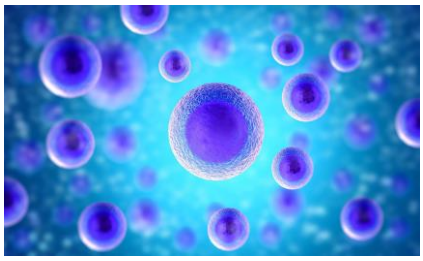
A
Project Report
On
"Cell Counter System"

(CE345 – Software Group Project-2)



Prepared by

17CE025 Jay Desai
17CE026 Shubham Dhameliya
17CE030 Aayush Gajjar
17CE036 Nimesh Italiya
17CE041 Kapil Kapuriya
17CE045 Isha Khimsuriya

Under the Supervision of
Prof. Amrin Shaikh

Submitted to

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Degree of Bachelor of Technology (B.Tech.)
in Computer Engineering (CE)
for 5th semester B.Tech.

Submitted at

CHARUSAT
CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
Accredited with Grade A by NAAC
Accredited with Grade A by KCG

U & P U. PATEL DEPARTMENT OF COMPUTER ENGINEERING
(NBA Accredited)
Chandubhai S. Patel Institute of Technology (CSPIT)
Faculty of Technology & Engineering (FTE), CHARUSAT
At: Changa, Dist: Anand, Pin: 388421.

October, 2019

DECLARATION BY THE CANDIDATES

We hereby declare that the project report entitled "**Cell Counter System**" submitted by us to Chandubhai S. Patel Institute of Technology, Changa in partial fulfilment of the requirement for the award of the degree of **B.Tech** in Computer Engineering, from U & P U. Patel Department of Computer Engineering, CSPIT/FTE, is a record of bonafide CE345 Software Group Project-2 (project work) carried out by us under the guidance of **Assistant Prof. Amrin Shaikh**. We further declare that the work carried out and documented in this project report has not been submitted anywhere else either in part or in full and it is the original work, for the award of any other degree or diploma in this institute or any other institute or university.

Jay Desai (17CE025)
Shubham Dhameliya(17CE026)
Ayush Gajjar (17CE030)
Nimesh Italiya (17CE036)
Kapil Kimsuriya (17CE041)
Isha Khimsuriya (17CE045)

Prof. Amrin Shaikh
Assistant Professor
U & P U. Patel Department of Computer Engineering,
CSPIT/FTE, CHARUSAT-Changa.

CHAROTAR UNIVERSITY OF SCIENCE AND TECHNOLOGY

Accredited with Grade A by NAAC
Accredited with Grade A by KCG

CERTIFICATE

This is to certify that the report entitled "**Cell Counter System**" is a bonafied work carried out by **Jay(17CE025), Shubham(17CE026), Ayush(17CE030), Nimesh(17CE036),Kapil(17CE041) and Isha(17CE045).**
and under the guidance and supervision of **Assistant Prof. Amrin Shaikh** for the subject **Software Group Project-2 (CE345)** of 5th Semester of Bachelor of Technology in **Computer Engineering** at Chandubhai S. Patel Institute of Technology (CSPIT), Faculty of Technology & Engineering (FTE) – CHARUSAT, Gujarat.

To the best of my knowledge and belief, this work embodies the work of candidate themselves, has duly been completed, and fulfills the Partial requirement of the ordinance relating to the B.Tech. Degree of the University and is up to the standard in respect of content, presentation and language for being referred by the examiner(s).

Under the supervision of,

Prof. Amrin Shaikh
Assistant Professor
U & P U. Patel Dept. of Computer Engineering.
CSPIT/FTE, CHARUSAT, Changa, Gujarat

Dr. Ritesh Patel
Head - U & P U. Patel Department of Computer Engineering,
CHARUSAT, Changa, Gujarat.

ABSTRACT

This is ERA in which the most important for everyone is “TIME” and all people tried very hard to save their time and perform more activities effectively. This project is to punch on this and save lot of efforts. This system is mainly for biological and pharmaceutical students, faculties and researchers. This system takes input as image of hemocytometer containing cells and count on behalf of them with greater accuracy along with in less amount of time which will increase productivity/research timespan by saving time from counting it manually.

This System provides modules like “Spore Counting”, “RBC Counting” , “WBC Counting” , “Platelet Counting” , “Bacteria Counting” and last option is “Other” in which user need to import image as well as select references from image and upon choice of user only those kind of cells will detect by system. So, if user demands for any more category then work on this last module and get benefit of this system as there are infinite diversity in this field so One can not limit it for any 3 to 5 types of cell only.

ACKNOWLEDGEMENT

It is a great feeling of satisfaction that we present our real venture in practical computing in the form of a project work. It is also a matter of privilege and an honor for us to work on the project "Cell Counter System".

Certainly, the project could not have been completed without the valuable suggestion and guidance from various sources. At the vary honest we would like to express our sincere gratitude to Assistant Prof. Amrin Shaikh for their valuable guidance during the project.

We are very grateful to our college for Chandubhai S. Patel Institute Of Technology in which we are going to submit our project. We would also like to thank all our lecturers who helped us entirely throughout our project.

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Chapter 1 - INTRODUCTION

1.1 PROJECT SUMMARY

An automatic counter for cells taken from hemocytometer with greater accuracy lead towards savings of time for students, faculties and researcher of the field of biology and pharmacy. Project contains total 6 modules including spore, rbc, wbc, platelet, bacteria and other module but last module is only for flexibility provide to user that in this filed there are millions of species of single spore so It is impossible to cover all species so in last module user have to select references from image and then based on choice of user, image will be trained and detected and return count to user. More you choose references , more accurate count will user get.

1.2 PURPOSE

The purpose behind opting this idea is to have knowledge about cross domain first and then it is something like that type of problem that never often understood by people and not having taken into consideration before. By automatic counter saves time of all including students, faculties and researchers and many more who are included in counting cells from microscopic image manually with higher percent of accuracy. Another big agenda is to gain experience in solving real time problem which is became more demandable nowadays.

1.3 OBJECTIVE

- To increase efficiency
- To save time
- To determine and maintain spore load
- To figure out validity of fertilizers
- To determine efficiency of drugs
- To check underlying conditions

1.4 SCOPE

- Software only provides counter
- Analysis of output is not determined by software
- Result depends on dataset either created by user or having data on machine
- Variations in this field is in millions so exact detection not possible practically
- It cannot differentiate 2 cells if both are overlapping completely or coordinates of both cells are nearly same.

Chapter 2 – PROJECT MANAGEMENT

2.1 PROJECT PLANNING

2.1.1 Project Development Approach and Justification

This system follows *ITERARIVE MODEL* from various SDLC models as following criteria's are satisfied :

For iterative model	Applied on System
Requirements of the complete system are clearly defined and understood.	Requirements of system is counting microscopic cell from image which is clearly defined and understood.
Major requirements must be defined; however, some functionalities or requested enhancements may evolve with time.	Categories on which we have to work is defined but some changes like overlapping cells should be consider into count or not, dilution factor also passed as argument to detect cells with precision.
There is a time to the market constraint.	4 types of market constraint we should have to take care of all : • Size of market which will be directly affected with your project • Misjudging pricing strategy • Quality of Workflow • Direction of Management
A new technology is being used and is being learnt by the development team while working on the project	Machine Learning, OpenCV, QT designer these are new concepts for team.
Resources with needed skill sets are not available and are planned to be used on contract basis for specific iterations.	No one have experience in above concepts so need to maintain balance between time period of learning and implementation of learning.
There are some high-risk features and goals which may change in the future.	This project should be completed in confidentiality and if it will disclose then functionality may change to be unique in market.

Table 2.1 Model Justification

2.1.2 Project Effort and Time, Cost Estimation

Inputs	Outputs	Inquiries
• Load image on which user wants to work. • Zoom in or Zoom out image. • Select operation on image. • Select particular area on which user wants to count cell. • select some sample cell image. • Train model button by using dataset. • Select accuracy and speed of a model. • stop training of a model. • Save model button. • Discard model button. • Test model button. • Load model button.	• Error Message (if user load Wrong image file.) • Load image Show by after Press Load Button • Zoom in image by after Press Zoom in Button • Zoom out image by after Press Zoom out Button • Perform the appropriate operation on image as per-user selection. • Create data set by selecting some sample cell image. • Train model button by using dataset. • Show accuracy of a model. • Show count on screen. • Highlight cell on image. • Show loaded model on screen.	• About • help • User will look, system has saved model for Delete or Load some model • User will do Search model

Table 2.2 Product Function I/O Summary

Number of inputs: 12
Number of outputs: 11
Number of inquiries: 4
Number of files: 10
Number of external interface: 8 (Python 3.6, anaconda, tensorflow, keras, opencv, pyqt5, matploatlib, numpy, sqlite Database, OS)

Measurement Parameter	Count (C)	Weighting Factor(W)	W*C
Inputs	12	3	36
Outputs	11	4	44
Inquiries	4	3	12
Files	10	7	70
External Interfaces	10	5	50
TOTAL			212

Table 2.3 Function Point Matrices

#	Influence Factors	Weight (F_i)	Comments
1	Does the system require reliable backup and recovery?	3	Some data base backup and recovery are provided.
2	Are data communications required?	3	Not direct data communication required.
3	Are there distributed processing functions?	5	All modules are isolated from each other.
4	Is performance critical?	5	Creating or executing machine learning model is critical.
5	Will the system run in an existing, heavily utilized operational environment?	5	Not directly related but will run in the same memory space with other operational programs.
6	Does the system require on-line entry?	0	All input and output are offline.

7	Does the on-line data entry require the input transaction to be built over multiple screens or operations?	0	
8	Are the master files updated on-line?	0	Image files updated offline
9	Are the inputs, outputs, files or inquiries complex?	4	Only input, output are complex, others are middle
10	Is the internal processing complex?	5	Machine learning algo and flexibility make the system complex
11	Is the code designed to be reusable?	4	The code can be adopted to other systems
12	Are conversion and installation included in the design?	4	
13	Is the system designed for multiple installations in different organizations?	5	There is need to installation in different organization
14	Is the application designed to facilitate change and ease of use by the user?	4	Design and interfaces make the system flexible
	ΣF_i	**44**	

Table 2.4 Complex Adjustment Values

CAF = [0.65+0.01*sum(Fi)]

CAF = [0.65+0.01* 44]

CAF = 1.09

UFP = 212

Function Point = UFP * CAF

Function Point = 212 * 1.09

Function Point = 231.08

COCOMO

LOC=FP*Language factor

We use Python. These programs average Language factor is 31. When we put it to the equation we get:

LOC=231.08 * 31 = 7163

KLOC=12131/1000=7.163

By using cocomo equations, we found the following results;

$E=a_b(KLOC)^{b}{}_{b}$ (Effort)

$D=c_b\,(E)^{\,d}{}_{b}$ (Duration)

Our Project is organic so we use $a_b=2.4$, $b_b=1.05$, $c_b=2.5$, $d_b=0.38$

$E=2.4*(7.163)^{1.05}$ = 18.96 person-month

$D=2.5*(18.96)^{0.38}$= 7.64 months

E/D ratio gives the recommended number of people. For Our Project it is:

E/D=18.96/7.64=2.49 ≈ 3 as our group consist of six people we fulfil necessary human resources.

2.1.3 Roles and Responsibilities

Member Name	Responsibilities	E-mail
Nimesh Italiya	Project Manager, Developer, Algorithm Designer, Integration Developer	17ce036@charusat.edu.in
Jay Desai	Business Analyst, High Level Designer, White Box Tester	17ce025@charusat.edu.in
Isha Kimsuriya	Adobe XD Designer,	17ce045@charusat.edu.in
Shubham Patel	GUI Designer, Integration Designer	17ce026@charusat.edu.in
Aayush Gajjar	Developer, Dataset Creator	17ce030@charusat.edu.in
Kapil Kapuriya	Black Box Tester	17ce041@charusat.edu.in

Table 2.5 Roles

2.2 PROJECT SCHEDULING

Chart is available in **Appendix** Section at the end of all chapters.

Chapter 3 – SYSTEM REQUIREMENTS STUDY

3.1 USER CHARACTERISTICS

The users who are interact with this system directly are must be aware about biology field and this software is also made for microbiological field, biochemistry field and biotech field students, researchers and faculties. So, person who is aware about this field, easily can use it as our software is user-friendly and imagine in case user is not of this field then still, he/she can easily adopt this software as each and every functionality with examples are provided in help section. But most important thing is about importing images for count and select references from image should be done via person who knows basic of these kind of cell counting for accurate output.

3.2 HARDWARE AND SOFTWARE REQUIREMENTS

Hardware:

PC/Computer with any OS

Software:

Python 3.7.2

3.3 ASSUMPTIONS AND DEPENDENCIES

- The users have sufficient knowledge of domain.
- Images gave to software must be in better resolution.
- Reference images must be selected wisely to count cell accurately.
- Based on dataset created by end user, count will be displayed for particular those kind of species.

Chapter 4 - SYSTEM ANALYSIS

4.1 STUDY OF CUURENT SYSTEM

Sr No.	Name	Front-End	Back-End	Features	URL
1	ATAPY	C++	NA	Blood Cells Counting	http://www.atapy.com/en-us/casestudies/helpingautomatebloodcellcounting.aspx
2	White Blood Cell Counter	.Net	NA	White Blood Cell differential counter	https://sourceforge.net/projects/celldiff/
3	Complete Blood Cell Count	MATLAB	NA	Blood Cell counter	http://www.iraj.in/journal/journal_file/journal_pdf/6-224-14544117441-4.pdf
4	Automated Blood Cell Counting	MATLAB	NA	Blood Cell Counting	https://www.ijareeie.com/upload/2017/january/10_Automated.pdf
5	TC-20 Automated Cell Counter	-	-	Spore Counting	https://www.bio-rad.com/en-in/product/tc20-automated-cell-counter?ID=M7FBG34VY

Table 4.1 Current Systems

4.2 PROBLEM AND WEAKNESSES OF THE CURRENT SYSTEM

As one can see that first 4 are of only blood cell counting and no other counting provided from these software. Last software provide spore counting but it is belong to well-known company *BIO-RAD* , so they not provide much details like which is front end and backend used by them and also software gives output only if image captured using their instrumental and for other instruments they not provide counting services.

4.3 REQUIREMENTS OF NEW SYSTEM

As one software should perform all types of counting and also it is not containing any kind of restrictions like counting performed only on some fix instrumental images only but it will be generic that, if image captured using any kind of hemocytometer then software should able to detect any kind of cells not only blood cells with greater accuracy.

And also user have rights to choose from image that these kind of cells should be taken into consideration and overall count comes on basis of user input only.

4.3.1 Functional Requirements

1. Counting Spores
    - Determine shape of Spore
    - Not consider dye which is not sustain properly
    - Spore may be count for particular region wise or from whole image
    - Detect Spore based on size of it given by user
    - Reference image mode should be count spore only based on selected spore within image
    - Display Count

2. Counting Blood Cells
    - Detect all blood cells
    - Differentiate RBC, WBC, Platelets
    - Differentiate WBC Cells
    - Separate Counter for each category
    - Blood cell may be count for particular region wise or from whole image
    - Reference image mode should be count blood cells only based on selected cell within image
    - Display Count

3. Counting Bacterial Fungus
    - Detect Bacterial fungus
    - Detect colony of bacteria
    - Differentiate colonies from image
    - Display Count

4. Determine type of cell
    - Differentiate Viable and Non-viable cell
    - Differentiate Live and Dead cell
    - Separate Counter for each an individual type
    - Display Count

4.3.2 Non-Functional Requirements

1. The graphical user interface shall have a consistent look and feel.
2. The load time for user interface screen must be less than 3-4 seconds.
3. The Cell Counter System should be stand-alone system in windows environment.
4. The System must give accurate result compare to manual effort.
5. The system shell be developed in Python language.
6. Specify the factors required to establish the required reliability of the software system at time of delivery.
7. Processing of image must not be taking too longer time that user exit from software.
8. Detecting cells or spore should be done within 5 minute.

4.4 USE CASE DIAGRAM

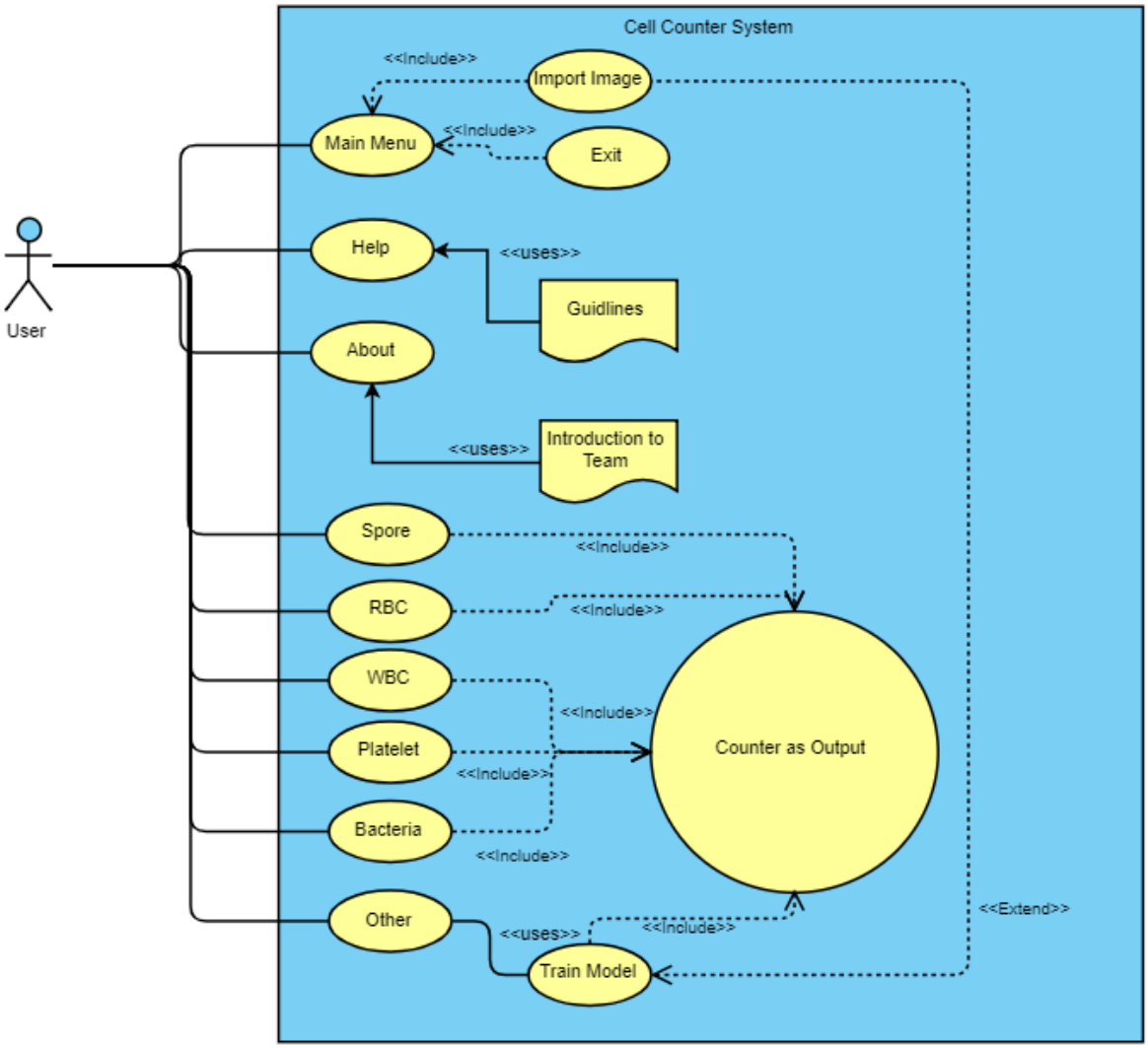


Fig 4.1 Use Case

4.5 CLASS DIAGRAM

Fig 4.2 Class Diagram (Part-1)

Fig 4.3 Class Diagram(Part-2)

4.6 SEQUENCE DIAGRAM

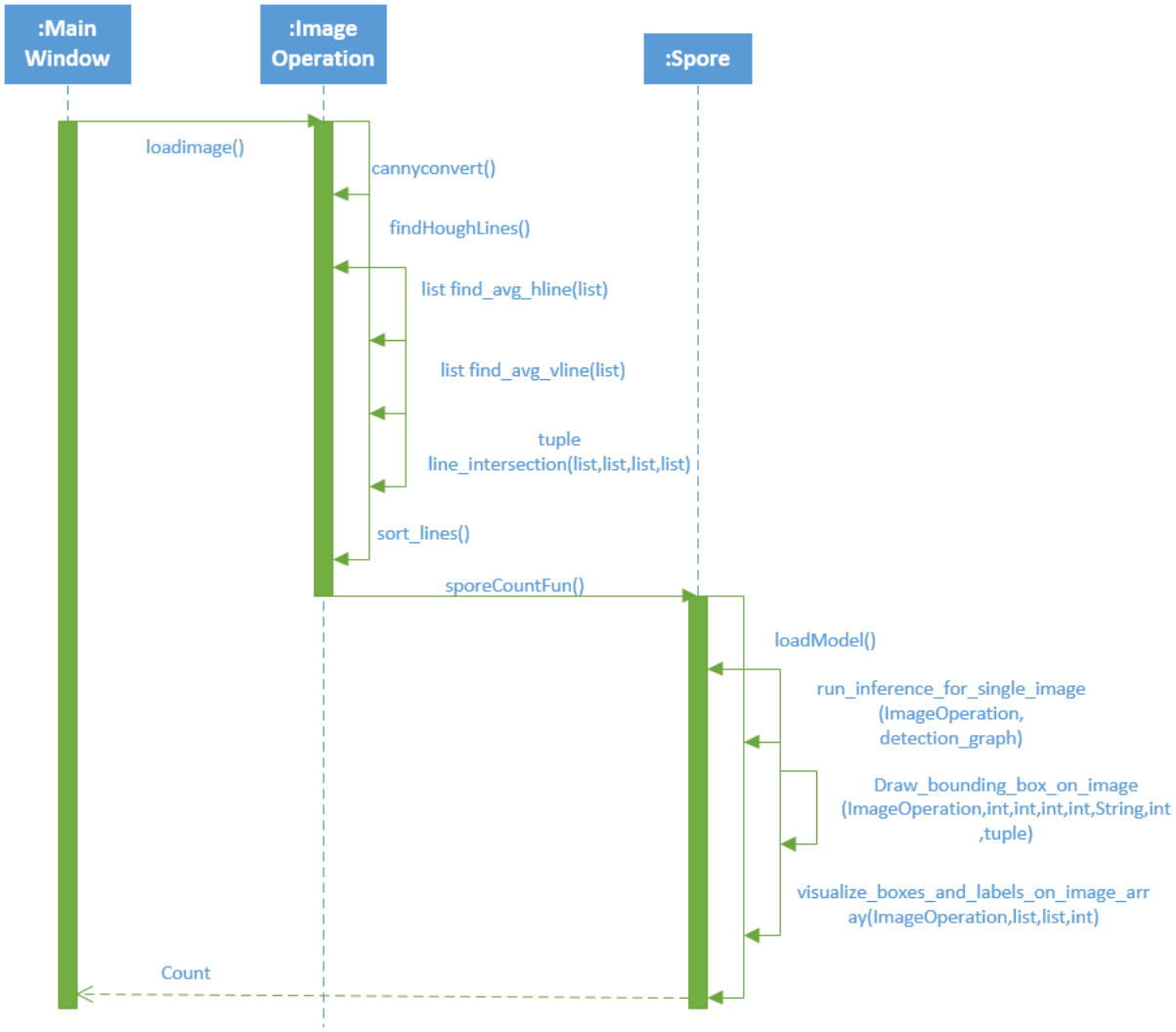


Fig 4.4 Spore Sequence Diagram

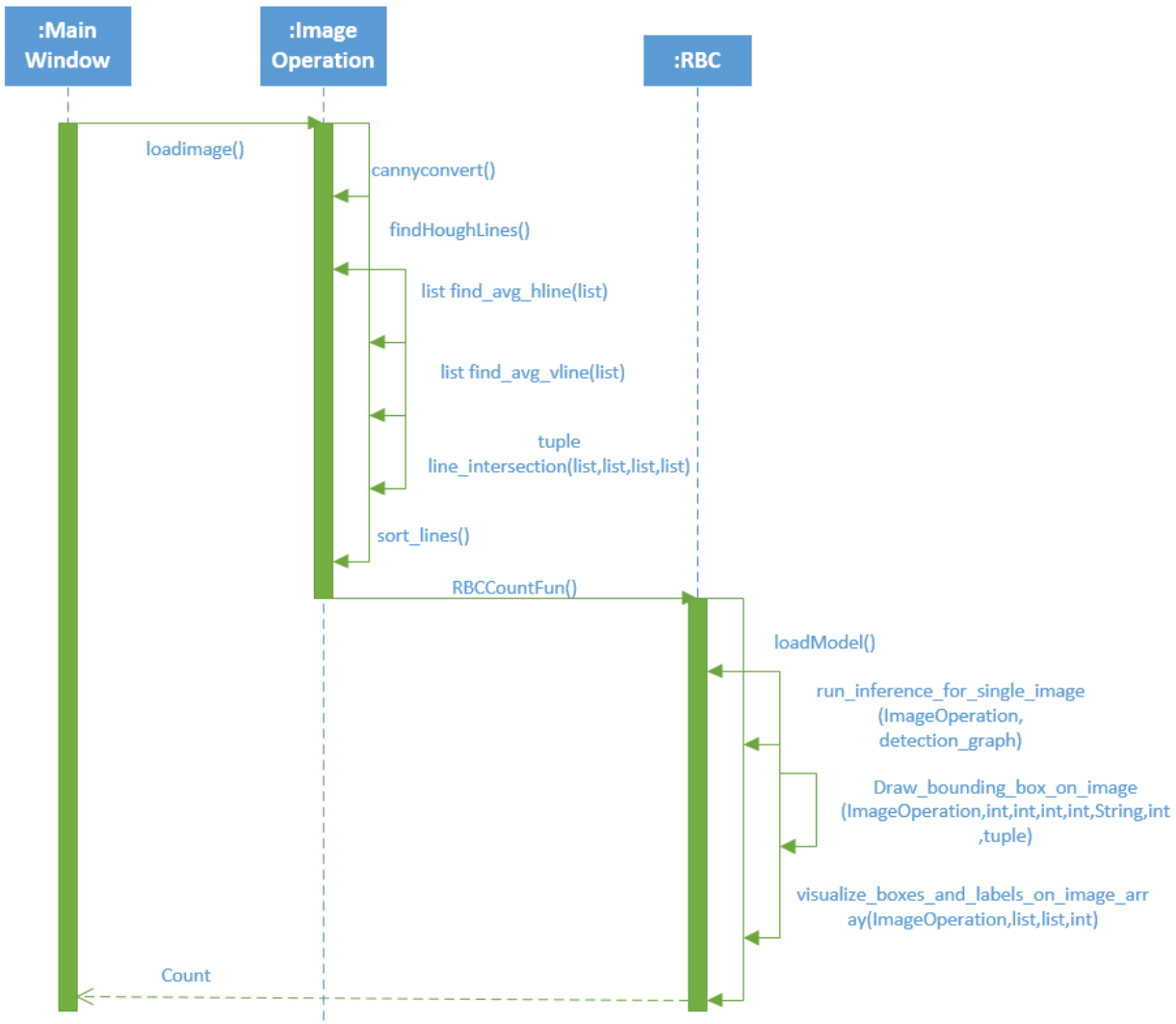


Fig 4.5 RBC Sequence Diagram

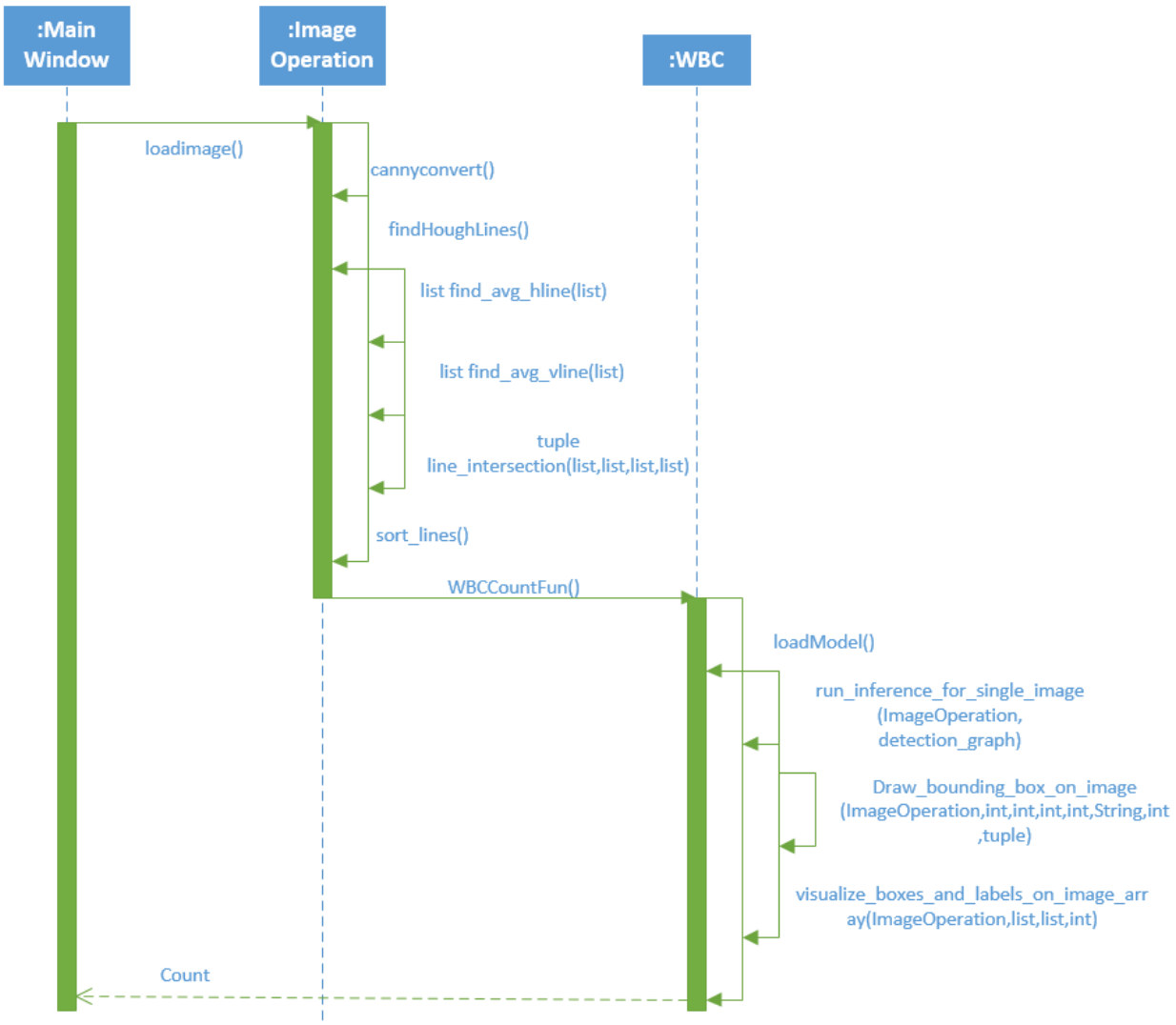


Fig 4.6 WBC Sequence Diagram

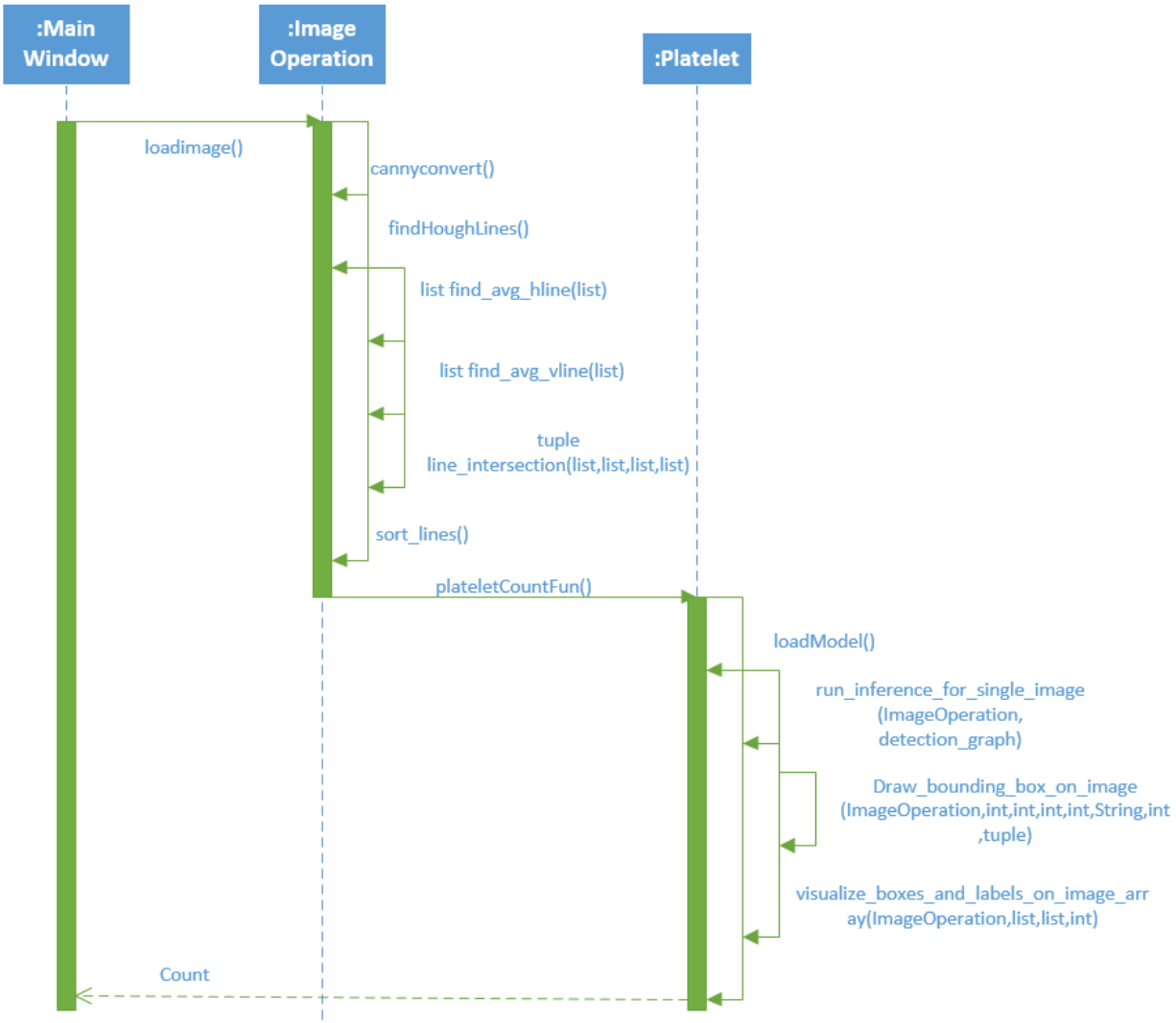


Fig 4.7 Platelet Sequence Diagram

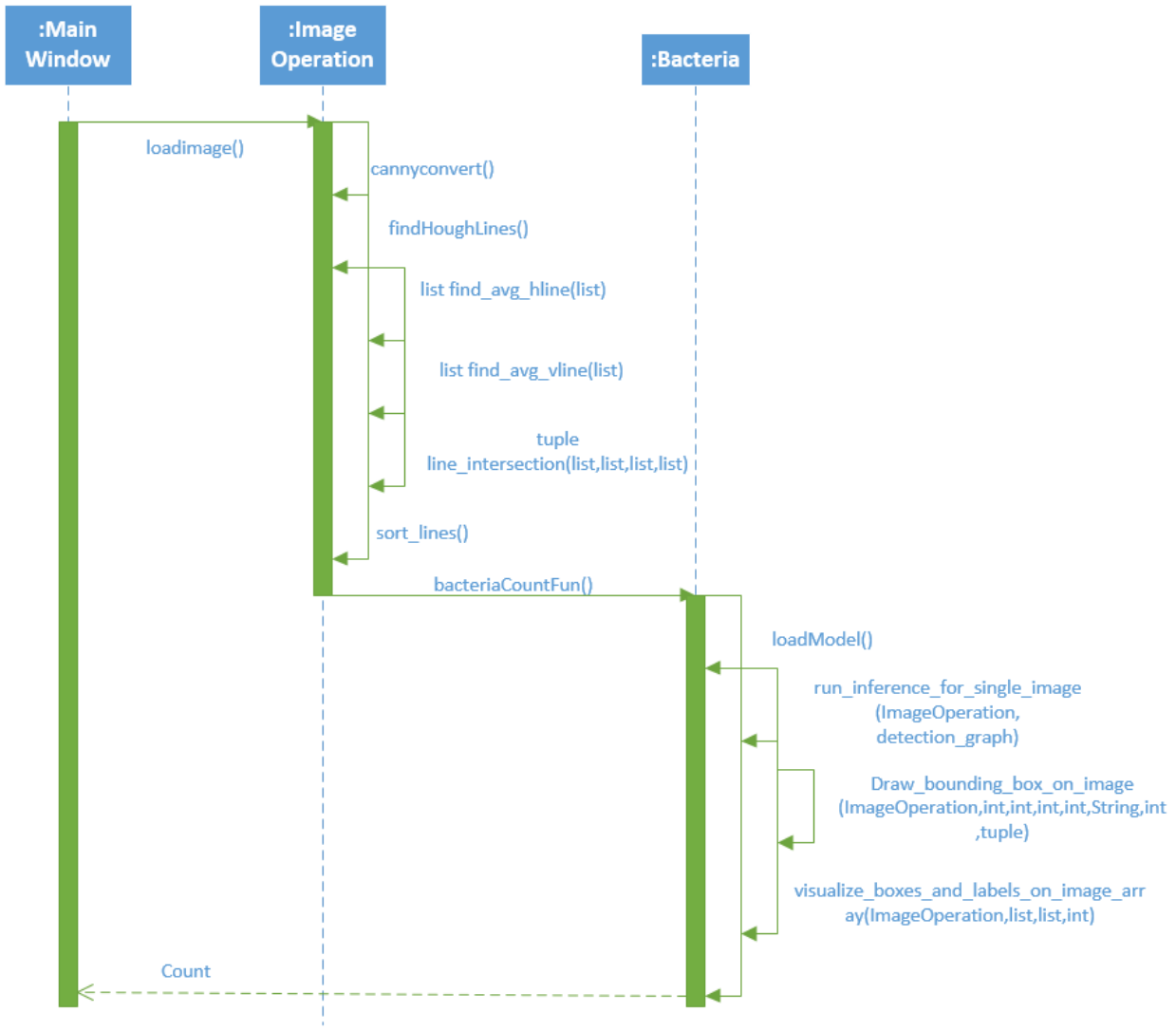


Fig 4.8 Bacteria Sequence Diagram

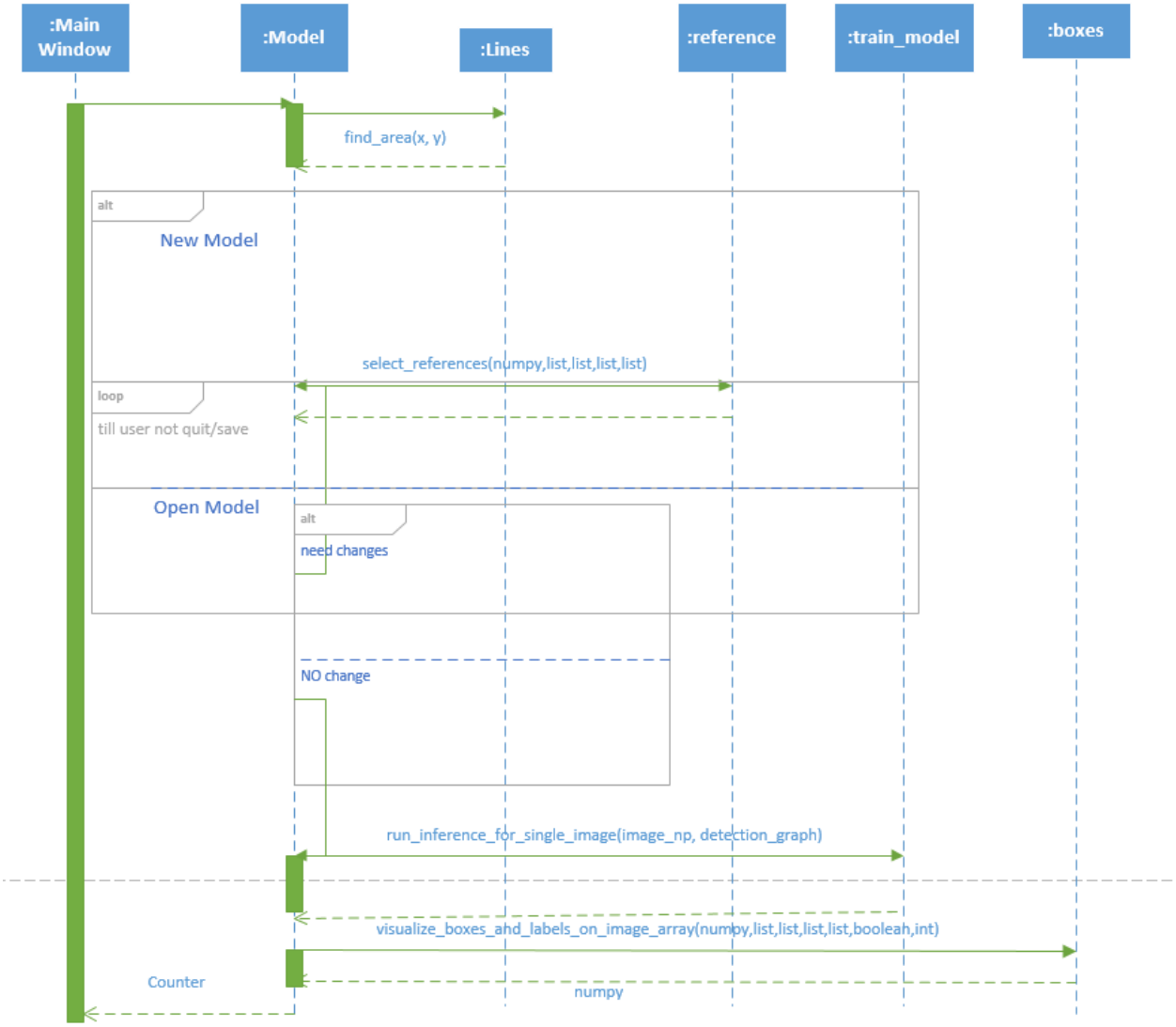


Fig 4.9 Other Sequence Diagram

4.7 CONTEXT DIAGRAM

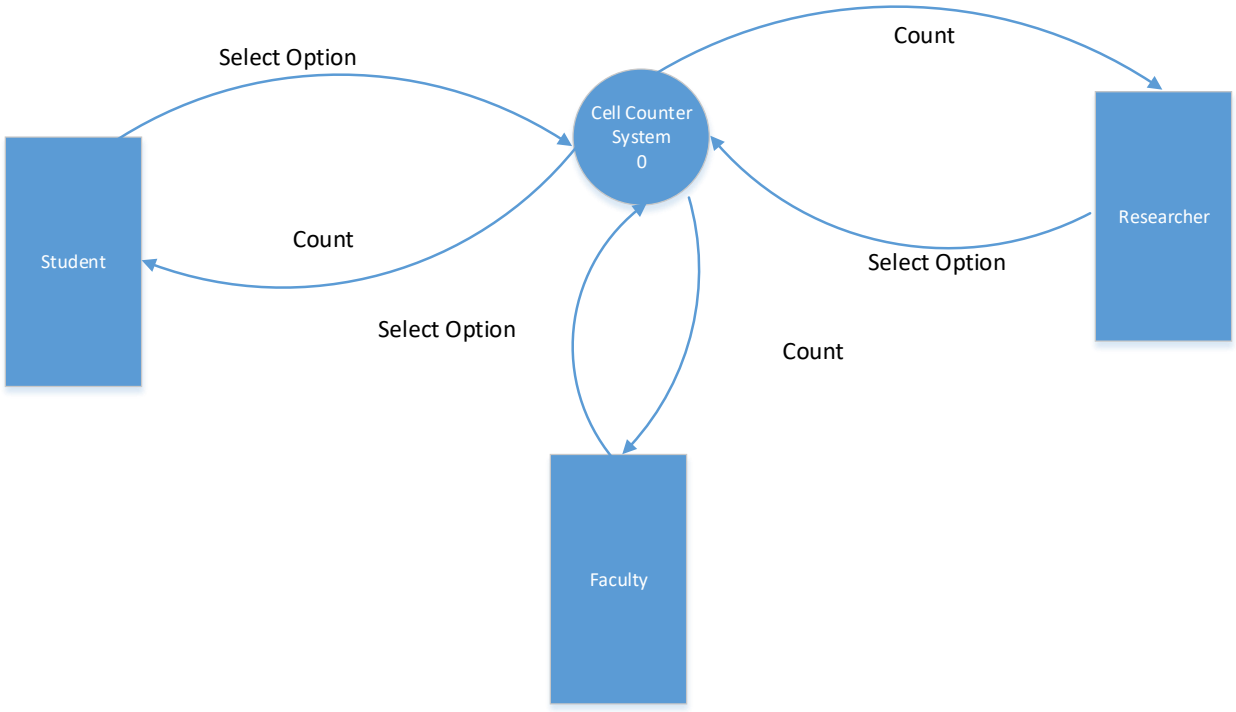


Fig 4.10 Context Diagram

4.8 DATA FLOW DIAGRAM

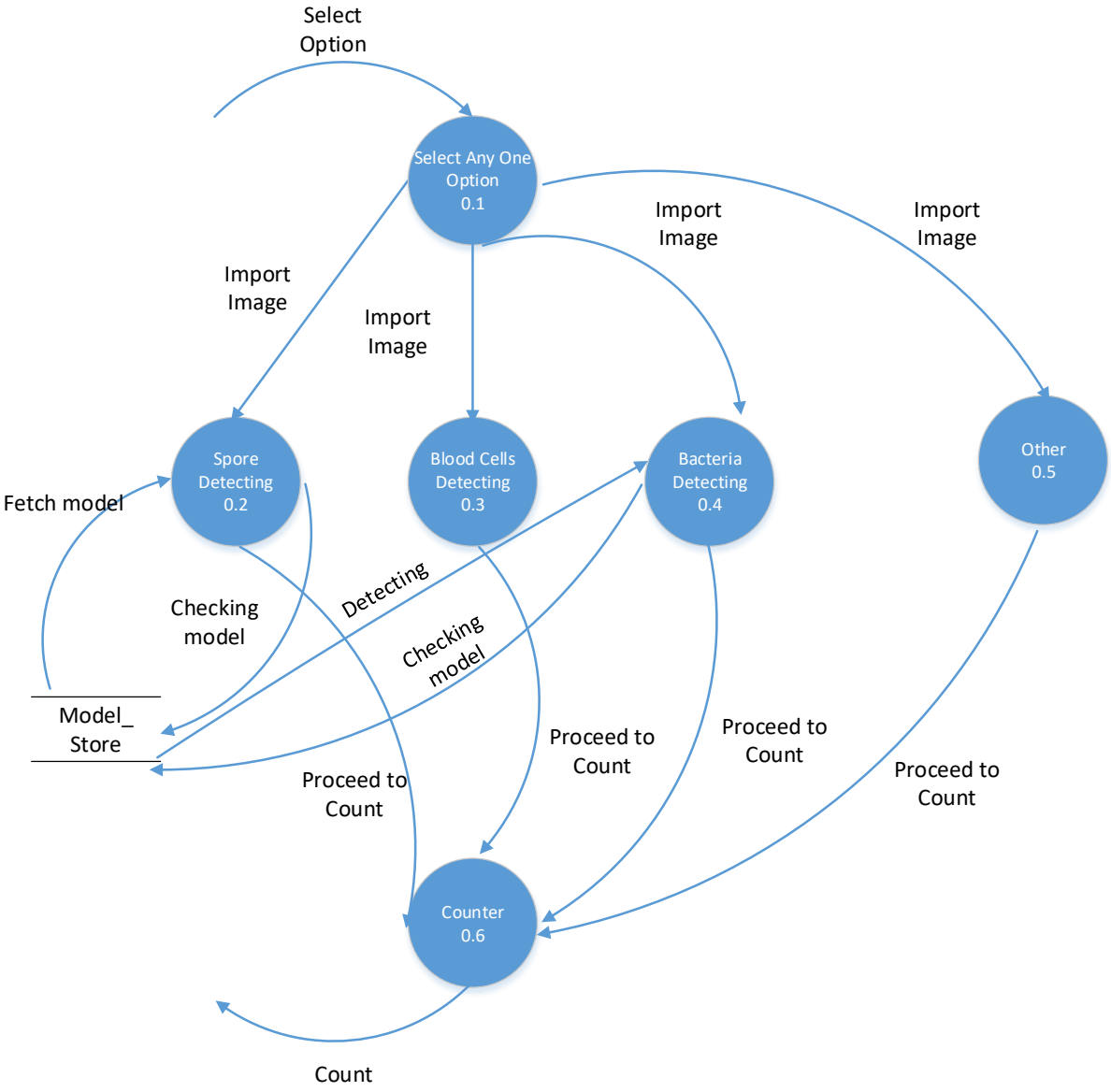


Fig 4.11 Level 1 DFD

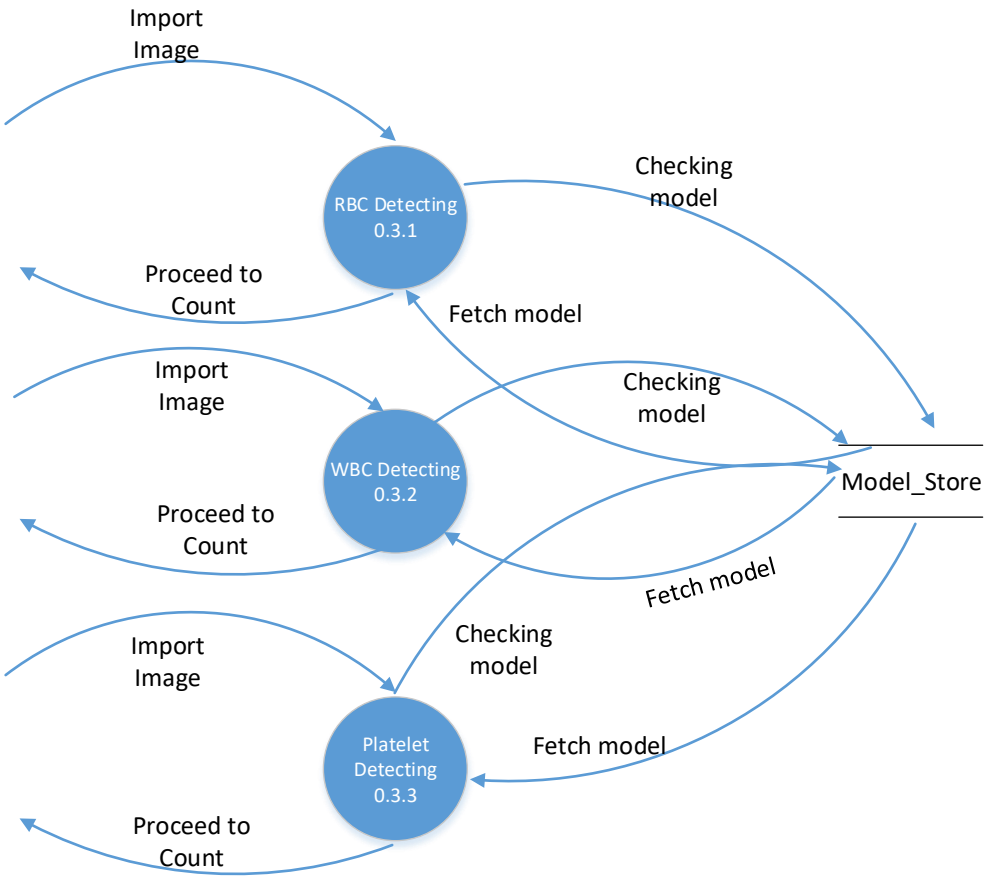


Fig 4.12 Level 2-a diagram

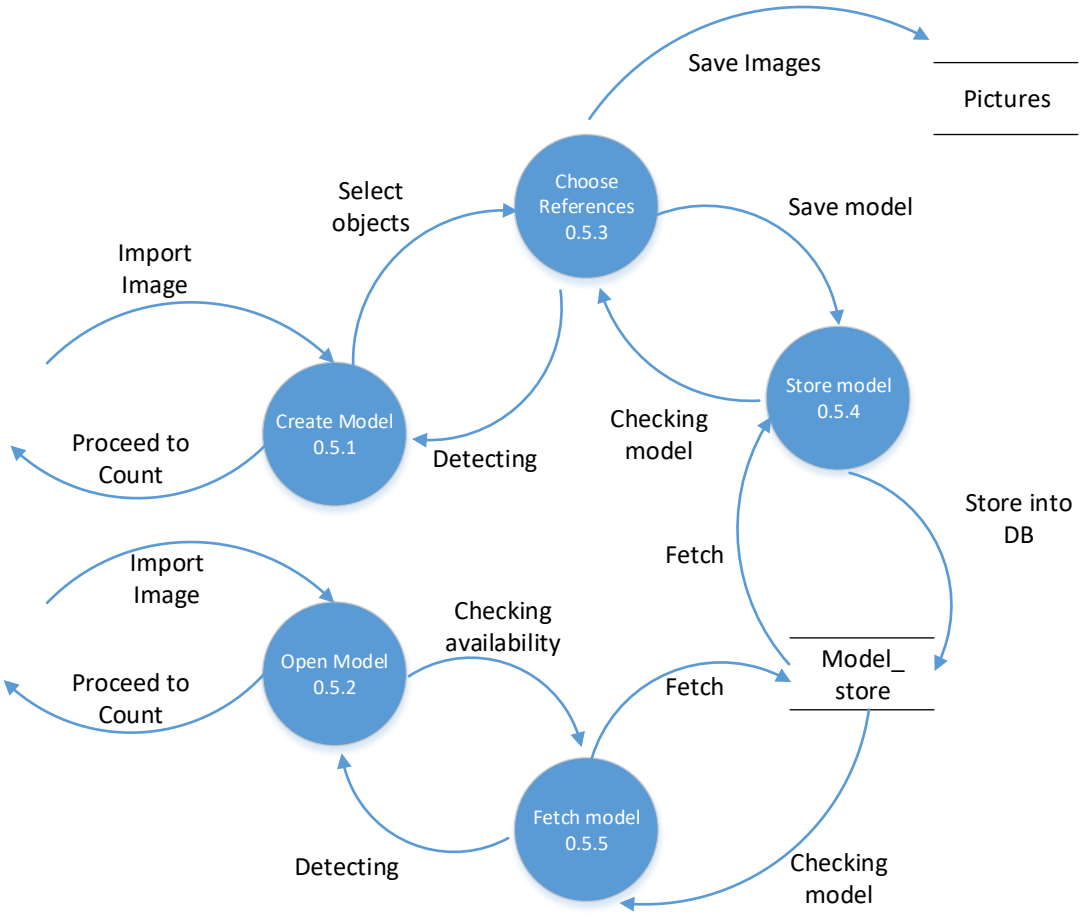


Fig 4.13 Level 2-b DFD

4.9 DATA MODELING

4.9.1 Data Dictionary

Data Dictionary

	Attributes	Type	Meaning
Table Models:	id	integer(11)	To store models in unique manner
	label	varchar(20)	To store name of that model
	accuracy	float	To determnie accuracy of model based on previous operations on it
	path	varchar(100)	To store absolute path of that model
Table Pictures:	id_model	integer(11)	To determine relationship of images to the model
	p_name	varchar(20)	To store name of image
	p_path	varchar(100)	To store absolute path of that image
	p_height	integer(11)	To store height value of image
	p_width	integer(11)	To store width value of image
	p_status	tinyint(1)	To store boolean value which indicate whether this image will use in traning or testing purpose

Table 4.2 Data Dictionary

4.9.2 ER Diagram

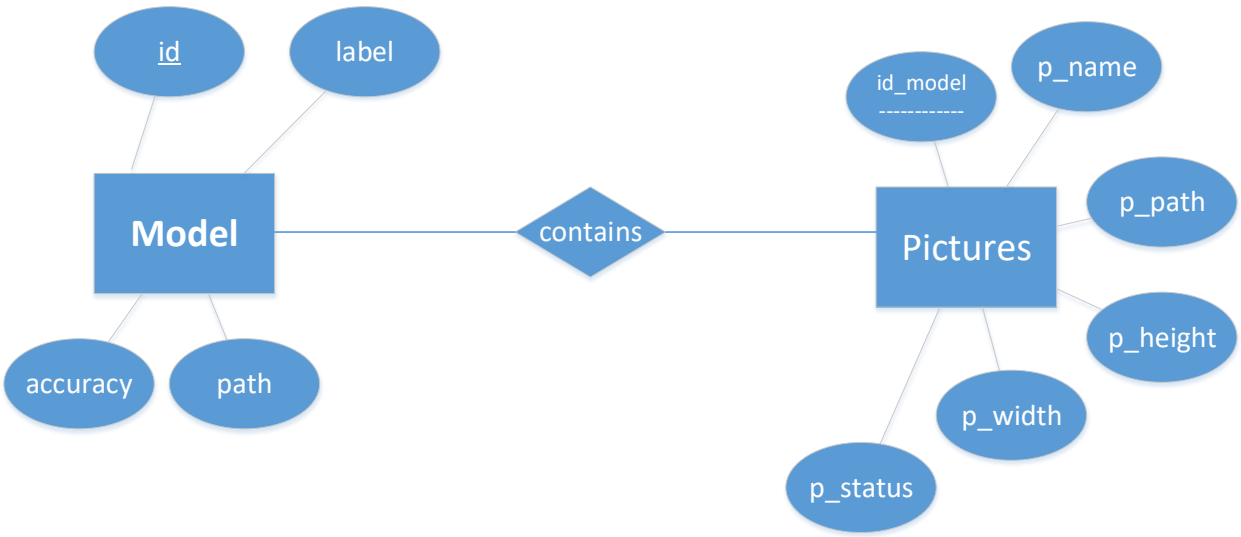


Fig 4.14 ER Diagram

Chapter 5 – SYSTEM DESIGN

5.1 STATE TRANSITION DIAGRAMS

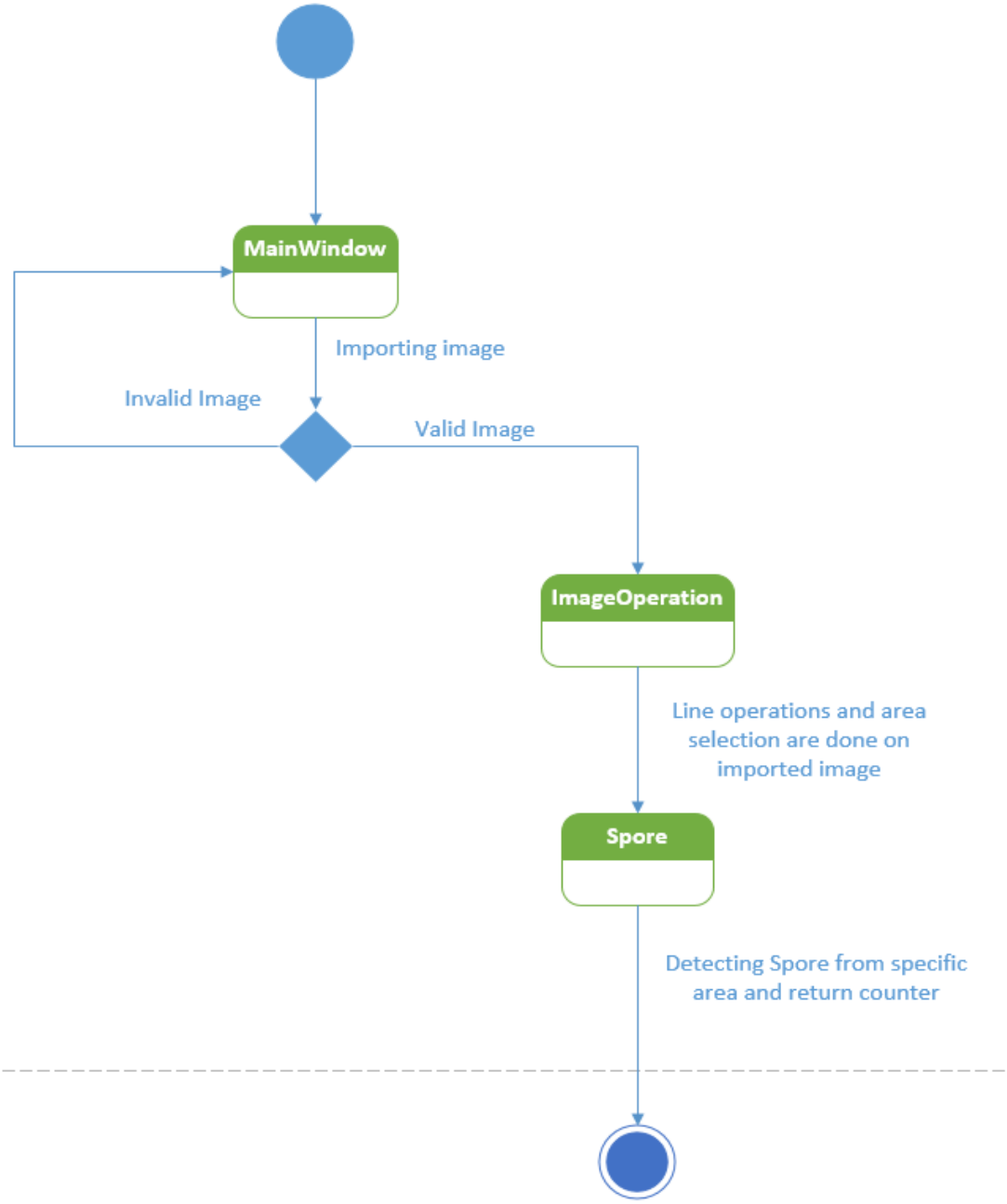


Fig 5.1 Spore State Diagram

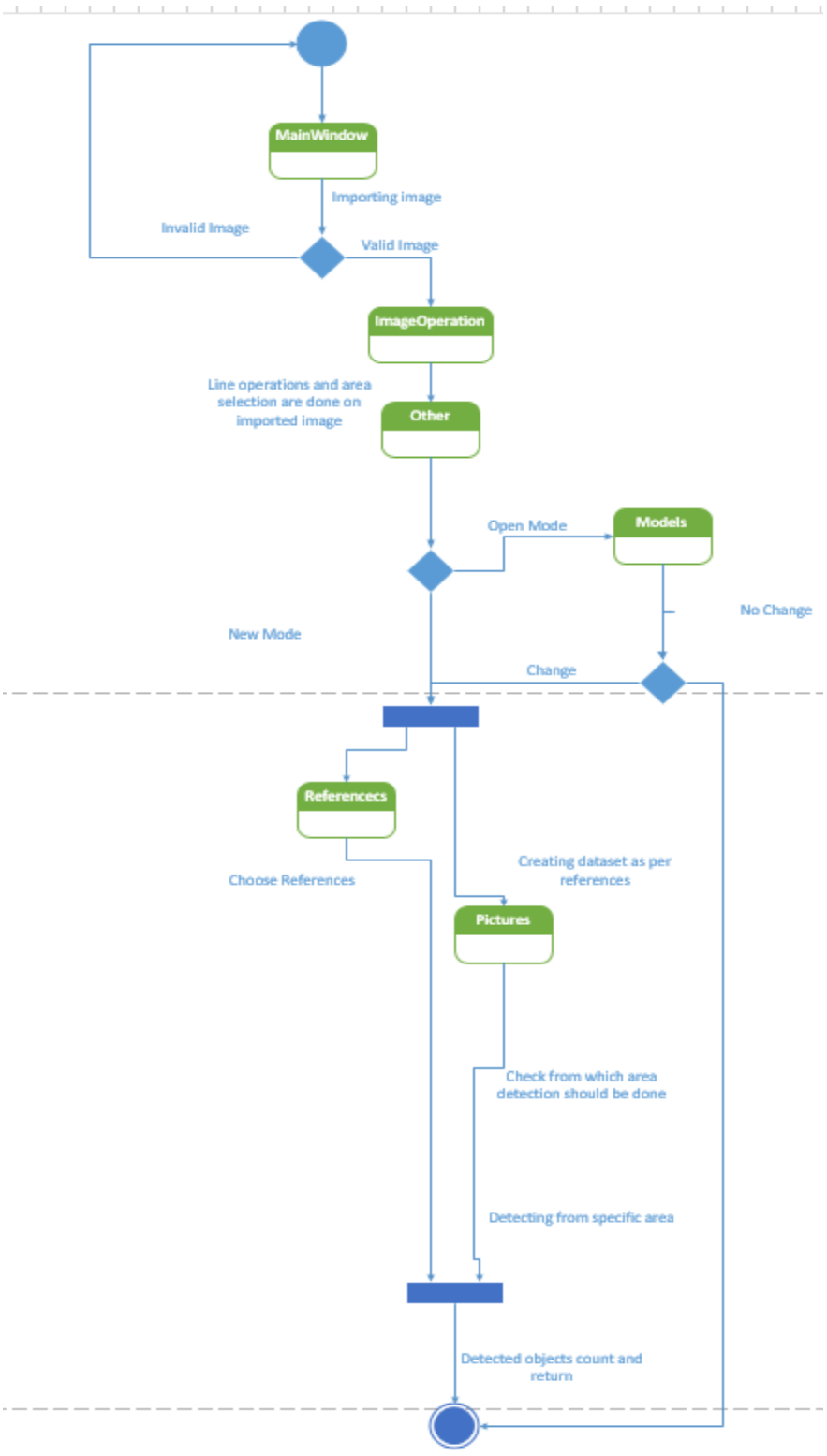


Fig 5.2 Other State Diagram

5.2 SAMPLE OF FORMS,REPORTS AND INTERFACE

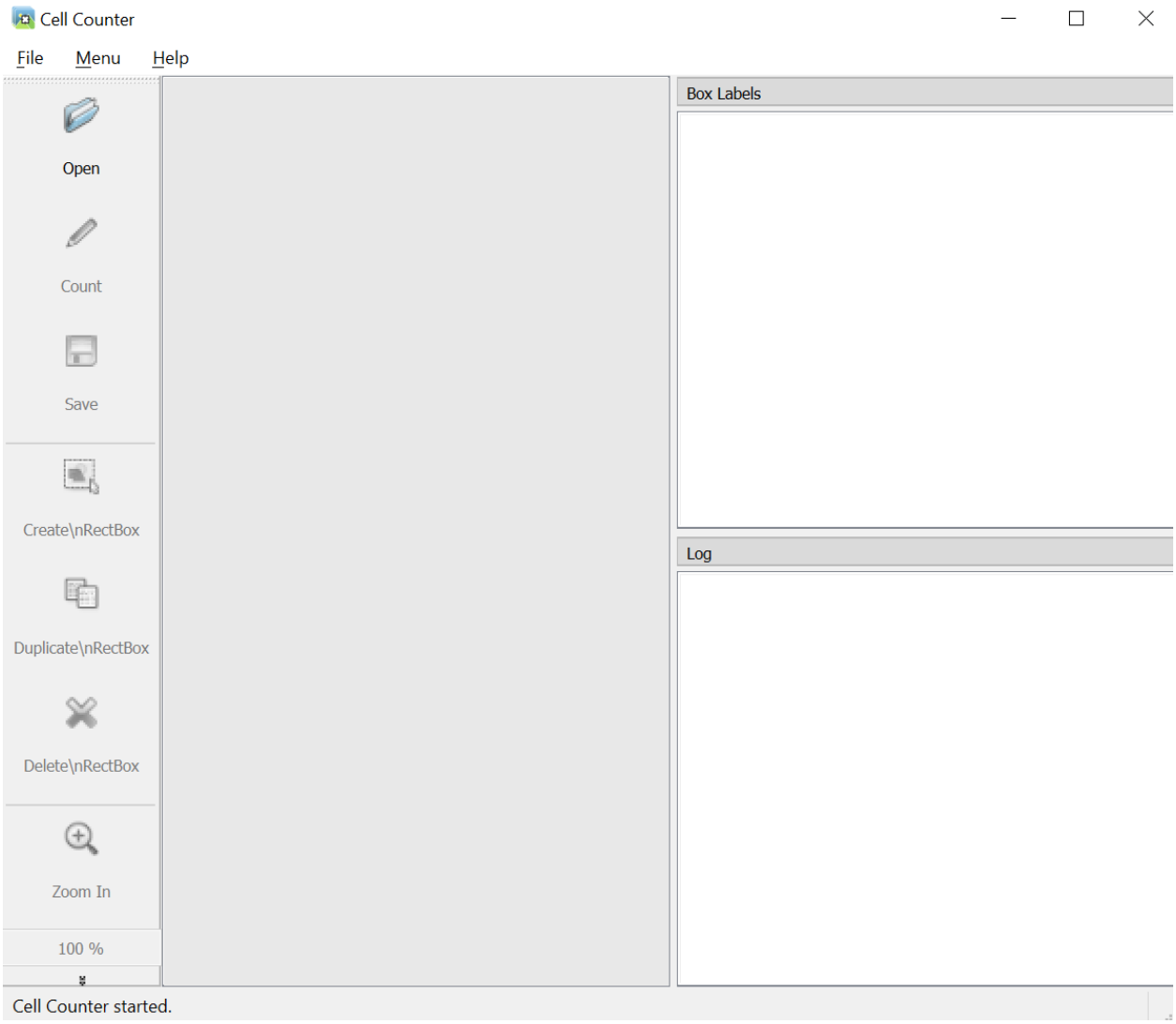


Fig 5.3 Main Window

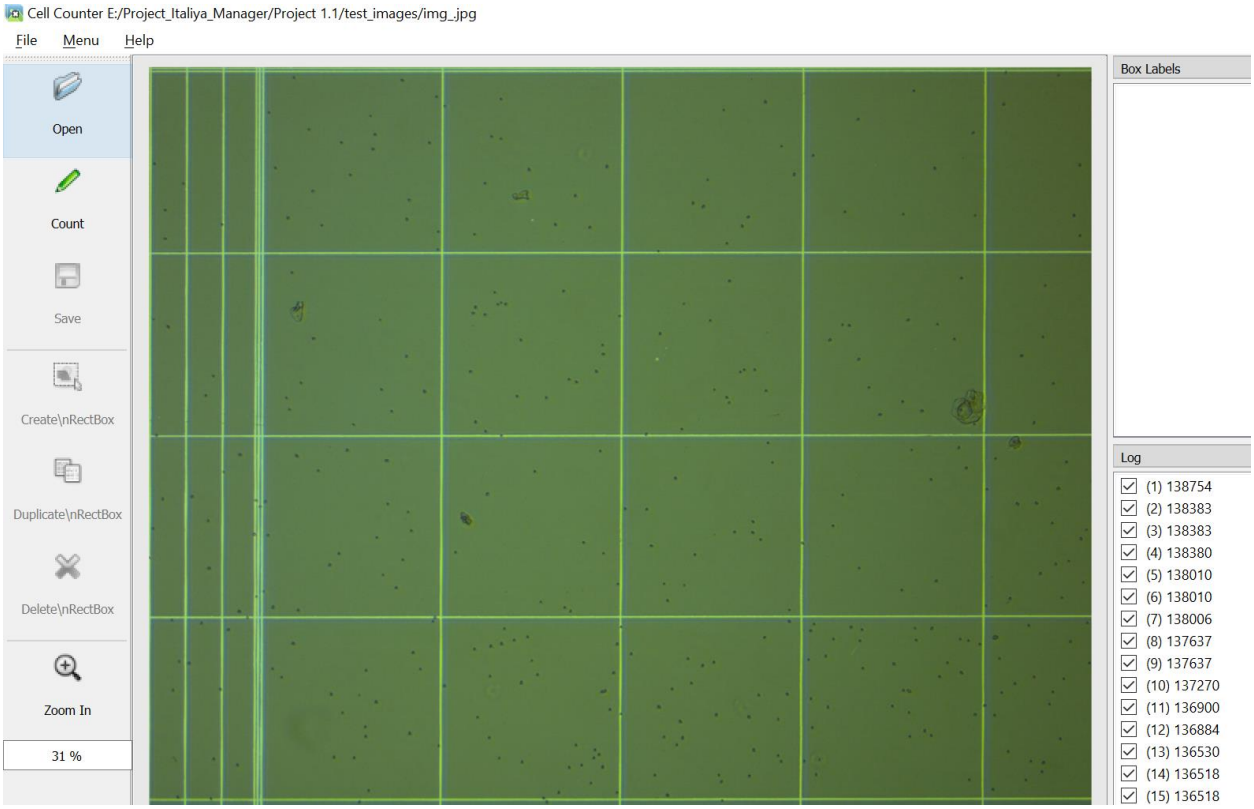


Fig 5.4 Image Open

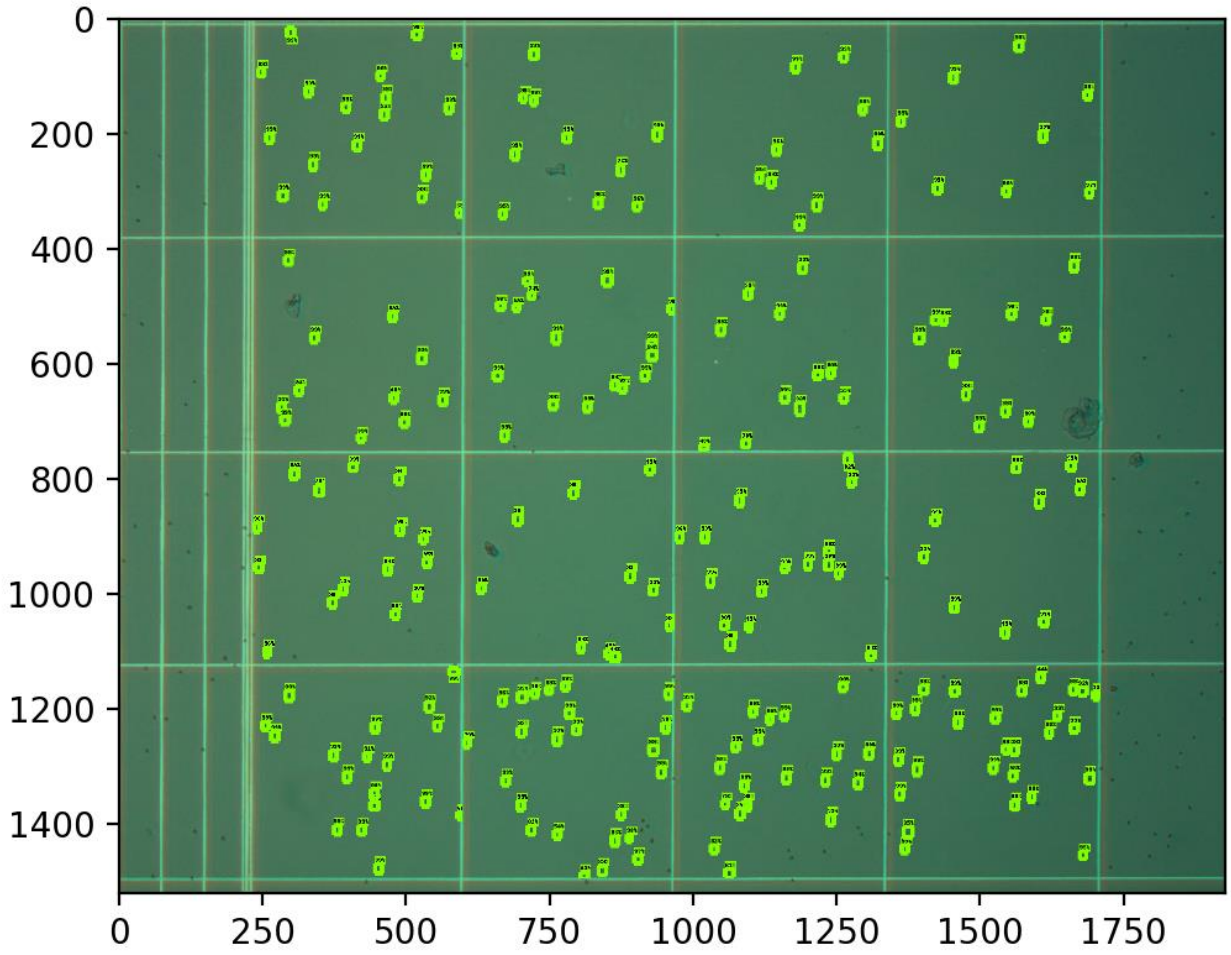


Fig 5.5 Detected Image

Chapter 6 - TESTING

6.1 TESTING PLAN

Basically, Team follows natural one process like first unit testing then integration testing of 2 or more modules and at the last combinations of all modules club together and check performance and stress that system can maintain.

As team accept *ITERATIVE MODEL* , testing needs to be done as per completion of single individual module which can be shown in following tables :

Developing Activity	**Testing Activity**
GUI Design	Gathering knowledge of testing
Spore Module	GUI testing
RBC Module	Spore module testing
WBC Module	RBC module testing
Platelet Module	WBC module testing
Bacteria Module	Platelet module testing
Other Module	Bacteria module testing
Waiting for test status	Other module testing

Table 6.1 Test Plan

6.2 TESTING STRATEGY

1. Test Strategy Identifier

The unique identifier for this Test Strategy is: TS_001

2. Introduction

This document refers to a project named “Cell Counter System” which was validate by test team and this is proof of validation of project that now any end users can work on it and result that are displayed from project will be accurate around 90% or above for any cells which are well-defined named inside project.

2.1. Purpose

The purpose of this Test Strategy is to define the overall approach that will be taken by the Test Team when delivering testing services to this project. The document helps to clarify the testing activities, roles and responsibilities, processes and practice to be used across successive projects. Where a project's testing needs deviate from what is covered by this Test Strategy the exceptions will be detailed in the Test Plan.

3. Test Items

Sr No.	Test Item	Test Suite ID
1	Spore Count	TS_SC_001
2	RBC Count	TS_RC_001
3	WBC Count	TS_WC_001
4	Platelet Count	TS_PC_001
5	Bacteria Count	TS_BC_001
6	Other Count	TS_OC_001
7	GUI	TS_GI_001

Table 6.2 Test Items

4. Features to be tested

- Spore Count
- RBC Count
- WBC Count
- Platelet Count
- Bacteria Count
- Other Count
- GUI

5. Features not to be tested

Where it is not possible for the team to test features of a Test Item that would have been expected or that would fall under the scope of testing shown in section 10.

6. Approach

All testing tasks will be conducted in line with the Software Test Life Cycle (STLC) and in support of the Software Development Life Cycle (SDLC). The documents used within the SDLC will be completed both by the Test Team and the project participants that are responsible for providing information and deliverables to the Test Team.

We decide for test strategy is to derive test cases after completing software design and implement testing parallelly for 2 modules to increase time utilization for testing tasks.

6.1. Analysis & Planning Phase Entry Criteria

For all projects the following criteria need to be met before the Test Items are accepted into the Analysis & Planning Phase:

- Requirements are finalized
- Documents are must be verified from both parties including end user and developer manager

6.2. Analysis & Planning Phase Exit Criteria

For the Analysis & Planning phase to be completed and allow items to move into the Test Phase the following criteria need to be achieved:

- Test Breakdowns and Test Cases are written and peer reviewed
- The list of features in the Test Breakdown have been prioritized.

6.3. Test Phase Entry Criteria

Before Test Items are made available for the Test Team to test it's expected that:

- All test tools are available and test infrastructure are available for use during testing
- All Test Items are development complete
- The correct versions of the code have been deployed to the correct test environments

6.4. Test Phase Exit Criteria

For the Test Items to exit testing the following conditions will have to be met:

- Test suite of that modules must be cleared all test items with "PASS" status.
- All planned testing activities has been completed to agreed levels.
- All high priority bugs have been fixed, retested and passed.
- No defects must be left in an open unresolved status.

6.5. Notification / Escalation Procedures

The following diagram shows the notification and escalation paths to be followed for the duration of the project Test Phase.

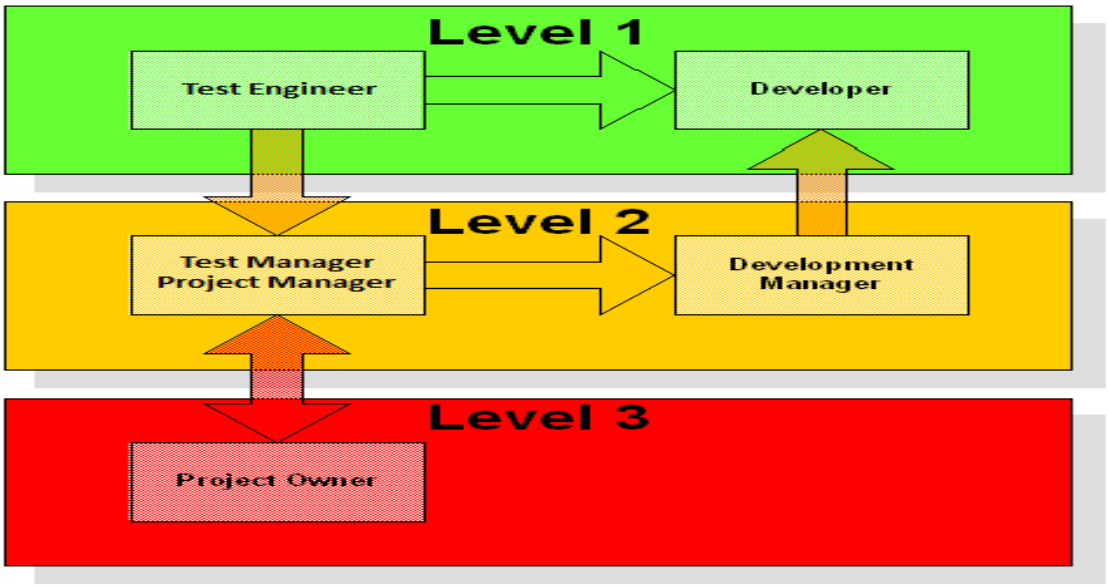


Fig 6.1 Notification Procedure

7. 'Pass/Fail' Criteria

Each Test suites must be containing several test items which must be declared as "PASS" for approving product but question is how to define this "PASS"?

Answer is simple as question that, Tester either from experience or from collecting information from end user side about working terminology of software as end user thought and then operate that software as same as end user and then if all actions, functionalities are up to the mark then tester can declared as "PASS" or if any single condition cannot be prevent then it

8. Testing Tasks

The Testing Tasks that the Test Team will deliver cover the following scope:

- **Fully In Scope:** Functional Testing
- **Partially in Scope:** Additional input testing for different dataset of different options.
- **Out of Scope:** Performance testing, all forms of Non-Functional testing.

9. Environmental and Infrastructure Needs

The following detail the environmental and infrastructure needs required for the testing of "Cell Counter System" Test Items.

Hardware

- Computer

Software

- Python 3.6.x: https://www.python.org/downloads/

10. Responsibility Matrix

The table below outlines the main responsibilities in brief for test activities:

Activity	BA	Project Manager	Test Engineer
Provision of Technical Documents	X	X	
Test Planning and Estimation		X	X
Review and Sign off Test Plan	X	X	
Testing Documentation		X	X
Test Preparation and Execution			X
Test Environment Set-up			X
Change Control of Test Environments		X	X
Provision of Unit Tested Test Items		X	
Bug fixes and return to the Test Team for re-test		X	
Product Change Control	X	X	
Ongoing Test Reporting		X	X
Test Summary Reporting		X	

Table 6.3 Responsibility Metrices

11. Risks and Contingencies

	Risk	Mitigation Strategy	Impact
1	Delays in delivering completed Test Items from Development would impact test timescales and final Release quality	Product Management and Development to advise of any delays and adjust Release Scope of Resources to allow the test activities to be performed.	High
2	Delays in the turn around time for fixing critical bugs, which would require re-testing, could have an impact on the project dates.	Strong management of bug resolution would be required from Development to ensure bugs are fixed and available for re-testing in the scheduled time.	High
3	The Test Team, Development or PM teams require domain guidance from one or the other and they are not available. This would delay project activities.	The Test Team, Development and PM teams to ensure they are available at critical points or contactable during the project activities.	Medium
4	Features of Test Items will not be testable.	The Test Team will record untested features and request the PM to assess business risk in support of the release of untested features.	Low
5	Unexpected dependencies between Test Items and service components are encountered that require revision of Test Scenarios and related Test Cases.	Information about dependencies is updated and communicated promptly to allow timely revision of Test Scenarios and Test Cases	Low

Table 6.4 Risks & Mitigation

6.3 TEST SUITE DESIGN

6.3.1 Spore Count

Test Scenarion ID	Test Scenario Description	Test Case ID	Test Case Description	Test Steps	Preconditions	Test Data	Post conditions	Expected Result	Actual Result	Status
TS_SC_001	Verify Count comes after selecting spore option	TC_SC_01	Import an image of spore on which model trained	1. Import spore image 2. Select "SPORE COUNT" option 3. Press on count button	Image quality should be more than of 300 * 300	temp_1.jpg	Count should be displayed in place of "log" label of right lower of GUI	Count should be displayed in range of 232 to 236	234	Pass
		TC_SC_02	Import an image of spore on which model tested	1. Import spore image 2. Select "SPORE COUNT" option 3. Press on count button	Image quality should be more than of 300 * 300	temp_2.jpg	Count should be displayed in place of "log" label of right lower of GUI	Count should be displayed in range of 300 to 310	307	Pass
		TC_SC_03	Import an image of spore which is tested on GUI and saved output as indicating labels with green border around each spore	1. Import spore image 2. Select "SPORE COUNT" option 3. Press on count button	Image quality should be more than of 300 * 300	temp_3.jpg	Count should be displayed in place of "log" label of right lower of GUI	Count should be wrong	7	Pass
		TC_SC_04	Import an image of any cell rather than spore	1. Import any image 2. Select "SPORE COUNT" option 3. Press on count button	Image quality should be more than of 300 * 300	temp_4.jpg	Count should be displayed in place of "log" label of right lower of GUI	Count should be wrong	21	Pass

Table 6.5 Spore Test Suite

6.3.2 RBC Count

Test Scenarion ID	Test Scenario Description	Test Case ID	Test Case Description	Test Steps	Preconditions	Test Data	Post conditions	Expected Result	Actual Result	Status
TS_RC_001	Verify Count comes after selecting RBC option	TC_RC_01	Import an image of rbc on which model trained	1. Import rbc image 2. Select "RBC COUNT" option 3. Press on count button	Image quality should be more than of 300 * 300	temp_5.jpg	Count should be displayed in place of "log" label of right lower of GUI	Count should be displayed in range of 245 to 268	254	Pass
		TC_RC_02	Import an image of rbc on which model tested	1. Import rbc image 2. Select "RBC COUNT" option 3. Press on count button	Image quality should be more than of 300 * 300	temp_6.jpg	Count should be displayed in place of "log" label of right lower of GUI	Count should be displayed in range of 317 to 336	331	Pass
		TC_RC_03	Import an image of any cell rather than rbc	1. Import any image 2. Select "RBC COUNT" option 3. Press on count button	Image quality should be more than of 300 * 300	temp_8.jpg	Count should be displayed in place of "log" label of right lower of GUI	Count Should be wrong	9	Pass

Table 6.6 RBC Test Suite

6.3.3 Bacteria Count

Test Scenarion ID	Test Scenario Description	Test Case ID	Test Case Description	Test Steps	Preconditions	Test Data	Post conditions	Expected Result	Actual Result	Status
TS_BC_001	Verify Count comes after selecting Bacteria option	TC_BC_01	Import an image of Bacteria on which model trained	1. Import Bacteria image 2. Select "Bacteria COUNT" option 3. Press on count button	Image quality should be more than of 300 * 300	temp_17.bmp	Count should be displayed in place of "log" label of right lower of GUI	Count should be in range of 200 to 220	207	Pass
		TC_BC_02	Import an image of Bacteria on which model tested	1. Import bacteria image 2. Select "Bacteria COUNT" option 3. Press on count button	Image quality should be more than of 300 * 300	temp_18.bmp	Count should be displayed in place of "log" label of right lower of GUI	Count should be in range of 212 to 227	217	Pass
		TC_BC_04	Import an image of any cell rather than Bacteria	1. Import any image 2. Select "Bacteria COUNT" option 3. Press on count button	Image quality should be more than of 300 * 300	temp_20.jpg	Count should be displayed in place of "log" label of right lower of GUI	Count should be wrong	9	Pass

Table 6.7 Bacteria Test Suite

6.3.4 Other Count

Test Scenarion ID	Test Scenario Description	Test Case ID	Test Case Description	Test Steps	Preconditions	Test Data	Post conditions	Expected Result	Actual Result	Status
TS_OC_001	Verify Count comes after selecting Other option	TC_OC_01	Import an image of Other on which model trained	1. Import any cell image 2. Select "Other COUNT" option 3. Press on count button	Image quality should be more than of 300 * 300	temp_21.jpg	Count should be displayed in place of "log" label of right lower of GUI	Count should be displayed in range of 232 to 236	234	Pass
		TC_OC_02	Import an image of Other on which model tested	1. Import any cell image 2. Select "Other COUNT" option 3. Press on count button	Image quality should be more than of 300 * 300	temp_22.jpg	Count should be displayed in place of "log" label of right lower of GUI	Count should be displayed in range of 300 to 310	307	Pass
		TC_OC_03	Import an image of Other which is tested on GUI and saved output as indicating labels with green border around each Other	1. Import any cell image 2. Select "Other COUNT" option 3. Press on count button	Image quality should be more than of 300 * 300	temp_03.jpg	Count should be displayed in place of "log" label of right lower of GUI	Count should be wrong	7	Pass
		TC_OC_04	Import an image not having any particular cells	1. Import any image 2. Select "Other COUNT" option 3. Press on count button	Image quality should be more than of 300 * 300	temp_24.jpg	Count should be displayed in place of "log" label of right lower of GUI	Count should be wrong	21	Pass

Table 6.8 Other Test Suite

6.3.5 GUI

Test Scenarion ID	Test Scenario Description	Test Case ID	Test Case Description	Test Steps	Preconditions	Test Data	Post conditions	Expected Result	Actual Result	Status
TS_GI_001	Validate all buttons displayed on left pannel	01_TC_GI_01	Validate Open button	1. RUN application	File Window should be opened for importing image	Any image file with various extensions allowed	Image should be load in central panel only	Image loaded without affecting panels	Image loaded correctly	Pass
		01_TC_GI_02	Validate Count button	1. RUN application 2. Import any type of image 3.Select any one option from options list	Button should be disabled till option is not selected from menu	Any image file with various extensions allowed	Button should be enabled if image resolution match with required crieteria	Button should be enable	Button enable correctly	Pass
		01_TC_GI_03	Validate Save button	1. RUN application 2. Import any type of image 3. Select "Other" option 4. Create at least one React Box within image for reference	Button should be disabled till other option is not selected from menu and reference on image not be created	Any image file with various extensions allowed	Button should be enabled if image resolution match with required crieteria	Button allowed to save reference file	Reference file saved perfectly	Pass
		01_TC_GI_04	Validate Create RectBox button	1. RUN application 2. Import any type of image 3. Select "Other" option	Button should be disabled till other option is not selected from menu	Any image file with various extensions allowed	Button should allow to use it multiple times	Button allowed to create rect. box	Multiple Rectangle boxes can be created succesfully	Pass
		01_TC_GI_05	Validate Duplicate RectBox button	1. RUN application 2. Import any type of image 3. Select "Other" option 4. Create at least one React Box within image for reference	Button should be disabled till other option is not selected from menu and reference on image not be created	Any image file with various extensions allowed	Button shoud allow to use it multiple times after creating one reference box	Button allowed to copy multiple instances of single rect. box	Multiple Rectangle boxes can be copied from one original succesfully	Pass

		01_TC_GI_06	Validate Delete RectBox button	1. RUN application 2. Import any type of image 3. Select "Other" option 4. Create at least one React Box within image for reference	Button should be disabled till other option is not selected from menu and reference on image not be created	Any image file with various extensions allowed	Button shoud allow to use it multiple times after creating one reference box and after deleting all boxes , again button should be disabled	Button allowed to delete multiple instances rect. box and disabled after not having any reference box	Multiple Rectangle boxes can be deleted succesfully and button goes to disable state as no more boxes available	Pass
		01_TC_GI_07	Validate Zoom In button	1. RUN application 2. Import any type of image	Button should be disabled till any kind of image is not loaded on center panel	Any image file with various extensions allowed	Button should be disabled after not containg image in central panel	Button allowed to zoom in to look more deep in image	Image can be zoomed perfectly not afftecting other widgets	Pass
		01_TC_GI_08	Validate Zoom out button	1. RUN application 2. Import any type of image	Button should be disabled till any kind of image is not loaded on center panel	Any image file with various extensions allowed	Button should be disabled after not containg image in central panel	Button allowed to zoom out to look more deep in image	Image can be zoomed out perfectly not afftecting other widgets	Pass
		01_TC_GI_09	Validate Fit Window button	1. RUN application 2. Import any type of image	Button should be disabled till any kind of image is not loaded on center panel	Any image file with various extensions allowed	Button should be disabled after not containg image in central panel	Button allowed to resize height and width to size of central panel	Image can be resized perfectly not afftecting other widgets	Pass
		01_TC_GI_10	Validate Fit Width button	1. RUN application 2. Import any type of image	Button should be disabled till any kind of image is not loaded on center panel	Any image file with various extensions allowed	Button should be disabled after not containg image in central panel	Button allowed to resize height and width to 364*360 approx.	Image can be resized perfectly not afftecting other widgets	Pass

TS_GI_002	Validate all widgets of right pannel	02_TC_GI_01	Validate box label widget	1. Importany image 2. Select"Other COUNT" option 3.Create at least one React Box within image for reference	Widget should contain not anything till steps are not followed	Any image file with various extensions allowed	After removing all references boxes widget again wiped	As box create with label name then it should be displayed inside widget and deleting box removing also from widget	labels are stored for reference boxes as per name saved into label and removed succesfully after deleting it.	Pass
		02_TC_GI_02	Validate Log widget	1. Import any image 2.Select any one option	Image quality should be more than of 300 * 300	Any image file with various extensions allowed	After removing image , widget wiped out all details	No. of square/reactangles detected from image should be displayed in decreasing order in terms of area	Succesfully display decreasing order list of all squares form image	Pass
TS_GI_003	Validate all menus of menubar	03_TC_GI_01	Validate Open File Menu	1. RUN application	All actions are accessable for user	Any image file with various extensions allowed	Image should be load in central panel only	Image loaded without affecting panels	Image loaded correctly	Pass
		03_TC_GI_02	Validate Save File menu	1. RUN application 2. Import any type of image 3. Select "Other" option 4. Create at least one React Box within image for reference	action should be disabled till other option is not selected from options and reference on image not be created	Any image file with various extensions allowed	action should be enabled if image resolution match with required crieteria	action allowed to save reference file	Reference file saved perfectly	Pass
		03_TC_GI_03	Validate Quit File menu	1. RUN application	Application should be opened	-	-	Software must be shut down	Software closed perfectly	Pass
		03_TC_GI_04	Validate Options	1. RUN application 2. Import any image	All options must be disabled till image not uploaded	Any image file with various extensions allowed	Any one option can be select at a time	Any one option can be opt for any image	For any kind of image one option succesfully opted	Pass
		03_TC_GI_05	Validate Help menu	1. RUN application	Any PDF reader must be installed on PC	-	-	PDFs should be opened	PDFs are succesfully opened	Pass

Table 6.9 GUI Test Suite

6.4 White Box

Independent Path Possible

Path	Statements Covered in one Path
1	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,56,60,61,62,63,64,65,66,67,68,69,29,30,31,32,33,34 ,35,70,71,72,73,74,75,76,77,38,39,40,41,42,43,44,78,79,80,81,92,93,94,95,96,97,98,99,100,82,83,84,85,86,87 ,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212,213,214,215,216,187,188,190,192,193 ,194,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168,169,171,172,173,174,175,176,177,178 ,136,137,138,140,142,143,144,145,146,149,150,151,152,156,161 ,180,181,221,223,228
2	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,56,60,61,62,63,64,65,66,67,68,69,29,30,31,32,33,34 ,35,70,71,72,73,76,78,82,84,86,87,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212 ,214,215,216,187,188,189,190,192,193,194,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168 ,174,175,176,177,178,136,137,138,140,142,143,144,145,147,149,150,151,152,156,161 ,180,181,221,223,228
3	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,58,60,61,62,63,64,65,66,67,68,69,29,30,31,34 ,35,70,78,79,80,81,92,93,94,95,96,97,98,99,101,102,103,104,82,83,84,85,86,88,89,111,112,113,114,115,119 ,121,122,123,124,208,209,210,211,212,213,214,215,216,187,188,189,190,192,193,195,197,199,200,201,202 ,203,204,205,217,164,165,166,167,168,169,171,172,173,174,175,176,177,178,136,137,138,140,142,143,144 ,145,146,149,150,151,152,156,161 ,180,181,221,223,228
4	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,56,60,61,62,63,64,65,66,67,68,69,29,30,31,34,35,70 ,78,79,82,83,84,86,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212,214,215,216,187 ,188,189,190,192,193,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168,174,175,176,177 ,178,136,137,138,140,142,143,144,145,147,149,150,151,152,156,161 ,180,181,221,223,228
5	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,56,60,61,62,63,64,65,66,67,68,69,29,30,31,32,33,34 ,35,70,71,72,76,77,38,39,40,41,42,43,44,78,79,80,82,83,84,85,86,87,88,89,111,112,113,114,115,119,121,122 ,123,124,208,209,210,211,212,213,214,215,216,187,188,190,192,193,194,195,197,199,200,201,202,203,204 ,205,217,164,165,166,167,168,169,171,172,173,174,175,176,177,178,136,137,138,140,142,143,144,145,146 ,149,150,151,152,156,161 ,180,181,221,223,228
6	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,56,60,61,62,63,64,65,66,67,68,70,71,72,73,74,75,76 ,78,79,82,83,84,86,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212,214,215,216,187 ,188,189,190,192,193,194,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168,174,175,176,177 ,178,136,137,138,140,142,143,144,145,147,149,150,151,152,156,161 ,180,181,221,223,228
7	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,60,61,62,63,64,65,66,67,68,70,78,79,80,81,92,93,94 ,95,96,97,98,99,100,82,83,84,85,86,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212 ,213,214,215,216,187,188,189,190,192,193,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168 ,169,171,172,173,174,175,176,177,178,136,137,138,140,142,143,144,145,146,149,150,151,152,156,161 ,180,181,221,223,228
8	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,60,61,62,63,64,65,66,67,68,70,78,79,82,83,84,86,87 ,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212,214,215,216,187,188,189,190,192 ,193,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168,174,175,176,177,178,136,137,138,140 ,142,143,144,145,147,149,150,151,152,156,161 ,180,181,221,223,228

9	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,60,61,62,63,64,65,66,67,68,70,71,72,73,76,77,38,39 ,40,43,44,78,79,80,81,92,93,94,95,96,97,98,99,101,102,103,104,82,84,86,88,89,111,112,113,114,115,119,121 ,122,123,124,208,209,210,211,212,213,214,215,216,187,188,190,192,193,194,195,197,199,200,201,202,203 ,204,205,217,164,165,166,167,168,169,171,172,173,174,175,176,177,178,136,137,138,140,142,143,144,145 ,146,149,150,151,152,156,161 ,180,181,221,223,228
10	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,60,61,62,63,64,65,68,69,29,30,31,32,33,34,35,70,71 ,72,76,78,79,82,83,84,85,86,87,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212,214 ,215,216,187,188,189,190,192,193,194,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168,174 ,175,176,177,178,136,137,138,140,142,143,144,145,147,149,150,151,152,156,161 ,180,181,221,223,228
11	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,60,61,62,63,64,65,68,69,29,30,31,32,33,34,35,70,71 ,72,73,74,75,76,77,38,39,40,41,42,43,44,78,79,80,82,83,84,86,87,88,89,111,112,113,114,115,119,121,122 ,123,124,208,209,210,211,212,213,214,215,216,187,188,189,190,192,193,195,197,199,200,201,202,203,204 ,205,217,164,165,166,167,168,169,171,172,173,174,175,176,177,178,136,137,138,140,142,143,144 ,145,146,149,150,151,152,156,161 ,180,181,221,223,228
12	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,60,61,62,63,64,65,68,69,29,30,31,34,35,70,78,79 ,82,83,84,86,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212,214,215,216,187,188 ,189,190,192,193,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168,174,175,176,177 ,178,136,137,138,140,142,143,144,145,147,149,150,151,152,156,161 ,180,181,221,223,228
13	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,60,61,62,63,64,65,68,69,29,30,31,34,35,70,78,79,80 ,81,92,93,94,95,96,97,98,99,100,82,83,84,85,86,87,88,89,111,112,113,114,115,119,121,122,123,124,208 ,209,210,211,212,213,214,215,216,187,188,190,192,193,194,195,197,199,200,201,202,203,204,205,217 ,164,165,166,167,168,169,171,172,173,174,175,176,177,178,136,137,138,140,142,143,144,145,146,149 ,150,151,152,156,161 ,180,181,221,223,228
14	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,60,61,62,63,64,65,68,70,71,72,73,76,78,79,82,83,84 ,86,87,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212,214,215,216,187,188,189,190 ,192,193,194,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168,174,175,176,177,178,136,137 ,138,140,142,143,144,145,147,149,150,151,152,156,161 ,180,181,221,223,228
15	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,60,61,62,63,64,65,68,70,71,72,76,77,38,39,40,43,44 ,78,79,80,81,92,93,94,95,96,97,98,99,101,102,103,104,82,83,84,86,88,89,111,112,113,114,115,119,121,122 ,123,124,208,209,210,211,212,213,214,215,216,187,188,189,190,192,193,195,197,199,200,201,202,203,204 ,205,217,164,165,166,167,168,169,171,172,173,174,175,176,177,178,136,137,138,140,142,143,144,145,146 ,149,150,151,152,156,161 ,180,181,221,223,228
16	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,60,61,62,63,64,65,68,70,78,79,82,83,84,85,86,87,88 ,89,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212,214,215,216,187,188,189,190,192,193 ,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168,174,175,176,177,178,136,137,138,140,142 ,143,144,145,147,149,150,151,152,156,161 ,180,181,221,223,228
17	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,60,61,62,63,64,65,68,70,78,79,80,82,83,84,86,87,88 ,89,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212,213,214,215,216,187,188,190,192,193 ,194,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168,169,171,172,173,174,175,176,177,178 ,136,137,138,140,142,143,144,145,146,149,150,151,152,156,161 ,180,181,221,223,228

18	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,58,60,61,62,63,64,65,66,67,68,69,29,30,31,32,33,34 ,35,70,71,72,73,74,75,76,78,79,82,83,84,86,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210 ,211,212,213,214,215,216,187,188,190,192,193,194,195,197,199,200,201,202,203,204,205,217,164,165,166 ,167,168,174,175,176,177,178,136,137,138,140,142,143,144,145,147,149,150,151,152,156,161,180 ,181,221,223,228
19	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,58,60,61,62,63,64,65,66,67,68,69,29,30,31,32,33,34 ,35,70,71,72,73,76,77,38,39,40,41,42,43,44,78,79,80,81,92,93,94,95,96,97,98,99,100,82,83,84,85,86,87,88,89 ,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212,213,214,215,216,187,188,189,190,192,193 ,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168,169,171,172,173,174,175,176,177,178,136 ,137,138,140,142,143,144,145,146,149,150,151,152,156,161 ,180,181,221,223,228
20	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,58,60,61,62,63,64,65,66,67,68,69,29,30,31,34 ,35,70,78,79,82,83,84,86,87,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212,214,215 ,216,187,188,189,190,192,193,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168,174,175,176 ,177,178,136,137,138,140,142,143,144,145,147,149,150,151,152,156,161 ,180,181,221,223,228
21	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,58,60,61,62,63,64,65,66,67,68,69,29,30,31,34,35 ,70,78,79,80,81,92,93,94,95,96,97,98,99,101,102,103,104,82,83,84,86,88,89,111,112,113,114,115,119,121 ,122,123,124,208,209,210,211,212,213,214,215,216,187,188,190,192,193,194,195,197,199,200,201,202,203 ,204,205,217,164,165,166,167,168,169,171,172,173,174,175,176,177,178,136,137,138,140,142,143,144,145 ,146,149,150,151,152,156,161 ,180,181,221,223,228
22	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,58,60,61,62,63,64,65,66,67,68,70,71,72,76,78,79,82 ,83,84,85,86,87,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212,213,214,215,216,187 ,188,190,192,193,194,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168,174,175,176,177,178 ,136,137,138,140,142,143,144,145,147,149,150,151,152,156,161 ,180,181,221,223,228
23	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,58,60,61,62,63,64,65,66,67,68,70,71,72,73,74,75,76 ,77,38,39,40,43,44,78,79,80,82,83,84,86,87,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210 ,211,212,213,214,215,216,187,188,189,190,192,193,195,197,199,200,201,202,203,204,205,217,164,165,166 ,167,168,169,171,172,173,174,175,176,177,178,136,137,138,140,142,143,144,145,146,149,150,151,152,156 ,161 ,180,181,221,223,228
24	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,58,60,61,62,63,64,65,66,67,68,70,78,79,82,83,84,86 ,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212,214,215,216,187,188,189,190,192 ,193,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168,174,175,176,177,178,136,137,138,140 ,142,143,144,145,147,149,150,151,152,156,161 ,180,181,221,223,228
25	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,58,60,61,62,63,64,65,66,67,68,70,78,79,80,81,92,93 ,94,95,96,97,98,99,100,82,83,84,85,86,87,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210,211 ,212,213,214,215,216,187,188,190,192,193,194,195,197,199,200,201,202,203,204,205,217,164,165,166,167 ,168,169,171,172,173,174,175,176,177,178,136,137,138,140,142,143,144,145,146,149,150,151,152,156,161 ,180,181,221,223,228

26	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,58,60,61,62,63,64,65,68,69,29,30,31,32,33,34,35,70 ,71,72,73,76,78,79,82,83,84,86,87,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210,211 ,212,213,214,215,216,187,188,190,192,193,194,195,197,199,200,201,202,203,204,205,217,164,165,166,167 ,168,174,175,176,177,178,136,137,138,140,142,143,144,145,147,149,150,151,152,156,161,180,181,221,223 ,228
27	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,58,60,61,62,63,64,65,68,69,29,30,31,32,33,34,35,70 ,71,72,76,77,38,39,40,41,42,43,44,78,79,80,81,92,93,94,95,96,97,98,99,101,102,103,104,82,83,84,86,88,89 ,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212,213,214,215,216,187,188,189,190,192 ,193,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168,169,171,172,173,174,175,176,177,178 ,136,137,138,140,142,143,144,145,146,149,150,151,152,156,161 ,180,181,221,223,228
28	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,58,60,61,62,63,64,65,68,69,29,30,31,34,35,70,78,79 ,82,83,84,85,86,87,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212,214,215,216,187 ,188,189,190,192,193,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168,174,175,176,177,178 ,136,137,138,140,142,143,144,145,147,149,150,151,152,156,161 ,180,181,221,223,228
29	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,58,60,61,62,63,64,65,68,69,29,30,31,34,35,70,78 ,79,80,82,83,84,86,87,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212,213,214,215 ,216,187,188,190,192,193,194,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168,169,171,172 ,173,174,175,176,177,178,136,137,138,140,142,143,144,145,146,149,150,151,152,156,161 ,180,181,221,223,228
30	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,58,60,61,62,63,64,65,68,70,71,72,73,74,75,76,78,79 ,80,81,92,93,94,95,96,97,98,99,100,82,83,84,86,88,89,111,112,113,114,115,119,121,122,123,124,208,209 ,210,211,212,213,214,215,216,187,188,190,192,193,194,195,197,199,200,201,202,203,204,205,217,164,165 ,166,167,168,174,175,176,177,178,136,137,138,140,142,143,144,145,147,149,150,151,152,156,161 ,180,181,221,223,228
31	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,58,60,61,62,63,64,65,68,70,71,72,73,76,77,38,39,40 ,43,44,78,79,82,83,84,85,86,87,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212,213 ,214,215,216,187,188,189,190,192,193,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168,169 ,171,172,173,174,175,176,177,178,136,137,138,140,142,143,144,145,146,149,150,151,152,156,161 ,180,181,221,223,228
32	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,58,60,61,62,63,64,65,68,70,78,79,80,81,92,93,94,95 ,96,97,98,99,101,102,103,104,82,83,84,86,87,88,89,111,112,113,114,115,119,121,122,123,124,208,209,210 ,211,212,214,215,216,187,188,189,190,192,193,195,197,199,200,201,202,203,204,205,217,164,165,166,167 ,168,174,175,176,177,178,136,137,138,140,142,143,144,145,147,149,150,151,152,156,161 ,180,181,221,223,228
33	12,15,16,17,18,21,22,23,26,47,48,49,50,51,52,53,54,55,58,60,61,62,63,64,65,68,70,78,79,82,83,84,86,88,89 ,111,112,113,114,115,119,121,122,123,124,208,209,210,211,212,213,214,215,216,187,188,190,192,193,194 ,195,197,199,200,201,202,203,204,205,217,164,165,166,167,168,169,171,172,173,174,175,176,177,178,136 ,137,138,140,142,143,144,145,146,149,150,151,152,156,161 ,180,181,221,223,228

Table 6.10 Path Table

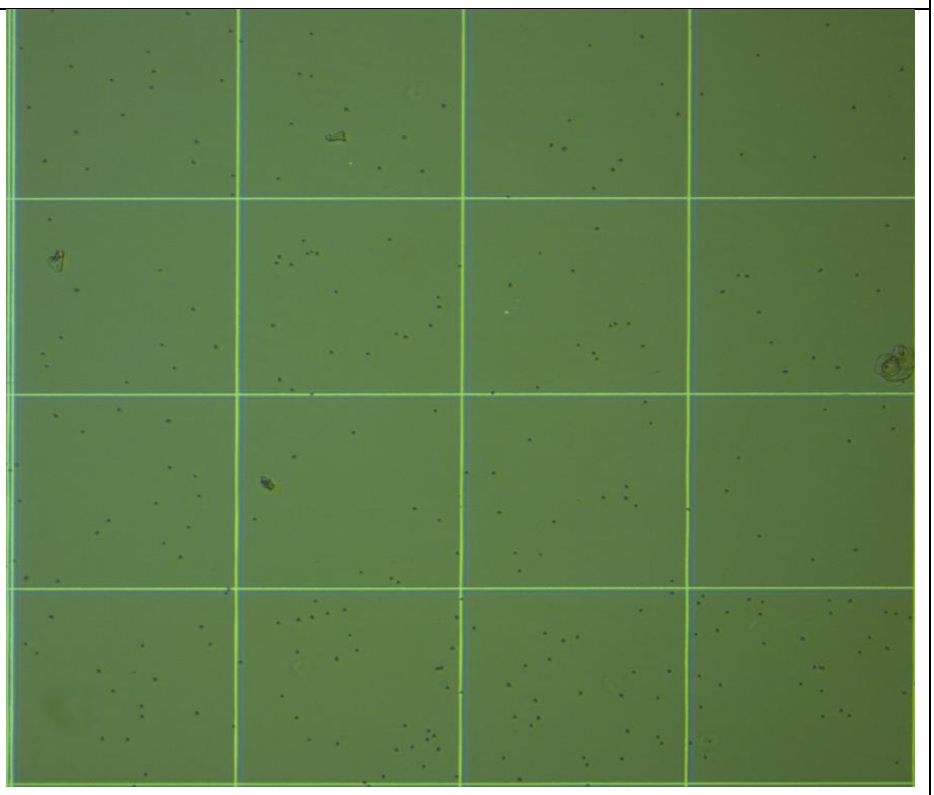
Sr No.	Image Name	Image
1	temp_1.jpg	
2	temp_2.jpg	

Table 6.11 Image Table

Path Coverage

Sr No.	Image Name	Paths Covered (Statements covered for that one specific path)
1	temp_1.jpg	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33
2	temp_2.jpg	1,2,4,5,6,7,8,10,11,12,13,14,16,17,18,19,20,22,23,24,25,26,28,29,30,31,33

Table 6.12 Path Coverage

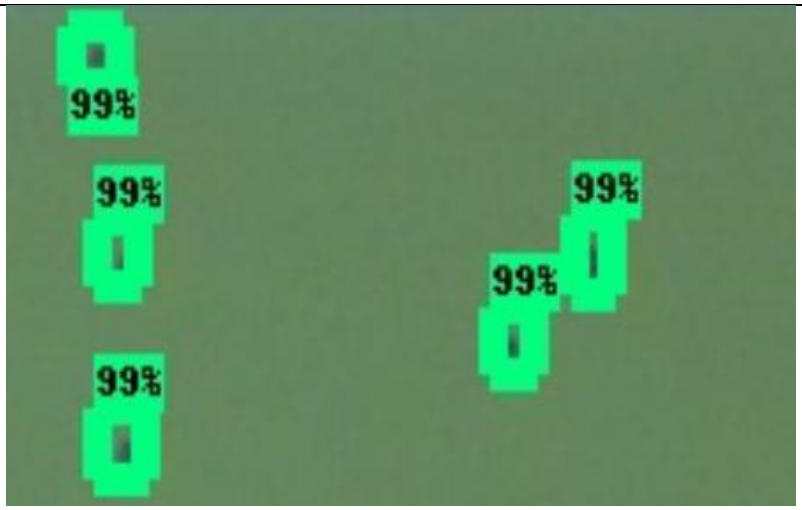
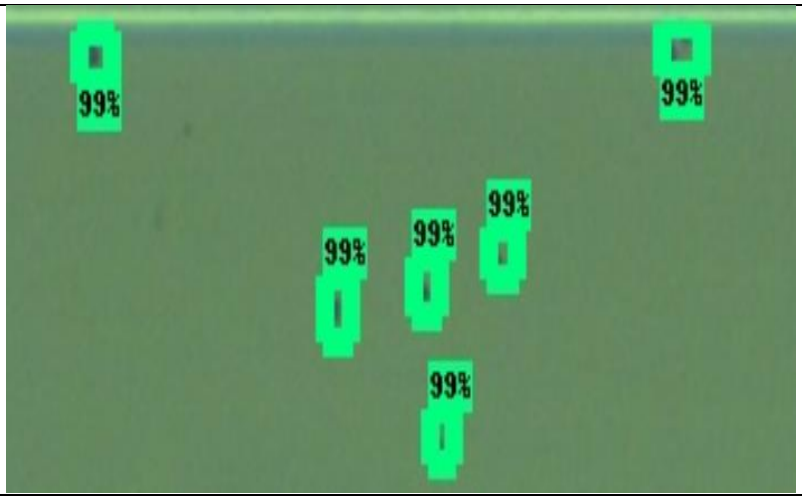
Branch Possible

Sr No.	Condition	For What condition is?
1	if(lines is not None)	To check whether lines are available and detect or not
2	if(a==0)	To check for detected line is horizontal line or vertical line
3	if (temp1[i][0] and temp1[i][2] == temp1[j][2] and np.abs(temp1[j][1] - temp1[i][1]) < 10)	To check whether detected line not be used before and having in same horizontal line with not more than 10px variation between 2 lines
4	if(t is not None)	To check whether any horizontal lines are there or not
5	if (temp2[i][0] and temp2[i][2] == temp2[j][2] and np.abs(temp2[j][1] – temp2[i][1]) < 10)	To check whether detected line not be used before and having in same vertical line with not more than 10px variation between 2 lines
6	if(t is not None)	To check whether any vertical lines are there or not
7	if(determinant==0)	To check whether 2 lines are parallel or not
8	if(top>total_display_str_height)	To check whether detected object is very close to upper/lower border of image , so label is given to opposite of that direction
9	if(scores is None or scores[i] > min_score_thresh)	To check whether prediction array is not null along with each single predicted object must be greater than 0.4 value
10	if(tensor_name in all_tensor_names)	To check whether predicted things contains more than one type then all things

		should be displayed or rather than only one thing should be displayed as detection
11	if ('detection_masks' in output_dict)	To check whether any model already been created or not
12	if(scale_percent>1)	To check whether imported image is more than 375*370 then rescale or not

Table 6.13 Branch Table

Branch Coverage

Sr No.	Image	Conditions Covered
1		8,9,10,11
2		1,2,3,4,8,9,10,11

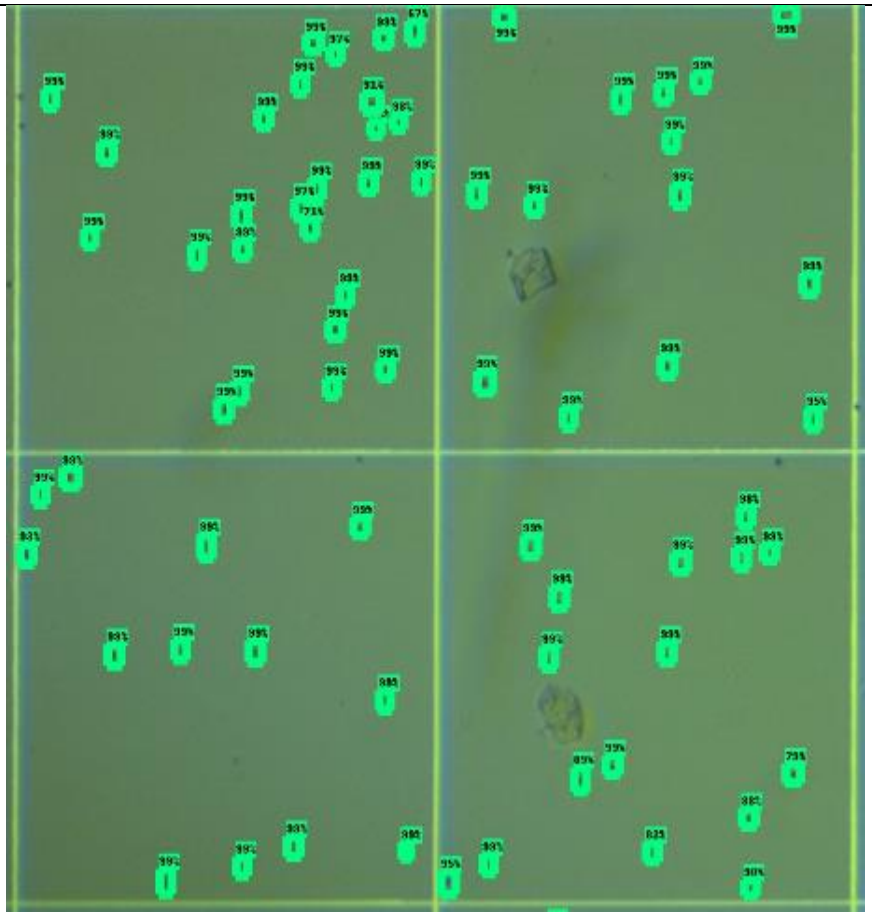
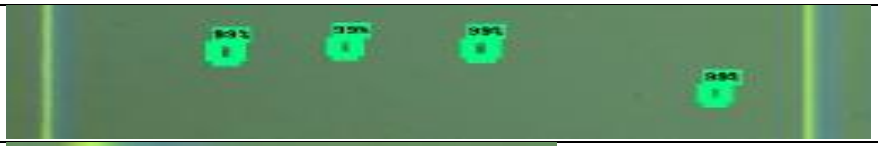
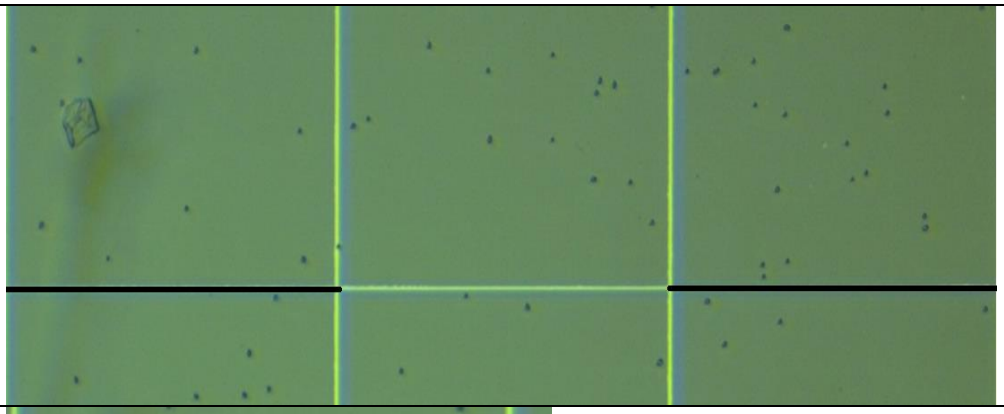
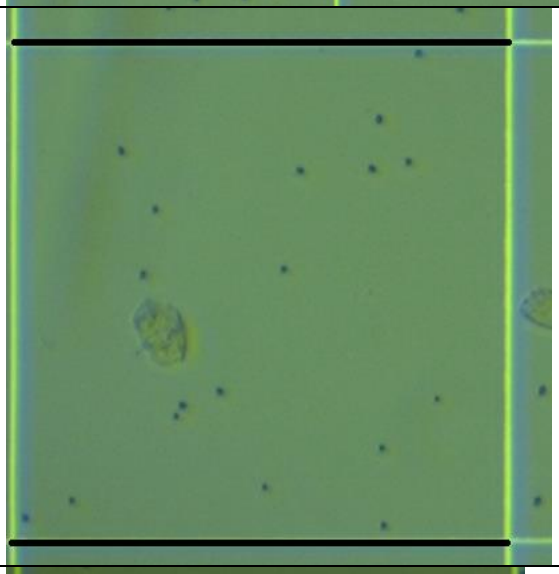
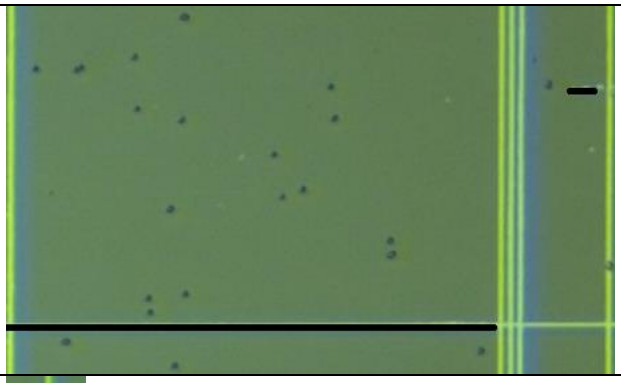
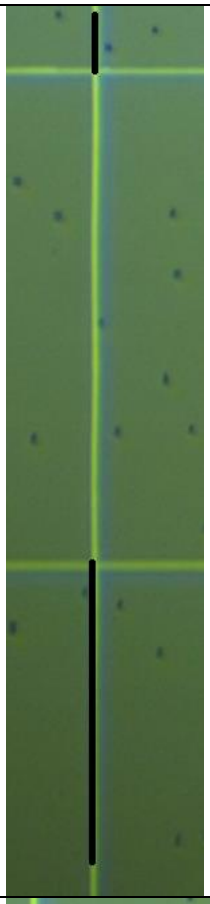
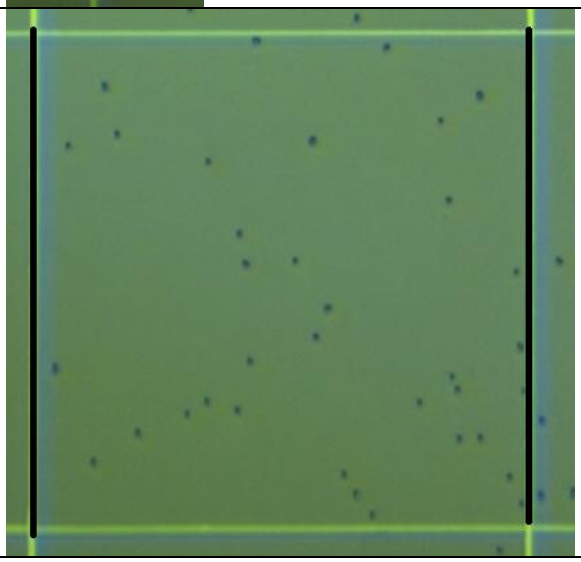
3		1,2,3,4,5,6,8,9, 10,11,12
4		1,2,5,6,7,9,10, 11
5		1,2,5,6

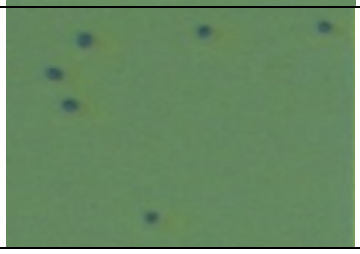
Table 6.14 Branch Coverage

Image Table

Sr No.	Image Name	Image
1	temp_1.jpg	
2	temp_2.jpg	
3	temp_3.jpg	
4	temp_4.jpg	
5	temp_5.jpg	

6	temp_6.jpg	
7	temp_7.jpg	
8	temp_8.jpg	

9	temp_9.jpg	
10	temp_10.jpg	

11	temp_11.jpg	
12	temp_12.jpg	
13	temp_13.jpg	
14	temp_14.jpg	

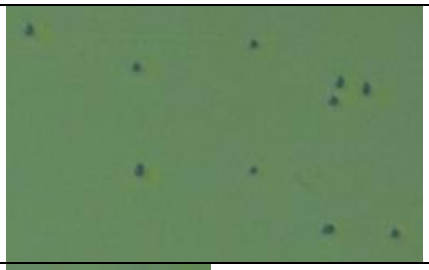
15	temp_15.jpg	
16	temp_16.jpg	

Table 6.15 Image Table

Condition Coverage

Sr No.	Condition	For What it is?	Input Image	Expected Output	Actual Output	Result
1	if(temp1[i][0])	To check whether horizontal line is used or not	temp_1.jpg	True	True	**Passed**
	if(temp1[i][0])		temp_2.jpg	False	False	**Passed**
2	if(temp1[i][2]==temp1[j][2])	To check whether both pieces of lines are in same horizontal line or not	temp_3.jpg	True	True	**Passed**
	if(temp1[i][2]==temp1[j][2])		temp_4.jpg	False	False	**Passed**
3	if(np.abs(temp1[j][1]-temp1[i][1])<10)	To check whether variation in pixels values of both pieces of line in same horizontal line must be less than 10	temp_5.jpg	True	True	**Passed**
	if(np.abs(temp1[j][1]-temp1[i][1])<10)		temp_6.jpg	False	False	**Passed**
4	if(temp2[i][0])	To check whether vertical line is used or not	temp_7.jpg	True	True	**Passed**
	if(temp2[i][0])		temp_8.jpg	False	False	**Passed**
5	if(temp2[i][2]==temp2[j][2])	To check whether both pieces of lines are in same vertical line or not	temp_9.jpg	True	True	**Passed**
	if(temp2[i][2]==temp2[j][2])		temp_10.jpg	False	False	**Passed**
6	if(np.abs(temp2[j][1]-temp2[i][1])<10)	To check whether variation in pixels	temp_11.jpg	True	True	**Passed**

		values of both pieces of line in same vertical line must be less than 10				
	if(np.abs(temp2[j][1]-temp2[i][1])<10)		temp_12.jpg	False	False	**Passed**
7	if(scores is None)	To check whether prediction array is null or not	temp_13.jpg	True	True	**Passed**
	if(scores is None)		temp_14.jpg	False	False	**Passed**
8	if(scores[i]>0.4)	To check whether predicted object more than 0.4 to detect and count for future operations	temp_15.jpg	True	True	**Passed**
	if(scores[i]>0.4)		temp_16.jpg	False	False	**Passed**

Table 6.16 Condition Coverage

Chapter 7 – CONCLUSION & DISCUSSION

7.1 SELF ANALYSIS OF PROJECT VIABILITIES

Main aspects of project viabilities are : Sustainability and business growth.

Till this day this system is not taking any charge for using it but as time pass, this system will become more popular and widespread use , team is currently thinking on at which price level software have to reach so that it is affordable by all colleges/universities and also team will get some benefits from system so it is *WIN-WIN* situation for both.

Sustainability of system is very crucial as system will use over wide range because so many diversities are available in this biology field so system must reach up to mark of satisfaction for every single image and accuracy should not be compromised.

7.2 PROBLEM ENCOUNTERED AND POSSIBLE SOLUTIONS

Main problem is about how to allocate task as all members are inexperience in every field so team decided that one cannot know his/her best abilities so let team decide which role are suit for whom and thus with help of teammates roles are assign to that particular team member.

Another major issue was lack of resources, as out of 6 , 2 members have not laptop after 2 weeks of initiate project. So, just make balance between this time period was little bit tough but then team approved permission from college to access lab even after college hours.

Third major problem is that if someone not completing his/her work then for maintaining a timeline of project manager must have to assign that task to someone else which is more reliable and thus switching tasks from one to another is key for solving this issue.

7.3 SUMMARY OF PROJECT WORK

This is very good experience to work in big group on such this kind of real time problem and understanding development between team members are very essential if it comes under coordination skill in industries. Some minor misunderstandings, little bit of clash between team members are there but they all are obvious as 6 person thought on same then there is always an chance of clash but after all at the end of session team comes up with one uniform thought which is very big deal. All members learnt a lot during this period of time and also some professional manners improved.

Chapter 8 – LIMITATION & FUTURE ENHANCEMENT

LIMITATION:

There should must be some drawback of any system, as this system works with subject which already have millions of variants for specific one species so major limitations are :

- Accuracy might not same for each modules
- Image quality play very vital role
- If References are not opted correctly, then system gives wrong output

FUTURE ENHANCEMENT:

As future concerns, Team tries hard to launch it on big stage and also include analytical parts which is derived from count so that this system will do everything on behalf of student, faculty and researchers. Another big future thought is to maintain accuracy up to 98% for every kind of cell detection.

Bibliography:

TensorFlow Installation :

https://gilberttanner.com/blog/installing-the-tensorflow-object-detection-api

PyQt5:

https://www.youtube.com/watch?v=JBME1ZyHiP8&list=PLQVvvaa0QuDdVpDFNq4FwY9APZPGSUyR4

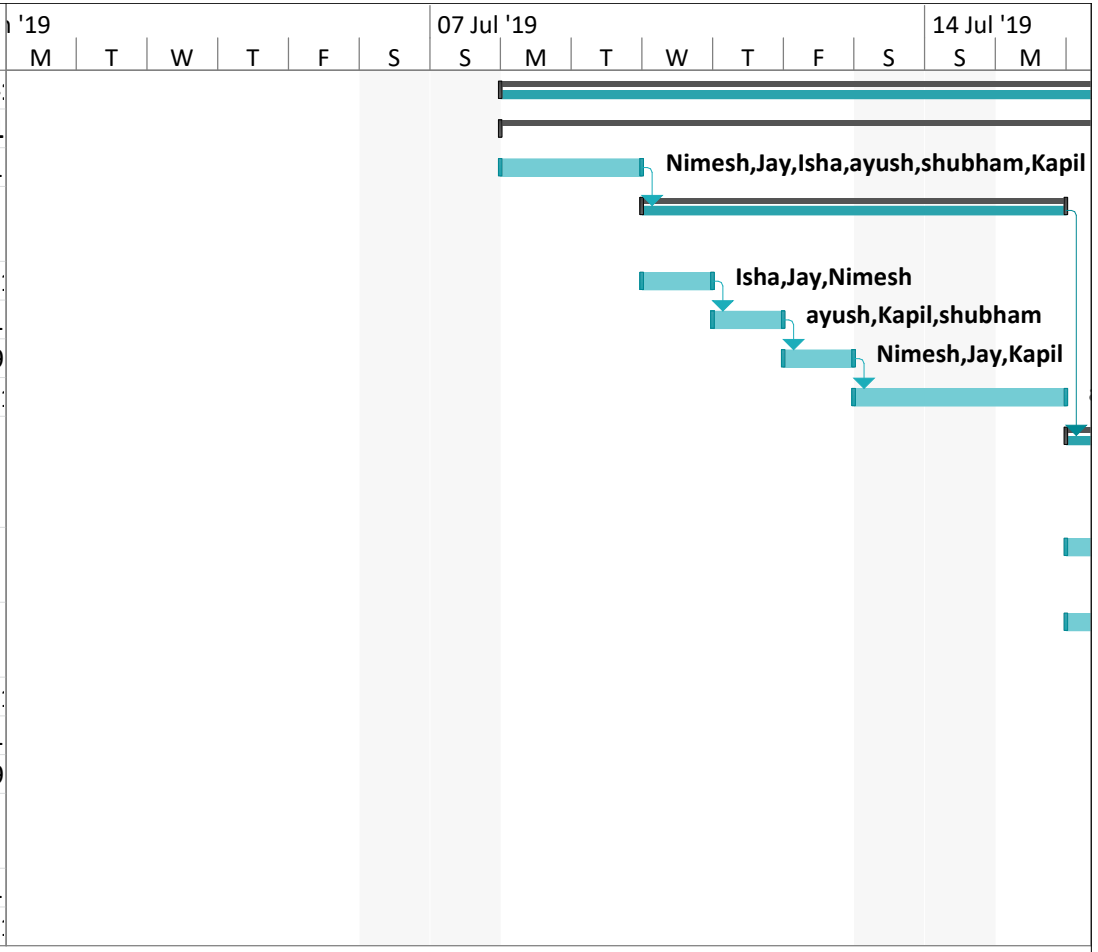
Python:

https://www.youtube.com/watch?v=QXeEoD0pB3E&list=PLsyeobzWxl7poL9JTVyndKe62ieoN-MZ3

Deep Learning techniques to build automotive-related algorithms:

https://www.udemy.com/course/applied-deep-learningtm-the-complete-self-driving-car-course/

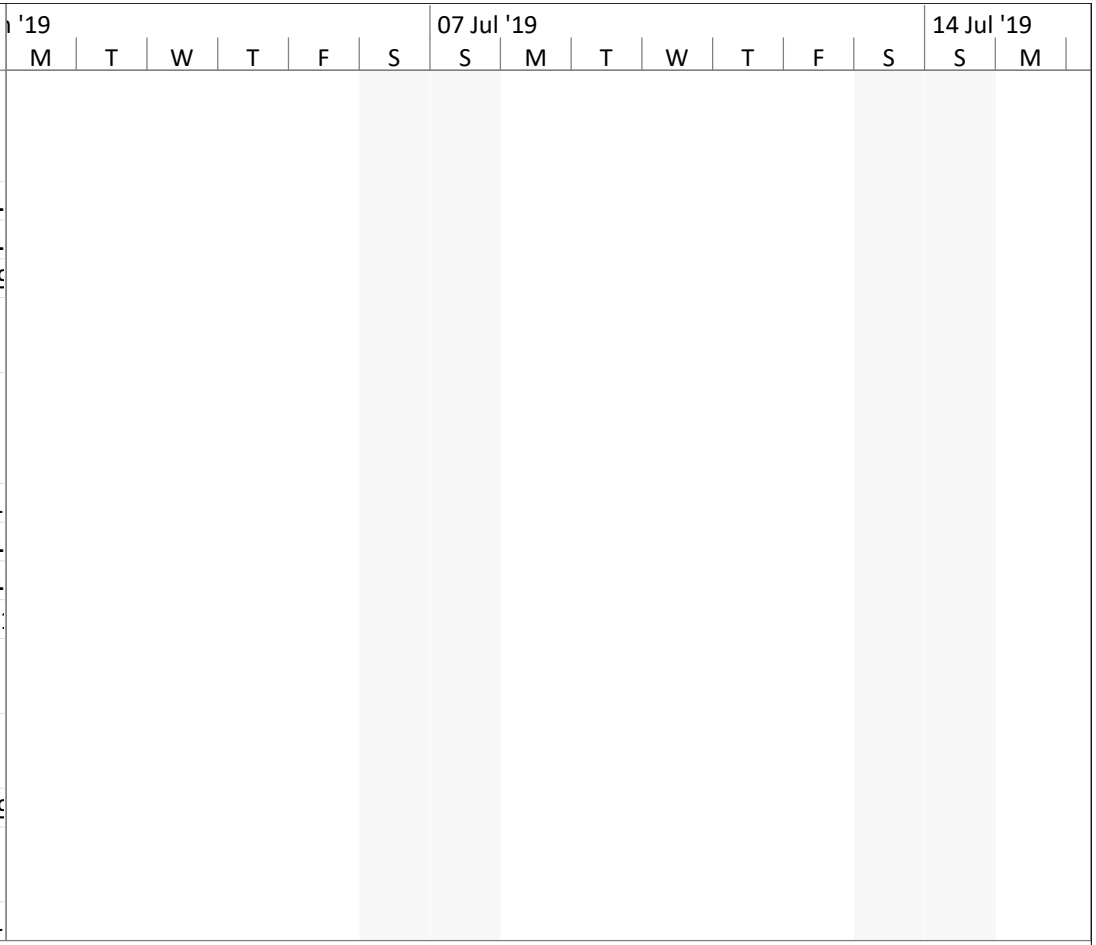
ID	Task Mode	Task Name	Duration	Start	Finish
1		**Cell Counter**	**3.55 mons**	**Mon 08-07-**	**Mon 14-10-**
2		**Software Requirem**	**14 days**	**Mon 08-07-**	**Thu 25-07-1**
3		Feasibility Study	2 days	Mon 08-07-	Tue 09-07-1
4		**Requirement Gathering**	**4 days**	**Wed 10-07-19**	**Mon 15-07-19**
5		Interview	1 day	Wed 10-07-	Wed 10-07-
6		Quesionnaries/	1 day	Thu 11-07-1	Thu 11-07-1
7		User Observati	1 day	Fri 12-07-19	Fri 12-07-19
8		Brain Storming	2 days	Sat 13-07-1	Mon 15-07-
9		**Software Requirement Specification**	**7 days**	**Tue 16-07-19**	**Wed 24-07-19**
10		Functional Requirements	1 day	Tue 16-07-19	Tue 16-07-19
11		Non-Funvtiona Requirements	1 day	Tue 16-07-19	Tue 16-07-19
12		User Stories	1 day	Wed 17-07-	Wed 17-07-
13		Use case diagra	1 day	Thu 18-07-1	Thu 18-07-1
14		Use case Narra	1 day	Fri 19-07-19	Fri 19-07-19
15		Decision Tree/Decision	1 day	Sat 20-07-19	Sat 20-07-19
16		SRS	3 days	Sun 21-07-1	Tue 23-07-1
17		GUI screen prir	1 day	Wed 24-07-	Wed 24-07-



Project: msproj11
Date: Fri 11-10-19

Task		Inactive Task		Start-only	
Split		Inactive Milestone		Finish-only	
Milestone		Inactive Summary		Deadline	
Summary		Manual Task		Progress	
Project Summary		Duration-only		Manual Progress	
External Tasks		Manual Summary Rollup			
External Milestone		Manual Summary			

ID	Task Mode	Task Name	Duration	Start	Finish
18		Software Requirement Validation	1 day	Thu 25-07-19	Thu 25-07-19
19		**Software Design**	**25 days**	**Fri 26-07-19**	**Thu 29-08-1**
20		**Structural Analys**	**10 days**	**Fri 26-07-19**	**Thu 08-08-1**
21		Model selectio	2 days	Fri 26-07-19	Sat 27-07-19
22		Identify function to	3 days	Sun 28-07-19	Tue 30-07-19
23		Decompose functions into subfunctions	3 days	Wed 31-07-19	Fri 02-08-19
24		DFD	5 days	Sat 03-08-19	Thu 08-08-1
25		**Structural Design**	**15 days**	**Fri 09-08-19**	**Thu 29-08-1**
26		**High-level desi**	**10 days**	**Fri 09-08-19**	**Thu 22-08-1**
27		ER diagram	2 days	Fri 09-08-19	Mon 12-08-
28		Sequence diagram	2 days	Tue 13-08-19	Wed 14-08-19
29		Activity flow	1 day	Thu 15-08-19	Thu 15-08-19
30		Structure dia	2 days	Fri 16-08-19	Sat 17-08-19
31		Object Oriented	4 days	Sun 18-08-19	Wed 21-08-19
32		Data Diction	1 day	Thu 22-08-1	Thu 22-08-1



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External Milestone	Manual Summary		

ID	Task Mode	Task Name	Duration	Start	Finish
33		**Detailed level design**	**5 days**	**Fri 23-08-19**	**Thu 29-08-19**
34		UI design	5 days	Fri 23-08-19	Thu 29-08-1
35		Algorithms d	5 days	Fri 23-08-19	Thu 29-08-1
36		**Coding**	**25 days**	**Fri 30-08-19**	**Thu 03-10-1**
37		Module 1 coding	5 days	Fri 30-08-19	Thu 05-09-1
38		Module 2 coding	4 days	Thu 12-09-1	Tue 17-09-1
39		Module 3 coding	4 days	Sun 22-09-1	Wed 25-09-
40		Module 4 coding	4 days	Mon 30-09-	Thu 03-10-1
41		**Testing**	**22 days**	**Fri 06-09-19**	**Mon 07-10-**
42		Module 1 testing	2 days	Fri 06-09-19	Mon 09-09-
43		Module 2 testing	2 days	Wed 18-09-	Thu 19-09-1
44		Module 3 testing	2 days	Thu 26-09-1	Fri 27-09-19
45		Module 4 testing	2 days	Fri 04-10-19	Mon 07-10-
46		**System integration**	**21 days**	**Tue 10-09-1**	**Tue 08-10-1**
47		Module 1 integra	1 day	Tue 10-09-1	Tue 10-09-1
48		Module 2 integra	1 day	Fri 20-09-19	Fri 20-09-19
49		Module 3 integra	1 day	Sat 28-09-19	Sat 28-09-19
50		Module 4 integra	1 day	Tue 08-10-1	Tue 08-10-1
51		**Customer feedback**	**21 days**	**Wed 11-09-**	**Wed 09-10-**
52		Customer feedback for	1 day	Wed 11-09-19	Wed 11-09-19
53		Customer feedback for	1 day	Sat 21-09-19	Sat 21-09-19

'19
M T W T F S 07 Jul '19 S M T W T F S 14 Jul '19 S M

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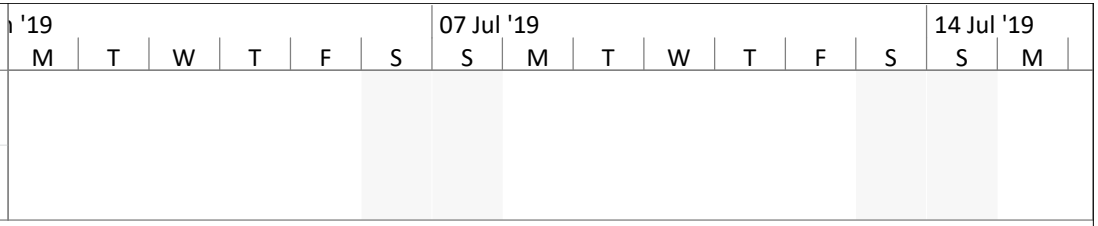
Project Summary	Duration-only	Manual Progress	
External Tasks	Manual Summary Rollup		
External Milestone	Manual Summary		

ID	Task Mode	Task Name	Duration	Start	Finish
54		Customer feedback for	1 day	Sun 29-09-19	Sun 29-09-19
55		Customer feedback for	1 day	Wed 09-10-19	Wed 09-10-19



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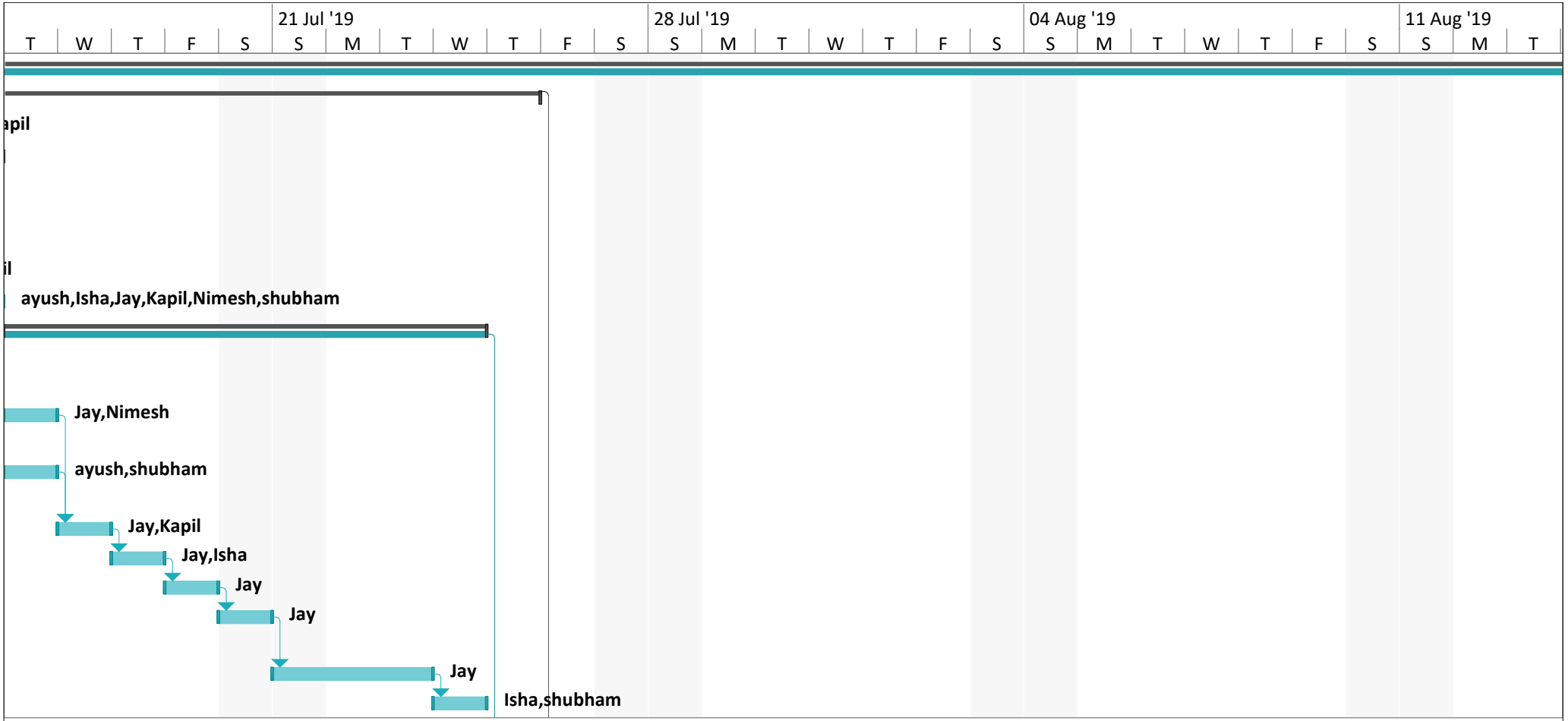

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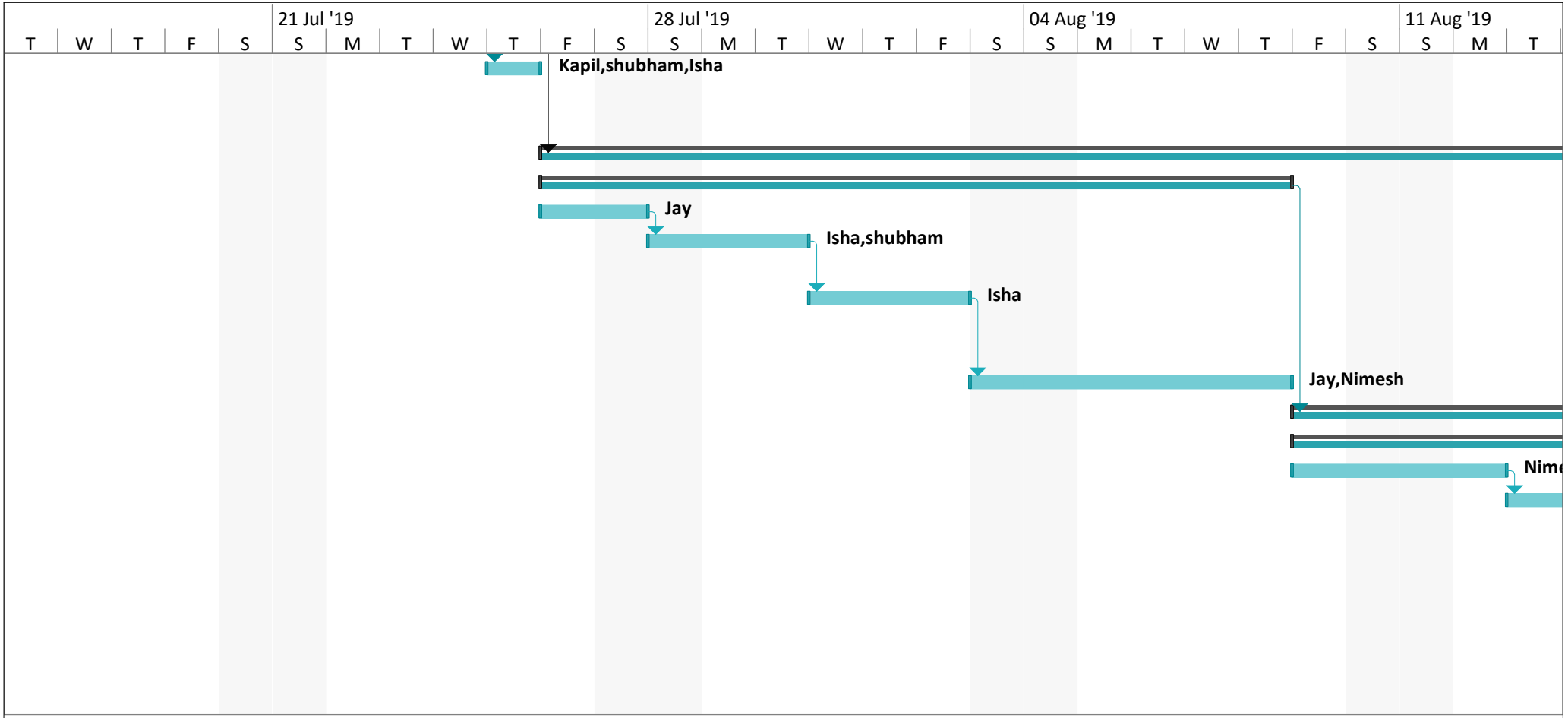

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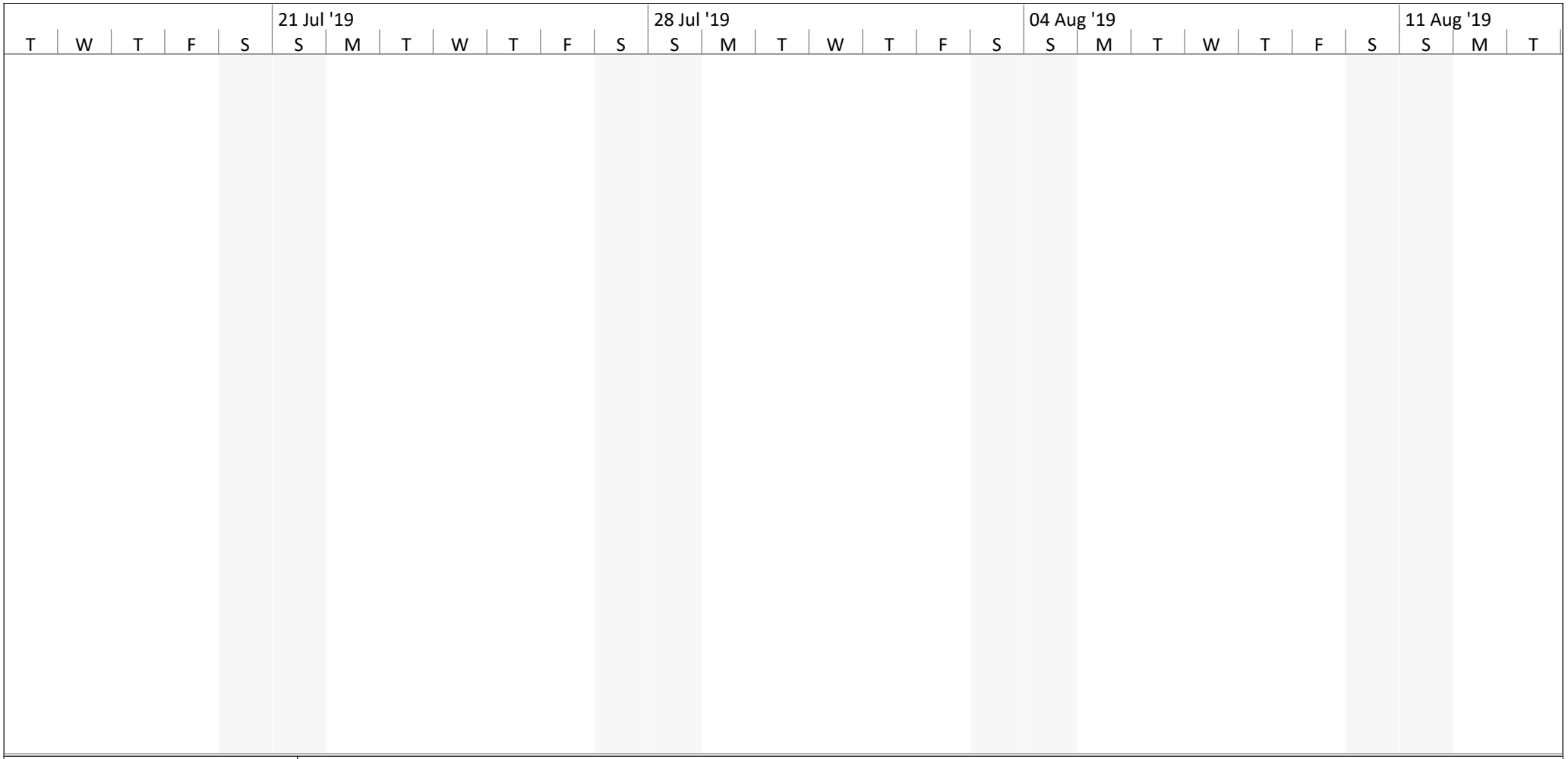

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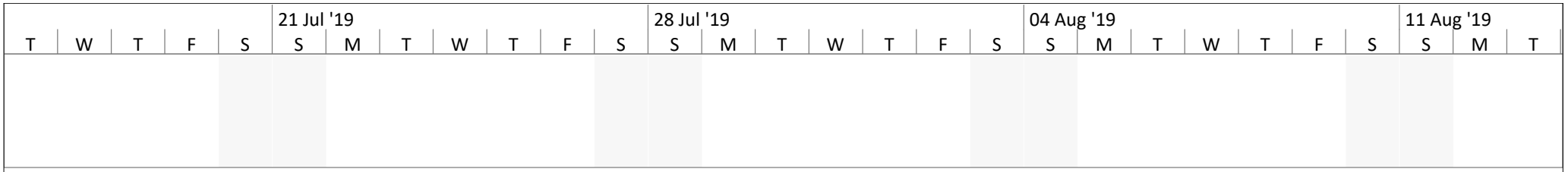

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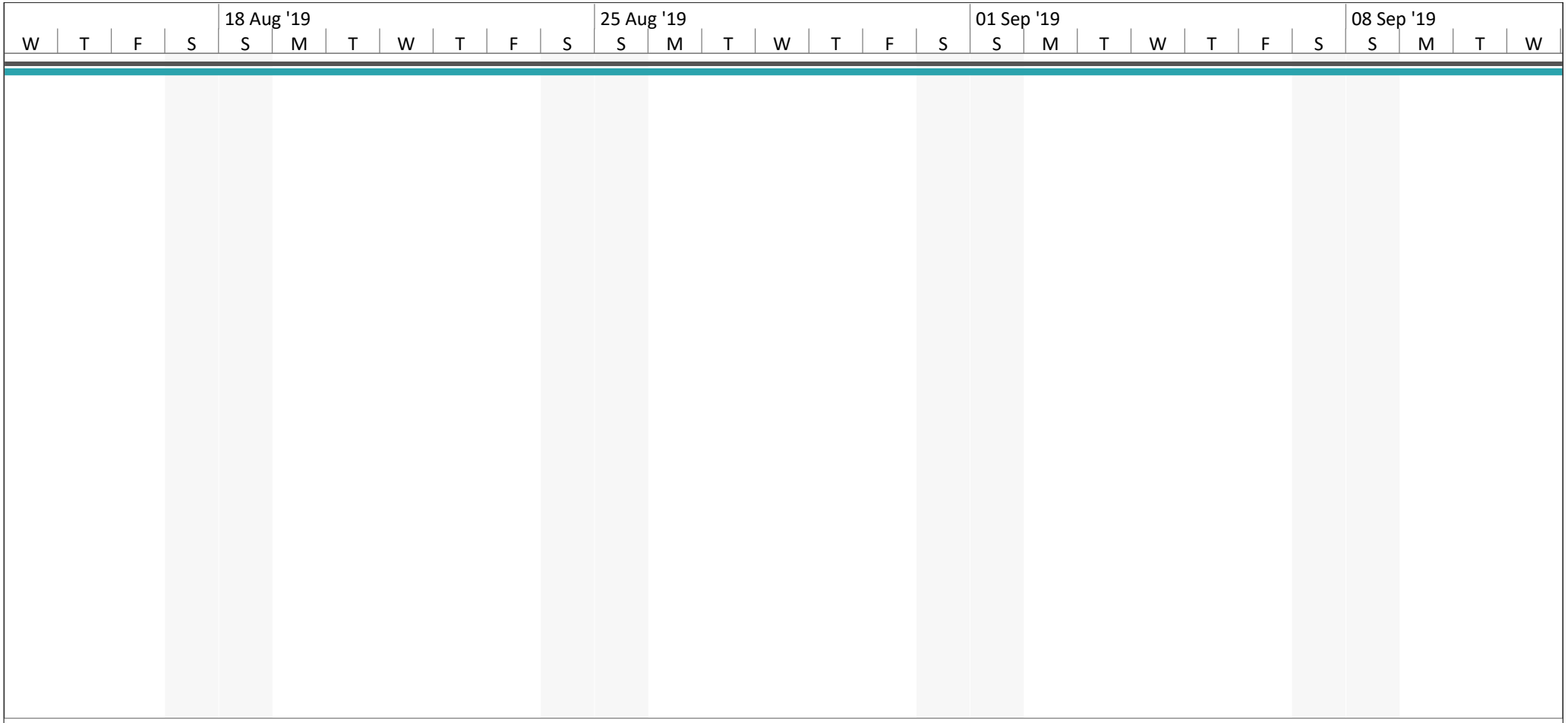

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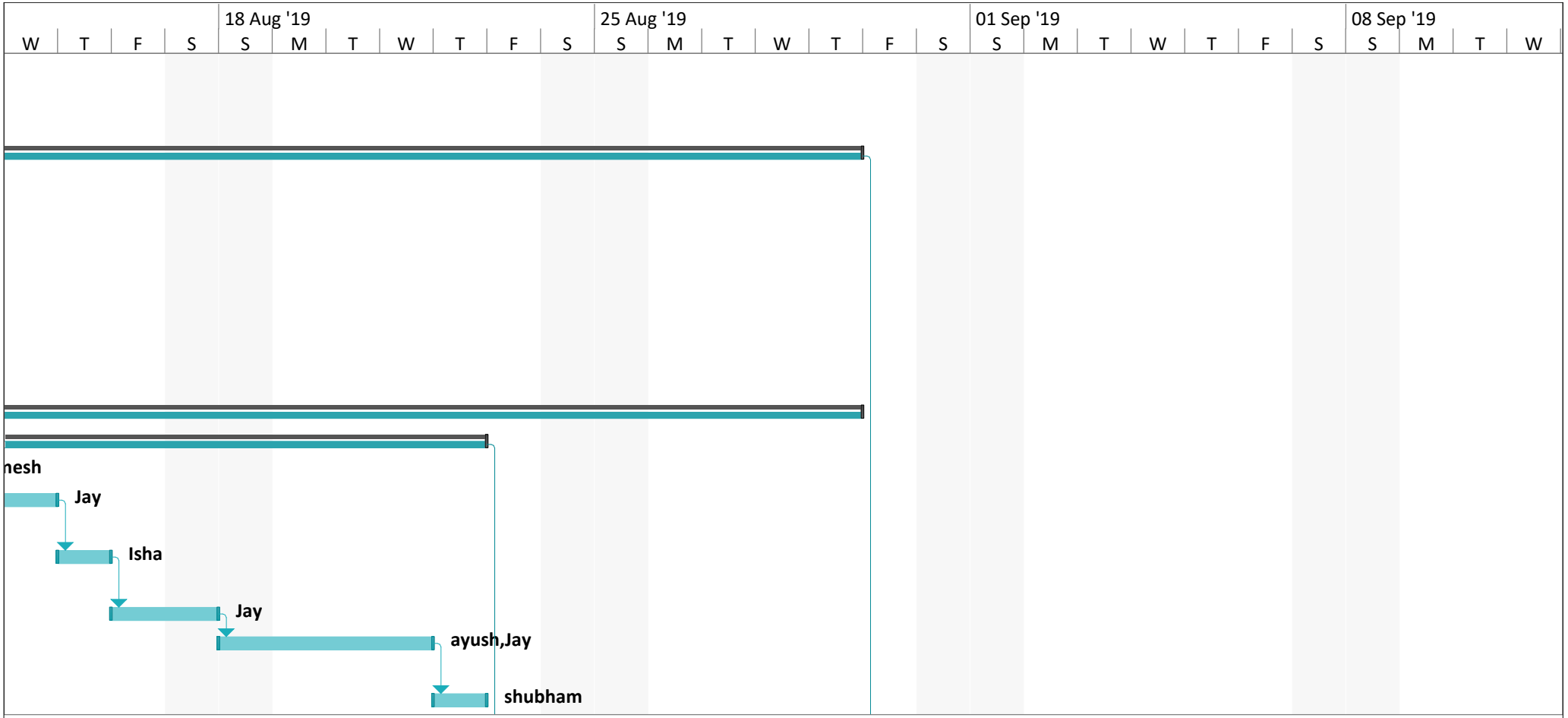

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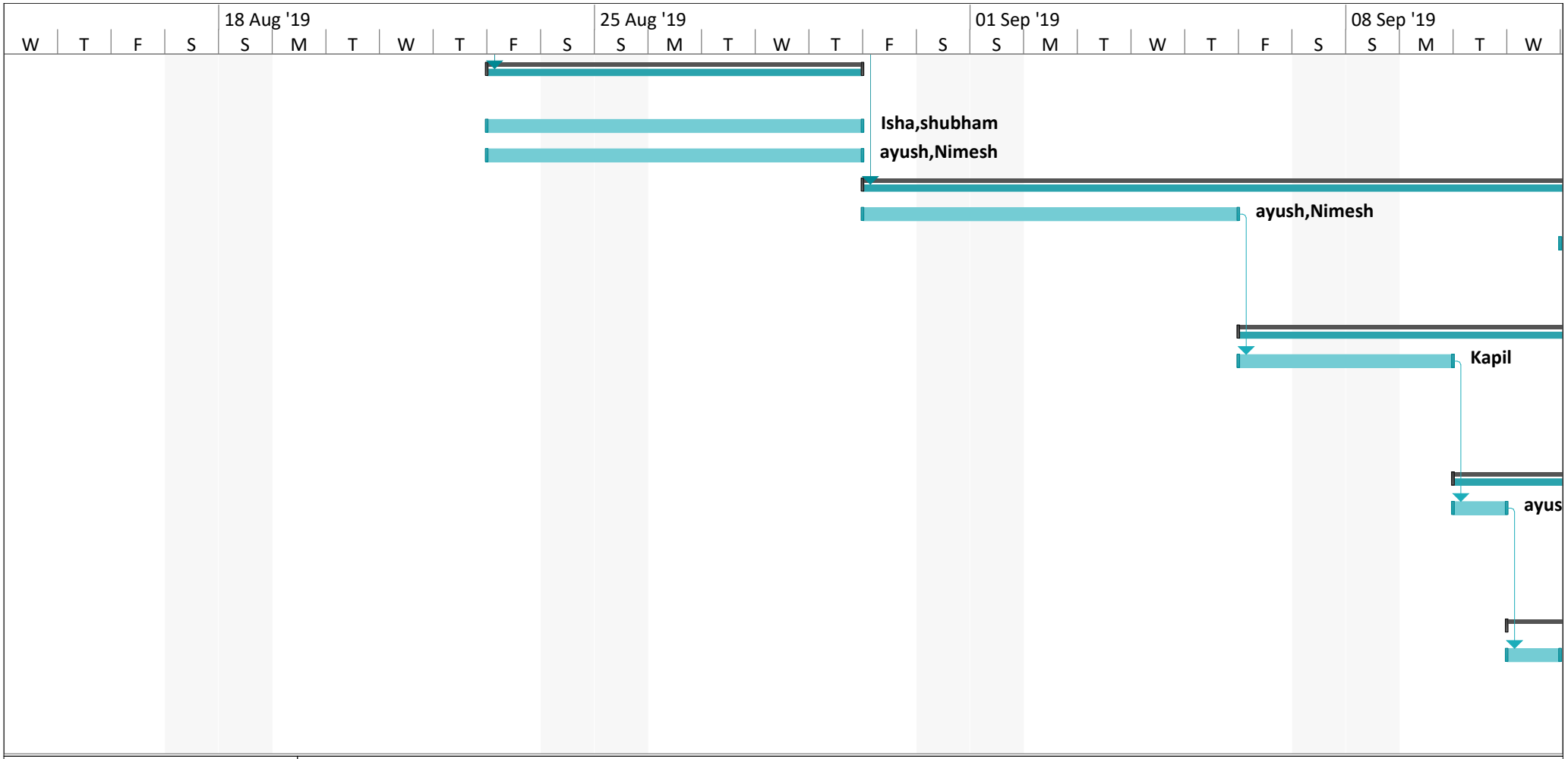

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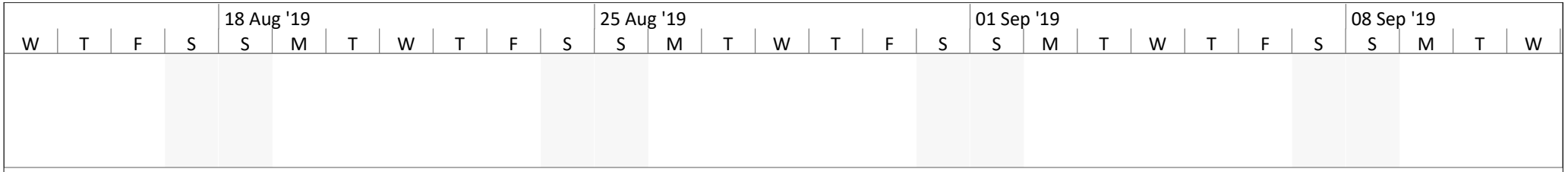

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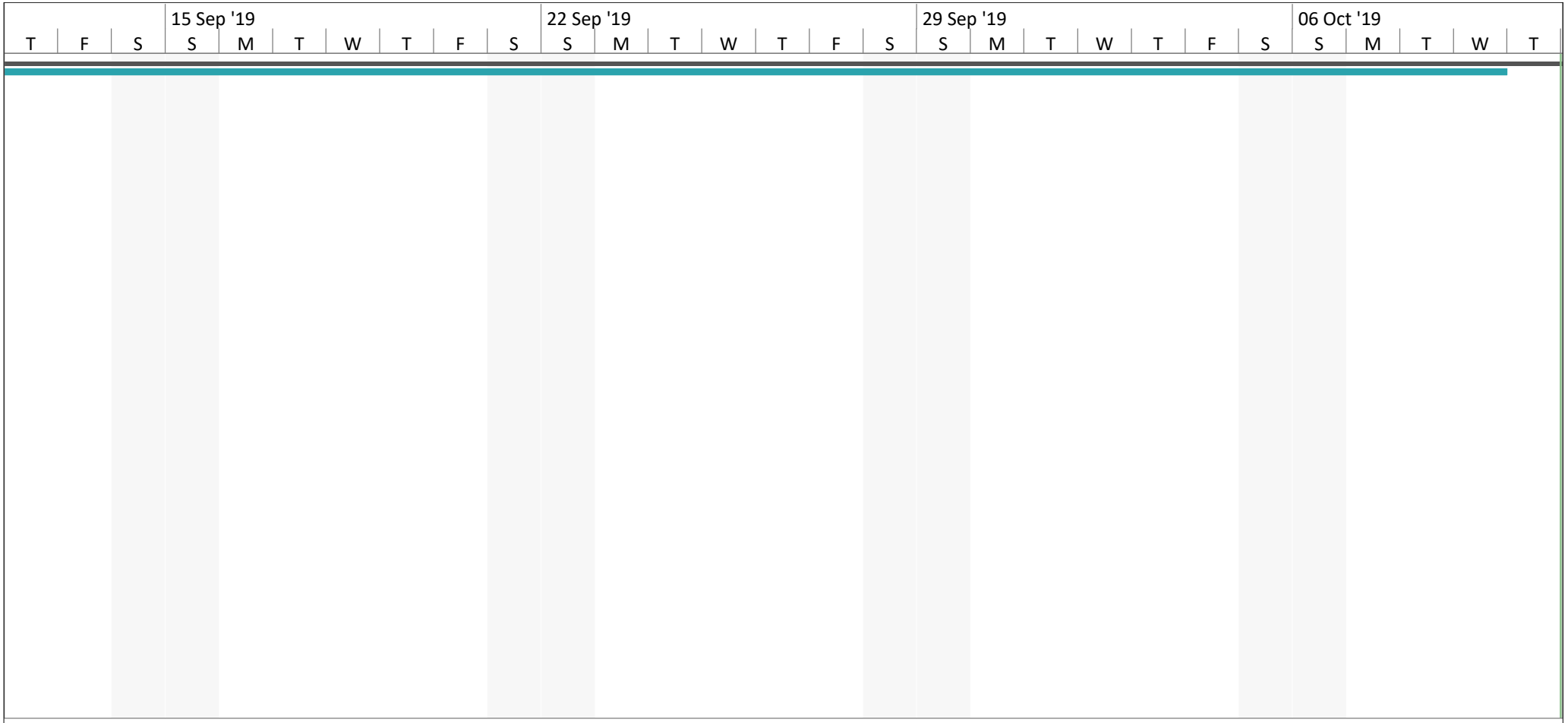

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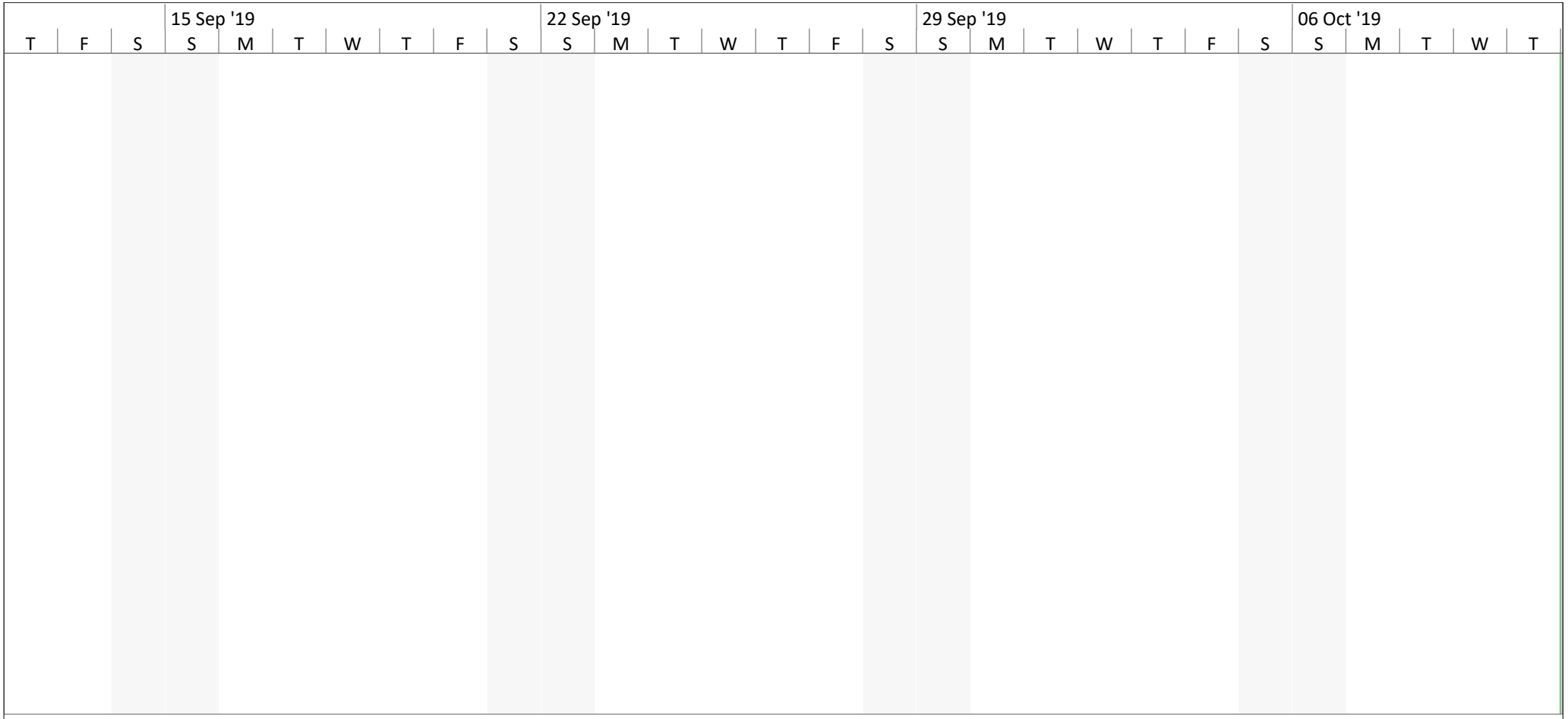

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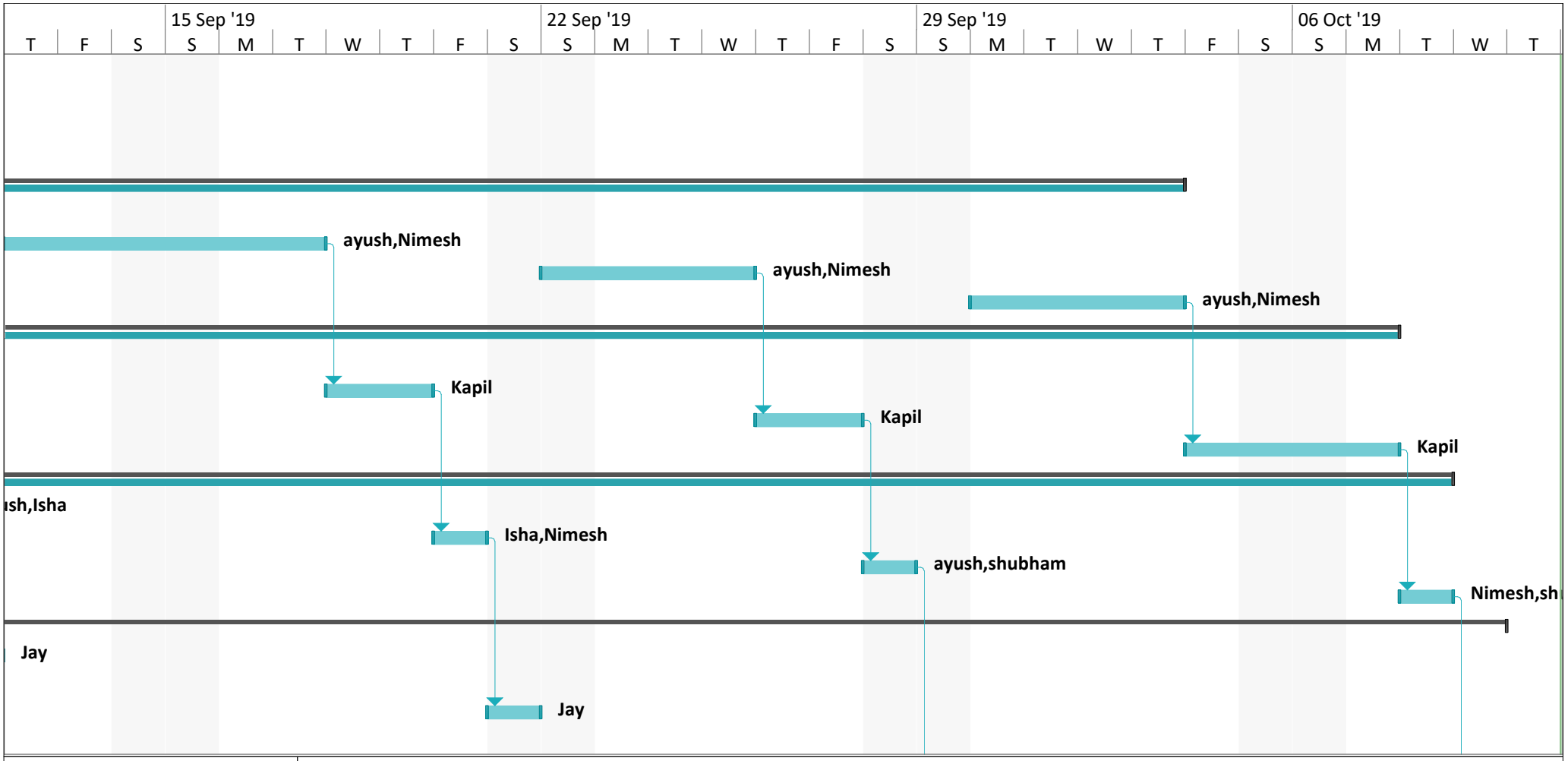

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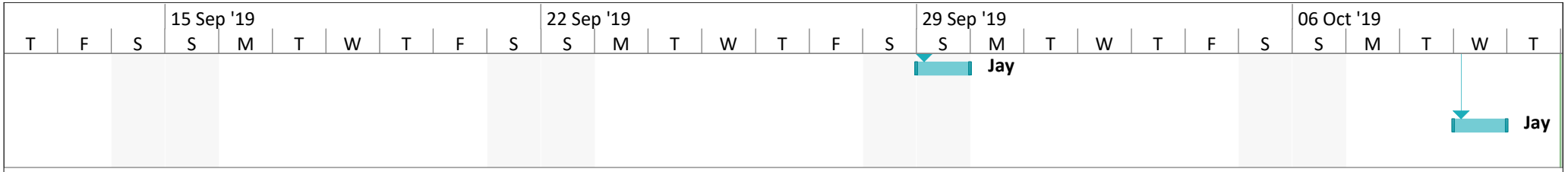

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