also be determined based on the learning objectives or the performance goals for the student.

Build a model that can transfer the text summary of the key knowledge to a visualization-based summarization (mind map):

- This model could use techniques like Graph Neural Networks (GNNs) to analyze the knowledge graph and generate a summary in the form of a mind map.
- The mind map could be dynamic, updating in real-time based on the student's performance analytics.

MEMBER 2	Colambage K.G IT20126438

Use SPARQL queries to retrieve relevant information from the knowledge graph:

- This can be done by formulating queries that extract information related to specific topics or concepts within the study material.
- The retrieved information can then be used to generate questions and answers.
- Build a natural language processing (NLP) model which trained on the retrieved information. The NLP model will be able to generate grammatically correct and meaningful questions and answers based on the information provided to it.

Categorize the questions according to Bloom's taxonomy:

- Once questions and answers are generated, the next step is to categorize them according to Bloom's taxonomy.
- This can be achieved by building a classification model that can identify the level of cognitive complexity required to answer a given question.
- The model will be able to categorize questions into one of the six levels of Bloom's taxonomy.

Integrate both NLP and classification models to generate questions and answers that are categorized according to Bloom's taxonomy:

- The NLP model can be used to generate questions and answers, and the classification model can be used to categorize them according to their cognitive complexity level.

MEMBER 3	Senaweera T.I.S IT20123468

- Track Bloom's levels-based metrics and calculate the scores for each level using Exponentially weighted moving average (EWMA) to give more weight to recent data and less weight to older data, making it more responsive to changes in the underlying data.
- Track platform-based metrics such as the number of visits, time spent, duration of interactions, material downloads, and date of visit.
- Develop a statistical index to calculate an overall performance level on a scale of 0 to 100 based on platform-based and Bloom's levels-based metrics.
- Calculate the index value daily or weekly for each student and forecast the future performance using time series analysis or machine learning models.
- Validate the generated index using a model with a similar dataset.

To validate the generated index value, a model with a similar dataset (LMS-based) will be used. Once the system is up and running, the index can be modified or updated according to the data collected from the system.

Design dashboard to visualize a student's performance in each level of Bloom's Taxonomy and overall performance using progress bar and gauge charts:

- Based on the results of the analysis, a user-friendly and customizable dashboard will be developed that presents relevant data and insights to students.
- Continuously update and modify the index value based on the data collected from the system and display in the dashboard.

MEMBER 4	Wijayasena W.D.N.D.T IT20133368

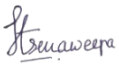
Develop an online resource recommending system that can analyze a student's submitted paragraph and recommend educational materials that are tailored to their reading level and the specific concepts they need clarification on.

- Preprocess the fetch data from the desktop application frontend using python NLTK libraries.
- Generate topics using topic modeling algorithm that is related to the uploaded content and compress those topics to avoid duplications. Use Latent Dirichlet allocation to identify main idea of the given content and generate topics. Topics that are generated using LDA can be duplicated with the same idea. To avoid this, similarity methods will use to identifies the similarity between each topic and keep the most relevant topic.
- Topics that are generated from the previous part will be used here to retrieve relevant resources. Consider the top k words to create query with top keywords in each topic, this new query will be executed over the search engine and retrieved resources. System uses Goggle API to fetch the URLs from the google search results.
- Rank the resources using topic-based relevance ranking rather than using common IR models.
- Measure the reading difficulty of the given content and rank the resources according to that. Flesch Reading Ease (FRE) will use to calculate the reading difficulty of the given passage.

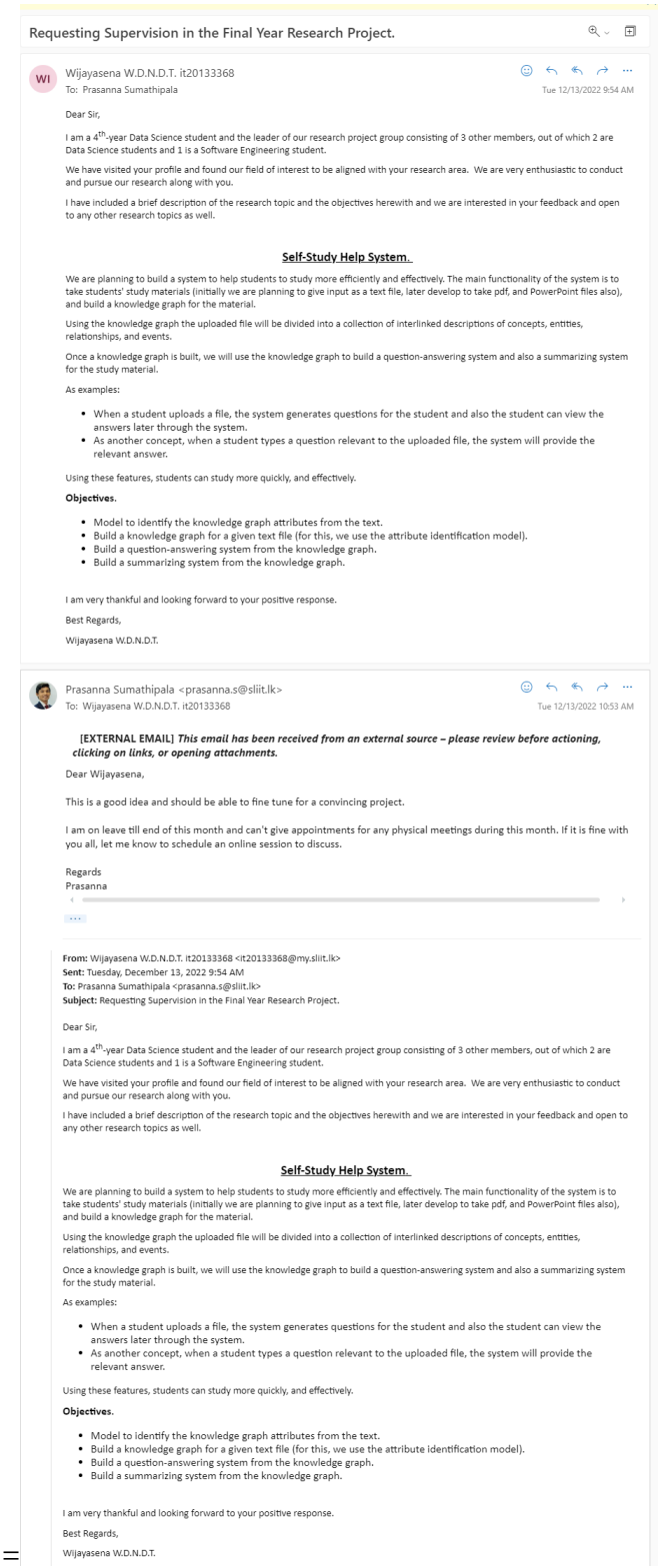
DECLARATION (Students should add the Digital Signature)

"We declare that the project would involve material prepared by the Group members and that it would not fully or partially incorporate any material prepared by other persons for a fee or free of charge or that it would include material previously submitted by a candidate for a Degree or Diploma in any other University or Institute of Higher Learning and that, to the best of our knowledge and belief, it would not incorporate any material previously published or written by another person in relation to another project except with prior written approval from the supervisor and/or the coordinator of such project and that such unauthorized reproductions will construe offences punishable under the SLIIT Regulations.

We are aware, that if we are found guilty for the above mentioned offences or any project related plagiarism, the SLIIT has right to suspend the project at any time and or to suspend us from the examination and or from the Institution for minimum period of one year".

	STUDENT NAME	**STUDENT NO.**	**Signature**
1	Wijayasena W.D.N.D.T	IT20133368	
2	Senaweera T.I.S	IT20123468	
3	Weerasekara N.N	IT20133504	
4	Colambage K.G	IT20126438	

Appendix 1: Acceptance E-mail by the Supervisor.



Requesting Supervision in the Final Year Research Project.

WI Wijayasena W.D.N.D.T. it20133368
To: Prasanna Sumathipala
Tue 12/13/2022 9:54 AM

Dear Sir,

I am a 4th-year Data Science student and the leader of our research project group consisting of 3 other members, out of which 2 are Data Science students and 1 is a Software Engineering student.

We have visited your profile and found our field of interest to be aligned with your research area. We are very enthusiastic to conduct and pursue our research along with you.

I have included a brief description of the research topic and the objectives herewith and we are interested in your feedback and open to any other research topics as well.

Self-Study Help System.

We are planning to build a system to help students to study more efficiently and effectively. The main functionality of the system is to take students' study materials (initially we are planning to give input as a text file, later develop to take pdf, and PowerPoint files also), and build a knowledge graph for the material.

Using the knowledge graph the uploaded file will be divided into a collection of interlinked descriptions of concepts, entities, relationships, and events.

Once a knowledge graph is built, we will use the knowledge graph to build a question-answering system and also a summarizing system for the study material.

As examples:

- When a student uploads a file, the system generates questions for the student and also the student can view the answers later through the system.
- As another concept, when a student types a question relevant to the uploaded file, the system will provide the relevant answer.

Using these features, students can study more quickly, and effectively.

Objectives.

- Model to identify the knowledge graph attributes from the text.
- Build a knowledge graph for a given text file (for this, we use the attribute identification model).
- Build a question-answering system from the knowledge graph.
- Build a summarizing system from the knowledge graph.

I am very thankful and looking forward to your positive response.

Best Regards,

Wijayasena W.D.N.D.T.

Prasanna Sumathipala <prasanna.s@sliit.lk>
To: Wijayasena W.D.N.D.T. it20133368
Tue 12/13/2022 10:53 AM

[EXTERNAL EMAIL] ***This email has been received from an external source – please review before actioning, clicking on links, or opening attachments.***

Dear Wijayasena,

This is a good idea and should be able to fine tune for a convincing project.

I am on leave till end of this month and can't give appointments for any physical meetings during this month. If it is fine with you all, let me know to schedule an online session to discuss.

Regards
Prasanna

From: Wijayasena W.D.N.D.T. it20133368 <it20133368@my.sliit.lk>
Sent: Tuesday, December 13, 2022 9:54 AM
To: Prasanna Sumathipala <prasanna.s@sliit.lk>
Subject: Requesting Supervision in the Final Year Research Project.

Dear Sir,

I am a 4th-year Data Science student and the leader of our research project group consisting of 3 other members, out of which 2 are Data Science students and 1 is a Software Engineering student.

We have visited your profile and found our field of interest to be aligned with your research area. We are very enthusiastic to conduct and pursue our research along with you.

I have included a brief description of the research topic and the objectives herewith and we are interested in your feedback and open to any other research topics as well.

Self-Study Help System.

We are planning to build a system to help students to study more efficiently and effectively. The main functionality of the system is to take students' study materials (initially we are planning to give input as a text file, later develop to take pdf, and PowerPoint files also), and build a knowledge graph for the material.

Using the knowledge graph the uploaded file will be divided into a collection of interlinked descriptions of concepts, entities, relationships, and events.

Once a knowledge graph is built, we will use the knowledge graph to build a question-answering system and also a summarizing system for the study material.

As examples:

- When a student uploads a file, the system generates questions for the student and also the student can view the answers later through the system.
- As another concept, when a student types a question relevant to the uploaded file, the system will provide the relevant answer.

Using these features, students can study more quickly, and effectively.

Objectives.

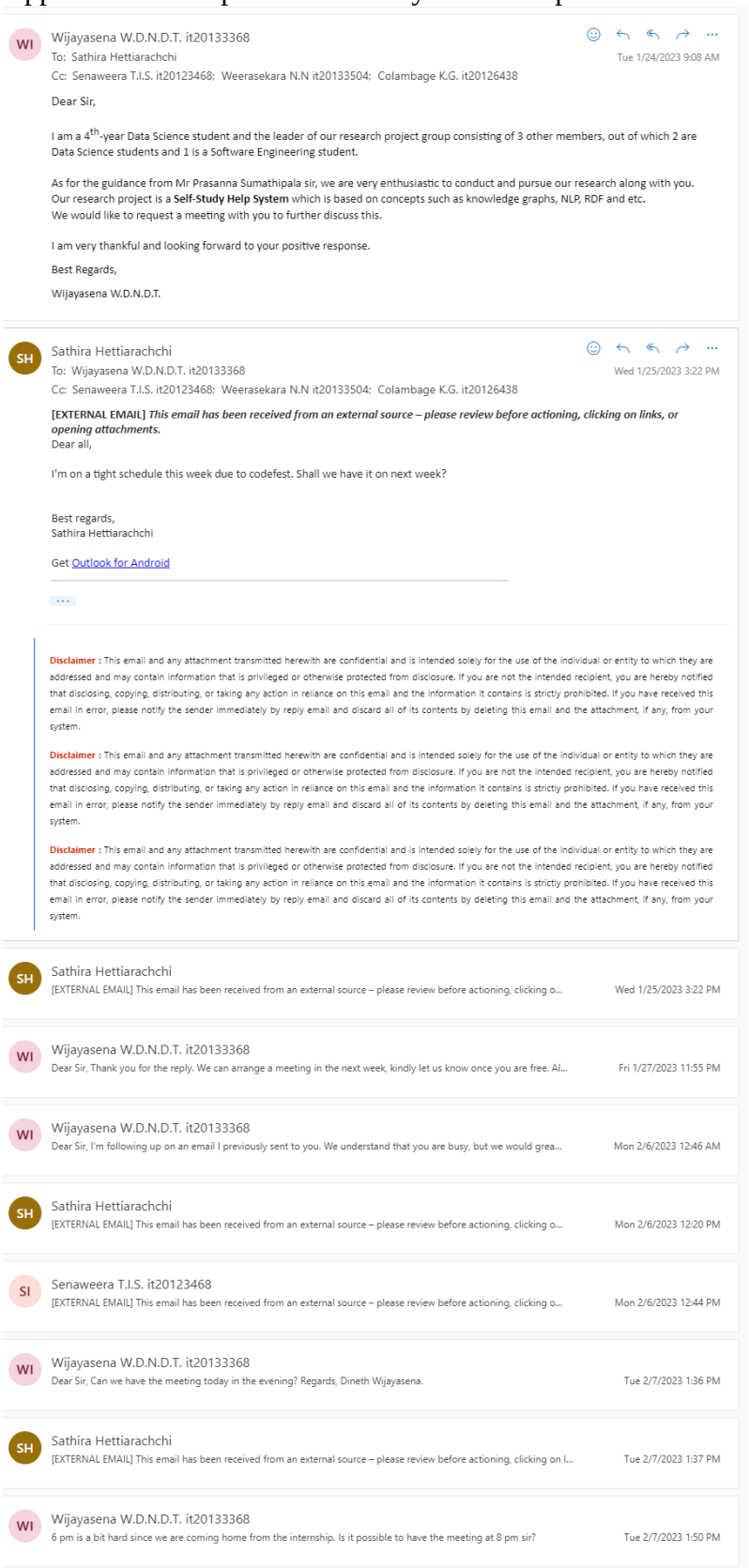
- Model to identify the knowledge graph attributes from the text.
- Build a knowledge graph for a given text file (for this, we use the attribute identification model).
- Build a question-answering system from the knowledge graph.
- Build a summarizing system from the knowledge graph.

I am very thankful and looking forward to your positive response.

Best Regards,

Wijayasena W.D.N.D.T.

Appendix 2: Acceptance E-mail by the Co-Supervisor.



WI Wijayasena W.D.N.D.T. it20133368
To: Sathira Hettiarachchi
Cc: Senaweera T.I.S. it20123468; Weerasekara N.N it20133504; Colambage K.G. it20126438
Tue 1/24/2023 9:08 AM

Dear Sir,

I am a 4th-year Data Science student and the leader of our research project group consisting of 3 other members, out of which 2 are Data Science students and 1 is a Software Engineering student.

As for the guidance from Mr Prasanna Sumathipala sir, we are very enthusiastic to conduct and pursue our research along with you.
Our research project is a **Self-Study Help System** which is based on concepts such as knowledge graphs, NLP, RDF and etc.
We would like to request a meeting with you to further discuss this.

I am very thankful and looking forward to your positive response.

Best Regards,

Wijayasena W.D.N.D.T.

SH Sathira Hettiarachchi
To: Wijayasena W.D.N.D.T. it20133368
Cc: Senaweera T.I.S. it20123468; Weerasekara N.N it20133504; Colambage K.G. it20126438
Wed 1/25/2023 3:22 PM

[EXTERNAL EMAIL] ***This email has been received from an external source – please review before actioning, clicking on links, or opening attachments.***
Dear all,

I'm on a tight schedule this week due to codefest. Shall we have it on next week?

Best regards,
Sathira Hettiarachchi

Get Outlook for Android

...

Disclaimer : This email and any attachment transmitted herewith are confidential and is intended solely for the use of the individual or entity to which they are addressed and may contain information that is privileged or otherwise protected from disclosure. If you are not the intended recipient, you are hereby notified that disclosing, copying, distributing, or taking any action in reliance on this email and the information it contains is strictly prohibited. If you have received this email in error, please notify the sender immediately by reply email and discard all of its contents by deleting this email and the attachment, if any, from your system.

Disclaimer : This email and any attachment transmitted herewith are confidential and is intended solely for the use of the individual or entity to which they are addressed and may contain information that is privileged or otherwise protected from disclosure. If you are not the intended recipient, you are hereby notified that disclosing, copying, distributing, or taking any action in reliance on this email and the information it contains is strictly prohibited. If you have received this email in error, please notify the sender immediately by reply email and discard all of its contents by deleting this email and the attachment, if any, from your system.

Disclaimer : This email and any attachment transmitted herewith are confidential and is intended solely for the use of the individual or entity to which they are addressed and may contain information that is privileged or otherwise protected from disclosure. If you are not the intended recipient, you are hereby notified that disclosing, copying, distributing, or taking any action in reliance on this email and the information it contains is strictly prohibited. If you have received this email in error, please notify the sender immediately by reply email and discard all of its contents by deleting this email and the attachment, if any, from your system.

SH Sathira Hettiarachchi
[EXTERNAL EMAIL] This email has been received from an external source – please review before actioning, clicking o... Wed 1/25/2023 3:22 PM

WI Wijayasena W.D.N.D.T. it20133368
Dear Sir, Thank you for the reply. We can arrange a meeting in the next week, kindly let us know once you are free. Al... Fri 1/27/2023 11:55 PM

WI Wijayasena W.D.N.D.T. it20133368
Dear Sir, I'm following up on an email I previously sent to you. We understand that you are busy, but we would grea... Mon 2/6/2023 12:46 AM

SH Sathira Hettiarachchi
[EXTERNAL EMAIL] This email has been received from an external source – please review before actioning, clicking o... Mon 2/6/2023 12:20 PM

SI Senaweera T.I.S. it20123468
[EXTERNAL EMAIL] This email has been received from an external source – please review before actioning, clicking o... Mon 2/6/2023 12:44 PM

WI Wijayasena W.D.N.D.T. it20133368
Dear Sir, Can we have the meeting today in the evening? Regards, Dineth Wijayasena. Tue 2/7/2023 1:36 PM

SH Sathira Hettiarachchi
[EXTERNAL EMAIL] This email has been received from an external source – please review before actioning, clicking on l... Tue 2/7/2023 1:37 PM

WI Wijayasena W.D.N.D.T. it20133368
6 pm is a bit hard since we are coming home from the internship. Is it possible to have the meeting at 8 pm sir? Tue 2/7/2023 1:50 PM