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# STATUS DOCUMENT 1

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“TeaBot” – Tea plantation preservation using an intelligent robot.



STUDENT NAME: Perera P.V.Y.

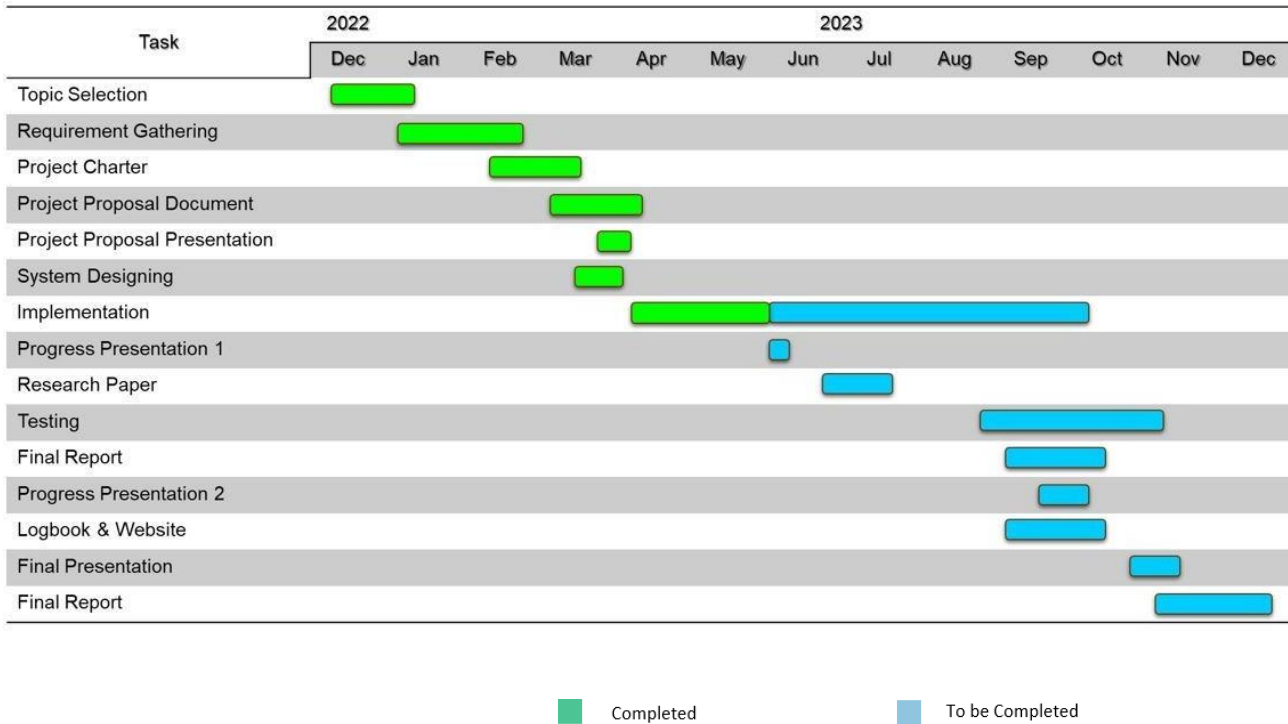
STUDENT NUMBER: IT20382476

GROUP ID:2023-044

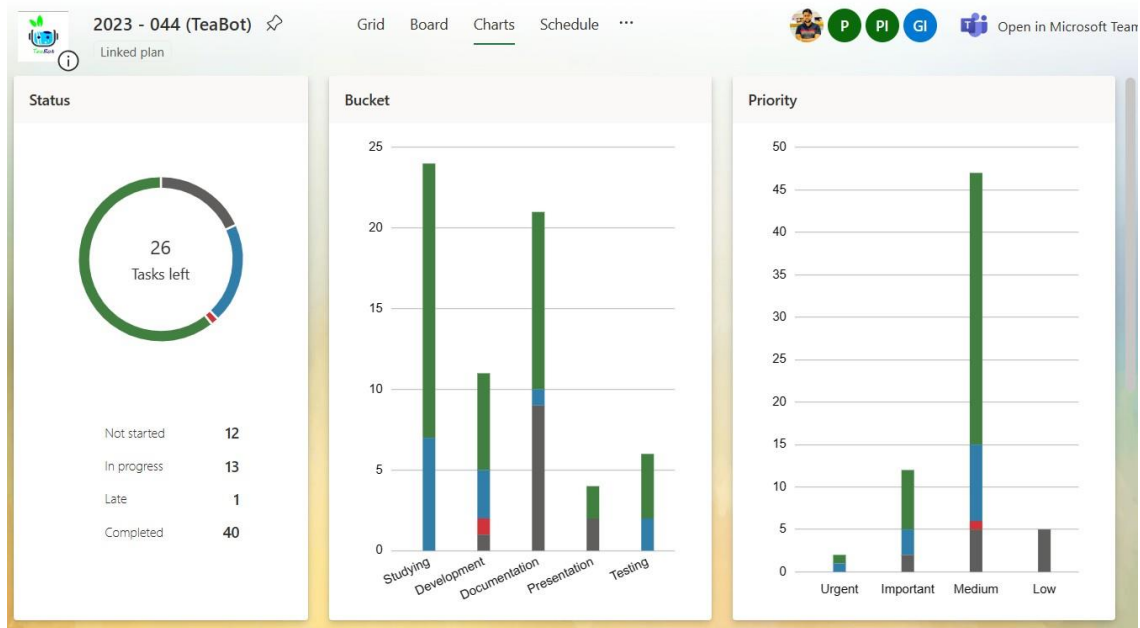
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# 1 GANNT CHART



## 2 PROJECT VIEWS MS PLANNER



Perera P.V.Y. it20382476

+ Add task

Studying

☐ Tuning the robot arm

### 3 WORK BREAK DOWN STRUCTURE MS PLANNER

2023 - 044 (TeaBot) Linked plan

Grid Board Charts Schedule ...

Open in Microsoft Teams Members Filter (0) Group by

#### Studying

- + Add task
- 06/28
- Communicating with the robot controller
- 07/14
- Researching regarding how to calculate the navigation angle of the TeaBot robot
- 07/06
- Researched Hough Transformer
- 06/29

#### Development

- + Add task
- Developing the emergency stop
- 07/17
- Program the motors with arduino
- 04/10
- Developing the MQTT for remote
- 07/05
- Developing the UNet model
- 07/03

#### Documentation

- + Add task
- Research Logbook
- 10/30
- Final Report - IT20265410
- 09/10
- Final Report - IT20382476
- 09/10
- Final Report - IT20011970
- 09/10
- Final Report - IT19973470

#### Presentation

- + Add task
- Final Presentation and Viva
- 09/28
- Progress Presentation-II
- 07/24
- Completed tasks 2

2023 - 044 (TeaBot) Linked plan

Grid Board Charts Schedule ...

Open in Microsoft Teams Members Filter (0) Group by Buck

#### Development

- + Add task
- Developing the emergency stop
- 07/17
- Program the motors with arduino
- 04/10
- Developing the MQTT for remote
- 07/05
- Developing the UNet model
- 07/03

#### Documentation

- + Add task
- Research Logbook
- 10/30
- Final Report - IT20265410
- 09/10
- Final Report - IT20382476
- 09/10
- Final Report - IT20011970
- 09/10
- Final Report - IT19973470

#### Presentation

- + Add task
- Final Presentation and Viva
- 09/28
- Progress Presentation-II
- 07/24
- Completed tasks 2

#### Testing

- + Add task
- Testing the robot movements in different terrains
- 07/20
- Testing the ML models in the testing field
- 07/21
- Completed tasks 4

## 4 EMAILS, MEETINGS WITH SUPERVISOR, CO-SUPERVISOR

Requesting for an Available Time Slot on 23rd Sunday to Discuss "TeaBot" Research Project

GI Gunawardana I.I.E. it19973470 <it19973470@my.sliit.lk> To: Shashika Lokuliyana Cc: Perera P.V.Y. it20382476; Premathilake H. T. M it20265410 +1 other Wed 4/19/2023 11:25 AM

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

Dear Madam,

You mentioned us previously to meet on 23rd of Sunday after 12:30 PM to discuss the progress of our "TeaBot" research project. Could you kindly let me know if there is any availability on Sunday 23rd to discuss about the research?

Thank you for your time and consideration.

Best regards,  
Gunawardana I.I.E (IT19973470)

Requesting for an Available Time Slot on 14th Sunday to Discuss "TeaBot" Research Project

GI Gunawardana I.I.E. it19973470 <it19973470@my.sliit.lk> To: Shashika Lokuliyana Cc: Perera P.V.Y. it20382476; Premathilake H. T. M it20265410 +1 other Wed 5/10/2023 5:48 PM

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

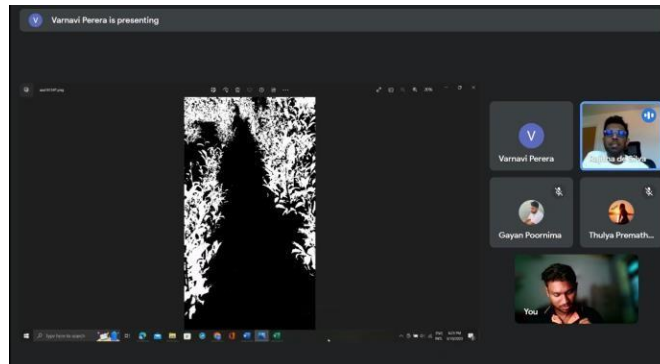
Dear Madam,

As per the previous discussion, we discussed to meet again on 14th of Sunday to see the progress of our "TeaBot" research project. Could you kindly let me know if there is any availability on Sunday 14th to discuss the research?

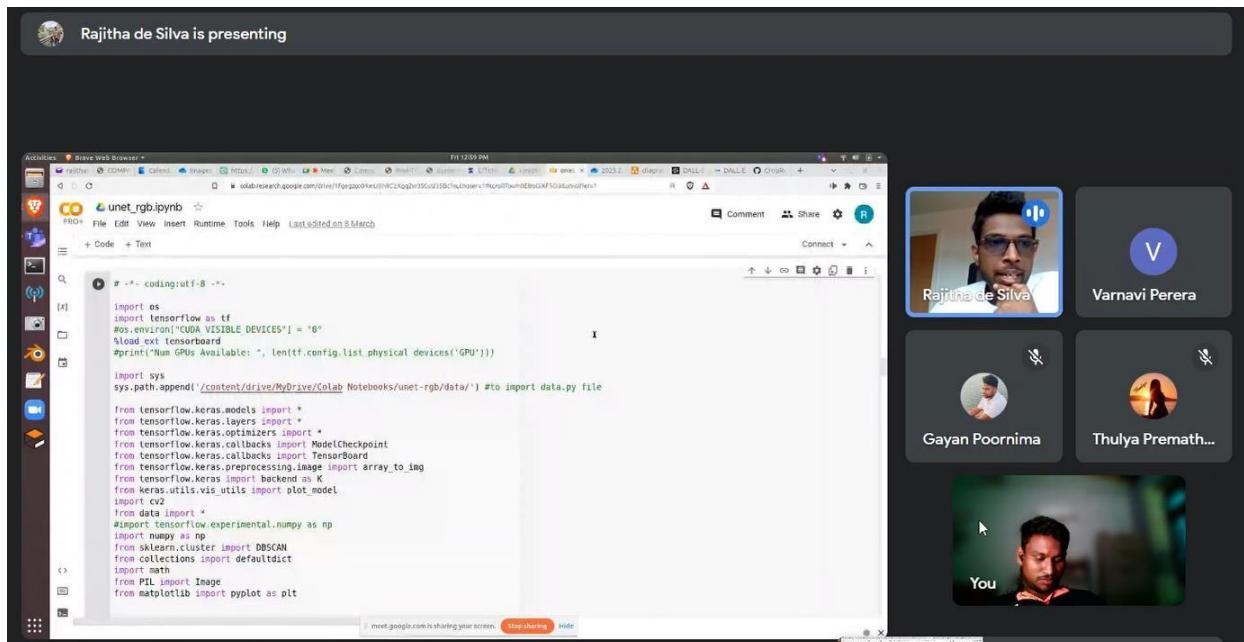
Thank you for your time and consideration.

Best regards,  
Gunawardana I.I.E (IT19973470)

Screenshots of meetings about dataset collection, and data labeling methods for automatic navigation & spraying with external supervisor Dr Rajitha De Silva



Discussions regarding Model Development.



Whatsapp conversations with the external supervisor.





## 5 Ms TEAMS AND CALLS

General Posts Files Tasks + Meet

proportional-integral-derivative

Hettiarachchi T. C. D. S. it19206806 2/8 10:51 AM  
PhD Candidate at University of Lincoln

Bamunusinghe G.P it20011970 2/8 10:52 AM  
Water is sprayed to the tree root using a water spraying mechanism. Basically, physics governs everything. Using computer visualization, we must determine the location of the tree's root and its distance from the surface. After determining the speed of the moving object, the water must be accurately sprayed at the root by adjusting the angle of the water spray nozzle. There are numerous variables in this mathematical parabolic water spraying system. Vehicle speed, root distance, water mixture density, water

See more

<https://onlinelibrary.wiley.com/doi/abs/10.1002/ps.2780330403>

[https://ieeexplore.ieee.org/abstract/document/9844341?casa\\_token=hj5eKl8-ldQAAAA:KWckZCBzKXhJEmFi\\_nigpjp5Mpw5h316oVitO\\_pBNov0rOjVnyUdpqAHsxzfX\\_veeJKQ24hT8F5tSU4](https://ieeexplore.ieee.org/abstract/document/9844341?casa_token=hj5eKl8-ldQAAAA:KWckZCBzKXhJEmFi_nigpjp5Mpw5h316oVitO_pBNov0rOjVnyUdpqAHsxzfX_veeJKQ24hT8F5tSU4)

**IEEE Xplore®**  
**Design and development an Agriculture robot for Seed sowing, Water spray and Fertigation**  
Agriculture is one of the oldest activities practiced by man. Due to its importance in our daily life and reliance on it, many technologists try to update a new development based on agricultural ro...

<https://www.sciencedirect.com/science/article/abs/pii/S0304388601000407>

**ELECTROSTATICS**  
**Agricultural electrostatic spray application: a review of significant research and development during the...**  
Electrostatic force fields are currently exploited for beneficially increasing the deposition efficiency of finely divided particulate matter used as ...

<https://www.sciencedirect.com/science/article/pii/S0048969721061805>

General Posts Files Tasks + Meet

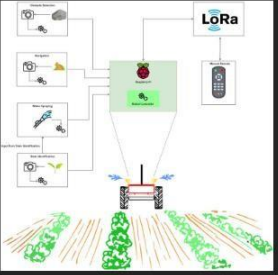
TA (1).docx

agri robot.pdf

Meeting ended: 3h 54m

Attendance report  
Click here to download attendance report

Reply



## 6 Prototype

Screenshot for the development of the mask

```
Creating training images...  
['/content/drive/MyDrive/TeaBot Research Dataset/TEABOT/model/train/image/145.jpg', '/content/dr  
Done: 0/614 images  
Done: 100/614 images  
Done: 200/614 images  
Done: 300/614 images  
Done: 400/614 images  
Done: 500/614 images  
Done: 600/614 images  
loading done  
Saving to .npy files done.  
Creating testall images...  
loading done  
Saving to .npy files done.  
Creating test images...  
loading done  
Saving to imgs_test.npy files done.  
Creating validation images...  
loading done  
Saving to .npy files done.
```

## Model Development

```
KerasTensor(type_spec=TensorSpec(shape=(None, 32, 32, 64), dtype=tf.float32, name=None), name='conv2d_21/ReLU')
conv9_shape: (None, 32, 32, 2)
KerasTensor(type_spec=TensorSpec(shape=(None, 32, 32, 1), dtype=tf.float32, name=None), name='conv2d_23/Sigmoid')
Model: "model"
```

Layer (type)	Output Shape	Param #	Connected to
input_1 (InputLayer)	[(None, 32, 32, 3)]	0	[]
conv2d (Conv2D)	(None, 32, 32, 64)	1792	['input_1[0][0]']
conv2d_1 (Conv2D)	(None, 32, 32, 64)	36928	['conv2d[0][0]']
max_pooling2d (MaxPooling2D)	(None, 16, 16, 64)	0	['conv2d_1[0][0]']
conv2d_2 (Conv2D)	(None, 16, 16, 128)	73856	['max_pooling2d[0][0]']
conv2d_3 (Conv2D)	(None, 16, 16, 128)	147584	['conv2d_2[0][0]']
max_pooling2d_1 (MaxPooling2D)	(None, 8, 8, 128)	0	['conv2d_3[0][0]']
conv2d_4 (Conv2D)	(None, 8, 8, 256)	295168	['max_pooling2d_1[0][0]']
conv2d_5 (Conv2D)	(None, 8, 8, 256)	590080	['conv2d_4[0][0]']
max_pooling2d_2 (MaxPooling2D)	(None, 4, 4, 256)	0	['conv2d_5[0][0]']
conv2d_6 (Conv2D)	(None, 4, 4, 32)	73760	['max_pooling2d_2[0][0]']
conv2d_7 (Conv2D)	(None, 4, 4, 32)	9248	['conv2d_6[0][0]']
dropout (Dropout)	(None, 4, 4, 32)	0	['conv2d_7[0][0]']
max_pooling2d_3 (MaxPooling2D)	(None, 2, 2, 32)	0	['dropout[0][0]']

conv2d_6 (Conv2D)	(None, 4, 4, 32)	73760	['max_pooling2d_2[0][0]']
conv2d_7 (Conv2D)	(None, 4, 4, 32)	9248	['conv2d_6[0][0]']
dropout (Dropout)	(None, 4, 4, 32)	0	['conv2d_7[0][0]']
max_pooling2d_3 (MaxPooling2D)	(None, 2, 2, 32)	0	['dropout[0][0]']
conv2d_8 (Conv2D)	(None, 2, 2, 1024)	295936	['max_pooling2d_3[0][0]']
conv2d_9 (Conv2D)	(None, 2, 2, 1024)	9438208	['conv2d_8[0][0]']
dropout_1 (Dropout)	(None, 2, 2, 1024)	0	['conv2d_9[0][0]']
up_sampling2d (UpSampling2D)	(None, 4, 4, 1024)	0	['dropout_1[0][0]']
conv2d_10 (Conv2D)	(None, 4, 4, 32)	131104	['up_sampling2d[0][0]']
concatenate (Concatenate)	(None, 4, 4, 64)	0	['dropout[0][0]', 'conv2d_10[0][0]']
conv2d_11 (Conv2D)	(None, 4, 4, 32)	18464	['concatenate[0][0]']
conv2d_12 (Conv2D)	(None, 4, 4, 32)	9248	['conv2d_11[0][0]']
up_sampling2d_1 (UpSampling2D)	(None, 8, 8, 32)	0	['conv2d_12[0][0]']
conv2d_13 (Conv2D)	(None, 8, 8, 256)	33024	['up_sampling2d_1[0][0]']
concatenate_1 (Concatenate)	(None, 8, 8, 512)	0	['conv2d_5[0][0]', 'conv2d_13[0][0]']
conv2d_14 (Conv2D)	(None, 8, 8, 256)	1179904	['concatenate_1[0][0]']

```

concatenate_3 (Concatenate)      (None, 32, 32, 128)  0      ['conv2d_1[0][0]',
                                     'conv2d_19[0][0]']

conv2d_20 (Conv2D)                (None, 32, 32, 64)   73792   ['concatenate_3[0][0]']

conv2d_21 (Conv2D)                (None, 32, 32, 64)   36928   ['conv2d_20[0][0]']

conv2d_22 (Conv2D)                (None, 32, 32, 2)    1154    ['conv2d_21[0][0]']

conv2d_23 (Conv2D)                (None, 32, 32, 1)     3      ['conv2d_22[0][0]']

```

```

=====
Total params: 13,642,917
Trainable params: 13,642,917
Non-trainable params: 0

```

```

loading data
load train images...
-----
load test images...
-----
load test label images...
-----
load train images...
loading data done
conv1 shape: (None, 32, 32, 64)
conv1 shape: (None, 32, 32, 64)
pool1 shape: (None, 16, 16, 64)
conv2 shape: (None, 16, 16, 128)
conv2 shape: (None, 16, 16, 128)
pool2 shape: (None, 8, 8, 128)
conv3 shape: (None, 8, 8, 256)

```

```

KerasTensor(type_spec=TensorSpec(shape=(None, 8, 8, 512), dtype=tf.float32, name=None), name='concatenate_5/concat:0', description="created by I
KerasTensor(type_spec=TensorSpec(shape=(None, 8, 8, 256), dtype=tf.float32, name=None), name='conv2d_38/Relu:0', description="created by I
KerasTensor(type_spec=TensorSpec(shape=(None, 8, 8, 256), dtype=tf.float32, name=None), name='conv2d_39/Relu:0', description="created by I
KerasTensor(type_spec=TensorSpec(shape=(None, 32, 32, 64), dtype=tf.float32, name=None), name='conv2d_43/Relu:0', description="created by I
KerasTensor(type_spec=TensorSpec(shape=(None, 32, 32, 128), dtype=tf.float32, name=None), name='concatenate_7/concat:0', description="crea
KerasTensor(type_spec=TensorSpec(shape=(None, 32, 32, 64), dtype=tf.float32, name=None), name='conv2d_44/Relu:0', description="created by
KerasTensor(type_spec=TensorSpec(shape=(None, 32, 32, 64), dtype=tf.float32, name=None), name='conv2d_45/Relu:0', description="created by
conv9 shape: (None, 32, 32, 2)
KerasTensor(type_spec=TensorSpec(shape=(None, 32, 32, 1), dtype=tf.float32, name=None), name='conv2d_47/Sigmoid:0', description="created b
got unet
Fitting model...
Epoch 1/2
WARNING:tensorflow:5 out of the last 5 calls to <function _BaseOptimizer.update_step_xla at 0x7faa502ddcf0> triggered tf.function retrac
WARNING:tensorflow:6 out of the last 6 calls to <function _BaseOptimizer.update_step_xla at 0x7faa502ddcf0> triggered tf.function retrac
491/491 [=====] - ETA: 0s - loss: 0.3750 - accuracy: 0.7989 - iou: 0.2100
Epoch 1: iou improved from -inf to 0.21002, saving model to /content/drive/MyDrive/TeaBot Research Dataset/TEABOT/model/model.hdf5
491/491 [=====] - 79s 126ms/step - loss: 0.3750 - accuracy: 0.7989 - iou: 0.2100 - val_loss: 0.4103 - val_accuac
Epoch 2/2
491/491 [=====] - ETA: 0s - loss: 0.3490 - accuracy: 0.8245 - iou: 0.2227
Epoch 2: iou improved from 0.21002 to 0.22273, saving model to /content/drive/MyDrive/TeaBot Research Dataset/TEABOT/model/model.hdf5
491/491 [=====] - 60s 122ms/step - loss: 0.3490 - accuracy: 0.8245 - iou: 0.2227 - val_loss: 0.4126 - val_accuac
Epoch 1/4
307/307 [=====] - ETA: 0s - loss: 0.3463 - accuracy: 0.8389 - iou: 0.2614
Epoch 1: iou improved from 0.22273 to 0.26144, saving model to /content/drive/MyDrive/TeaBot Research Dataset/TEABOT/model/model.hdf5
307/307 [=====] - 38s 119ms/step - loss: 0.3463 - accuracy: 0.8389 - iou: 0.2614
Epoch 2/4
307/307 [=====] - ETA: 0s - loss: 0.3410 - accuracy: 0.8428 - iou: 0.2651
Epoch 2: iou improved from 0.26144 to 0.26513, saving model to /content/drive/MyDrive/TeaBot Research Dataset/TEABOT/model/model.hdf5
307/307 [=====] - 35s 116ms/step - loss: 0.3410 - accuracy: 0.8428 - iou: 0.2651
Epoch 3/4
307/307 [=====] - ETA: 0s - loss: 0.3380 - accuracy: 0.8439 - iou: 0.2673
Epoch 3: iou improved from 0.26513 to 0.26734, saving model to /content/drive/MyDrive/TeaBot Research Dataset/TEABOT/model/model.hdf5
307/307 [=====] - 35s 115ms/step - loss: 0.3380 - accuracy: 0.8439 - iou: 0.2673
Epoch 4/4

```