



## 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)

TeaBot: Tea plantation preservation using an intelligent robot

RESEARCH GROUP

(As per the Topic  
Assessment Form)

Robotics & Intelligent Systems

PROJECT NUMBER

(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 | Gunawardana I.I.E  | IT19973470  | 077 678 8890 | it19973470@my.sliit.lk |
| 2 | Perera P.V.Y       | IT20382476  | 071 881 8052 | it20382476@my.sliit.lk |
| 3 | Premathilake H.T.M | IT20265410  | 076 553 5277 | it20265410@my.sliit.lk |
| 4 | Bamunusinghe G.P   | IT20011970  | 076 640 9484 | it20011970@my.sliit.lk |

**SUPERVISOR, CO\_ SUPERVISOR Details**

| <b>SUPERVISOR Name</b>         | <b>CO-SUPERVISOR Name</b>      |
|--------------------------------|--------------------------------|
| Ms. Shashika Lokuliyana        | Ms. Narmada Gamage             |
| <b>Signature</b>               | <b>Signature</b>               |
| Attach the email as Appendix 1 | Attach the email as Appendix 1 |
| 24.03.2023                     | 24.03.2023                     |
| <b>Date</b>                    | <b>Date</b>                    |

**EXTERNAL SUPERVISOR Details** (if any, may be from the industry)

|                      |                       |                  |                 | Attach the email as Appendix 3   |
|----------------------|-----------------------|------------------|-----------------|--|
| Name                 | Affiliation           | Contact Address  | Contact Numbers | Signature/Date   |
| Mr. Rajitha De Silva | University of Lincoln | rajitha@ieee.org | 0717605538      |  |

**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)

In large-scale tea estates, ensuring proper watering, and fertilizing tea plants precisely has been a challenge. Despite attempts to improve this process through various techniques, these efforts have not achieved the desired results due to issues such as inefficient resource usage, high costs, and a shortage of labor [1]. Additionally, acquiring a large workforce drastically increases expenses. The task of accurately and punctually watering and fertilizing tea plantations with manual labor is not feasible and, in some situations, it has been inefficient.

A lot of manpower is required to maintain large-scale tea estates. Moreover, in some regions due to socialization, there are only a few people engaged as laborers, and high labor salaries, and irresponsible tasks done by the laborers have led to resource wastage. Carrying the day-to-day activities of a large-scale tea plantation has been a huge challenge due to these occurrences. Disadvantages are identified using an interview done with largescale tea estate owners. A reference from a tea estate owner is attached. The economic crisis in Sri Lanka has led to huge expenses and resource utilization. Gaining a considerable amount of profit is harder.

Automatic watering systems have been implemented to overcome these matters and maintain tea plantations effectively. Such as Center Pivot Irrigation, Drip Irrigation. In the Center Pivot Irrigation system, the required services and maintenance must be supplied at the correct time, or else the system will break down, frequent replacement of sprinkler nozzles are needed, which involves a large amount of initial cost. For some soil conditions like clayey soil, some wheeled machines, there is a chance the wheels getting stuck [2]. When it comes to the Drip Irrigation system, implementing the system requires a high initial cost. Also, the short lifespan of pipes in this system needs frequent maintenance [3]. In the matter of fertilizing systems, also have negative impacts on large-scale Agri-fields.

An approach, manual robots are developed for fertilizer feeding and spraying, and harvesting but operating the robot manually requires trained employees, and the robot is only limited to fertilization and harvesting [4]. These robots are tested on flat and straight lands and are not suitable for varying environmental lands. Also, tea-plucking robots have been developed and human interactions are essential for robot navigation [5].

By considering all the facts of aforementioned systems also do not fulfill the requirements, so a novel system should be suggested to increase the process efficiently.

- [1] S. A. O'Shaughnessy et al., "Identifying Advantages and Disadvantages of Variable Rate Irrigation: An Updated Review," *Appl. Eng. Agric.*, vol. 35, no. 6, pp. 837–852, 2019, doi: 10.13031/aea.13128.
- [2] A. Shilpa, V. Muneeswaran, and D. Devi Kala Rathinam, "A Precise and Autonomous Irrigation System for Agriculture: IoT Based Self Propelled Center Pivot Irrigation System," 2019 5th Int. Conf. Adv. Comput. Commun. Syst. ICACCS 2019, pp. 533–538, Mar. 2019, doi: 10.1109/ICACCS.2019.8728550.
- [3] B. Jayant, K. Dahiya, A. Rukhiyar, R. Raj, and R. K. Meena, "A REVIEW OF THE DRIP IRRIGATION SYSTEM," *J. Eng. Res. Appl.*, vol. 01, no. 01, 2022, doi: 10.55953/JERA.2022.1103.
- [4] R. Polvara, F. Del Duchetto, G. Neumann, and M. Hanheide, "Navigate-and-Seek: A Robotics Framework for People Localization in Agricultural Environments," *IEEE Robot. Autom. Lett.*, vol. 6, no. 4, pp. 6577–6584, Oct. 2021, doi: 10.1109/LRA.2021.3094557.
- [5] Y. L. Lai, P. L. Chen, and P. L. Yen, "A Human-Robot Cooperative Vehicle for Tea Plucking," 7th Int. Conf. Control. Decis. Inf. Technol. CoDIT 2020, pp. 217–222, Jun. 2020, doi: 10.1109/CODIT49905.2020.9263925.

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

**Main Objective:** To implement a smart robot for the tea plantation to water and fertilize the tea plants in an efficient way.

**Sub Objective 1:** To develop an algorithm for the robot controller to navigate the robot with the coordinates given by the computer vision and identify hazards.

**Sub Objective 2:** To develop an image segmentation algorithm to detect the tea plantation rows in varying environmental conditions for the automatic navigation of the robot and detecting the end of the tea plantation path.

**Sub Objective 3:** To develop an image processing algorithm to precisely identify the end of the stem and pass the coordinators to the robot controller.

**Sub Objective 4:** To develop an algorithm to operate the water spraying function in real-time with respect to the relative movement of the robot.

**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)

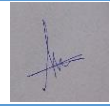


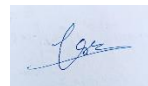
|  |                                  |
|--|----------------------------------|
| MEMBER 1   | Gunawardana I.I.E<br>IT19973470  |
| <ul style="list-style-type: none"> <li>▪ Creating the robot chassis and the mechanical parts.</li> <li>▪ Creating the PID(Proportional Integral Derivative) controller to navigate the robot.</li> <li>▪ Creating the robot's autonomous drive with the given coordinates by the computer vision and creating the manual controller for the robot.</li> <li>▪ Identify the front-facing hazard object using yolov5 and capture the distance to the object using ultrasonic sensors and emergency stop the robot, then notify the administrator.</li> </ul> |                                  |
| MEMBER 2   | Perera P.V.Y<br>IT20382476       |
| <ul style="list-style-type: none"> <li>▪ Collect the dataset, and apply data transforming, and normalizing techniques.</li> <li>▪ Select the most suitable image segmentation model to detect the crop rows considering the above requirements.</li> <li>▪ Develop the image segmentation model to detect the tea plantation rows.</li> <li>▪ Train the image segmentation model, apply hyperparameter tuning techniques, and test the model.</li> <li>▪ Deploy the model to the robot controller.</li> </ul>  |                                  |
| MEMBER 3   | Premathilake H.T.M<br>IT20265410 |
| <ul style="list-style-type: none"> <li>▪ Initially identify the data requirements and gather the dataset.</li> <li>▪ Apply data preprocessing techniques for the collected dataset.</li> <li>▪ Select an image processing algorithm to develop the model.</li> <li>▪ Training an image processing algorithm to detect the endpoint of a stem.</li> <li>▪ Testing the model and tune its hyperparameters to improve its performance.</li> <li>▪ Deploy the model to the "TeaBot" robot controller.</li> </ul>   |                                  |
| MEMBER 4   | Bamunusinghe G.P                 |

|  |
|--|
| IT20011970   |
| <ul style="list-style-type: none"> <li>▪ Creating the hardware mechanism for water spraying.</li> <li>▪ Tuning the water spray motors according to the robot's motion.</li> <li>▪ Spraying water to the plants according to the relative velocity of the robot by using the 4 nozzles (nozzles will be controlled with stepper motors) to the groups of plants.</li> </ul> |

#### 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 | Gunawardana I.I.E  | IT19973470  |  |
| 2 | Perera P.V.Y       | IT20382476  |  |
| 3 | Premathilake H.T.M | IT20265410  |  |
| 4 | Bamunusinghe G.P   | IT20011970  |  |

Appendix 1 :



IT4010 – Research Project - 2023

Topic Assessment Form

## 10. Supervisor checklist (supervisors should fill sections 10 and 11)

a) Is this research problem valid?

Yes ☒ No ☐

b) Is the proposed research group correct?

Yes ☒ No ☐

c) Is the proposed research area correct?

Yes ☒ No ☐

d) Do the proposed sub-objectives match the students' specialization?

Yes ☒ No ☐

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

Yes ☒ No ☐

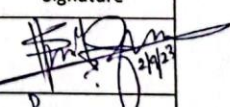
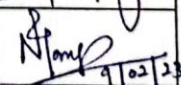

f) Is the scope of the solution practical?

Yes ☒ No ☐

g) Do all sub-objectives have sufficient novelty?


Yes ☒ No ☐

## 11. Supervisor details


|  | Title | First Name | Last Name  | Signature   |
|--|-------|------------|------------|---|
| Supervisor   | Ms.   | Shashika   | Lokuliyana |  |
| Co-Supervisor  | Ms.   | Narmada    | Gamage     |  |
| External Supervisor  | Mr.   | Rajitha    | De Silva   |  |
| Summary of external supervisor's (if any) experience and expertise<br>He is a Ph.D. Scholar at the University of Lincoln. He is reading his Ph.D., in agricultural robotics. |       |            |            |   |




## Appendix 2 :





Gunawardana I.I.E. it19973470 <it19973470@my.sliit.lk>



Thu 2/2/2023 12:35 PM

To:  Narmada Gamage

Cc:  Hettiarachchi T. C. D. S. it19206806;  Perera P.V.Y. it20382476 +2 others

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


Dear Madam,

We are a group of SE, IT, and DS. We would like to have you as our final year research project co-supervisor because the previous year's student who did Tangi Guru, Thiwanka Cholitha, recommended you as a supportive co-supervisor. So, we discussed many research areas and identified that increasing the productivity of agricultural fields will be a good impact on Sri Lanka.


As our topic, we have chosen to develop, an agriculture robot for large-scale agriculture fields. We are looking forward to a positive reply from you.

Thank you!


Best Regards,  
Gunawardana I.I.E



Narmada Gamage <narmada.g@sliit.lk>



Thu 2/2/2023 12:40 PM

To:  Gunawardana I.I.E. it19973470

Cc:  Hettiarachchi T. C. D. S. it19206806;  Perera P.V.Y. it20382476 +2 others

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


Dear students,

I would like to co-supervise the project


BR



**SLIIT UNI**  
THE KNOWLEDGE UNIVERSITY



**ICAC**



**Narmada Gamage**  
Lecturer  
Department of CSE  
SLIIT | Malabe Campus  
+94 117 543925 | +94 717 404036

## Appendix 3 :

