INTEGRATED DESIGN PROJECT (IDP II)

CSE-460

AUTOMATED FRESHNESS AND DEFECTION DETECTOR

PROJECT PLAN DOCUMENT

Submitted by

GROUP - FOXTROT A

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1. Introduction

1.1 Document Purpose

A project management plan is a formal document that defines how a project is going to be carried out. It outlines the scope, goals, budget, timeline, and deliverables of a project, and it's essential for keeping a project on track [1]. It is the key to any successful project. From the document the project team members acknowledge their tasks & what to do in future to complete this project.

1.2 Associated Documents

Software requirements specification, project proposal, project scheduling, project budget, UI design document etc. are prepared along with the project plan document.

1.3 Project Plan Maintenance

Project plan maintenance is the process of tracking and enabling project activities in accordance with the project plan is an essential factor in overall project success [2]. Planning for the project might change on basis of requirements of the clients. Project maintenance helps us to adjust any changes in the timeline in the middle of a project.

2. Project Scope

2.1. Objectives

2.1.1. To create a detector of freshness and defection for grading general raw fruits or vegetables for industrial use.

2.1.2. To establish an efficient automated process to increase the accuracy of spoilt food detection.

2.1.3. Reduction of required manual manpower and human dependency at industrial level.

2.1.4. Introduction to image recognition system and computer vision to make the defect detection system viable and fast.

2.2. Success Criteria

2.2.1. The first step of success depends on the data preprocessing. From trained model the system can identify the object.

2.2.2. After identifying the object, the system must be able to compare the freshness and defection of the object with the trained model.

2.2.3. The UI system has to be easy for the workers to use. From the page of UI, workers must be able to see the fruits coming through the conveyor belt.

2.2.4. The owner must be able to access the statistical data of per date from the UI page.

3. Deliverables

3.1. To client

Client of the project is Food industry. It is required to find out objects that should be delivered to the client and list them and make documentation. Firstly, the developer team needs to collect information from the client to make prototype and deliver them for feedback. Then, temporary executable project is created for test analysis. In this the developers need to list which components and hardwires are suitable for the project, minimum and maximum threshold value of the stress level, mechanical part that are required for procurement etc. Finally, the client is given an estimation time about project delivery date.

3.2. From client

To make project properly suitable for client, the developing team needs feedback from the client side. For their better understanding, documentation is essential. Documentation can contain nontechnical terms or technical terms with explanation. Documentation should be delivered frequently to the client for review. Test analysis need to be based on real time activities. After using the updated project and data can be collected from client and find out output accuracy. User can recommend certain changes. Also, the developer team need to give them support for further change in system.

4. Project Approach

The Agile software development methodology is one of the simplest and effective processes to turn a vision for a business need into software solutions[3].

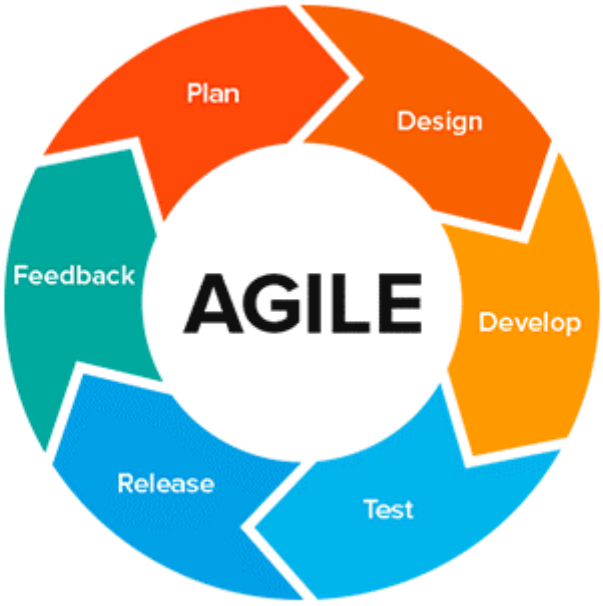


Fig: Overview of Agile Method

The aim of agile methods is to reduce overheads in the software process and to be able to respond quickly to changing requirements without excessive rework. As our

client is food industry, their requirements can change during the development process or after the development process. Our main aim is to satisfy our client in a professional way where the continuous change in the system should not cost much & the requirements has to be met.

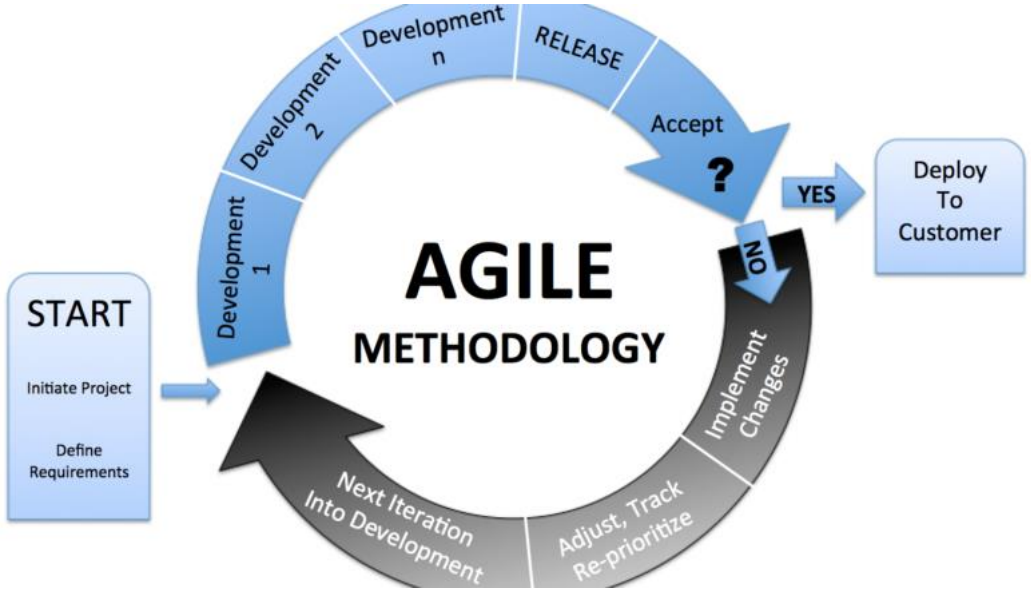


Fig: Agile Methodology

4.1. Project Team Organization

We distributed the task among five group members as follows:

Task Name	Resource Names
Food Freshness & Defection Detector	
Project Initialization	
Group Forming	
Initial Project Proposal	
Modified Project proposal	
Approval	
Planning	
Micro Plan	

Micro Plan Session-1	Eusha Khan,Fardeen Ashraf,Zannatul Ferdous,Sumaiya Kashmin Zim,Shahir Zaoad
Micro Plan Session-2	Eusha Khan,Fardeen Ashraf,Shahir Zaoad,Sumaiya Kashmin Zim,Zannatul Ferdous
Detail Plan	
Detail plan allocation	Eusha Khan,Fardeen Ashraf,Shahir Zaoad,Sumaiya Kashmin Zim,Zannatul Ferdous
Detail plan presentation	Eusha Khan,Fardeen Ashraf,Shahir Zaoad,Sumaiya Kashmin Zim,Zannatul Ferdous
Project Scheduling	Fardeen Ashraf,Shahir Zaoad,Sumaiya Kashmin Zim,Zannatul Ferdous
Field Work	**Field Work Cost**
Hardware Allocation	Fardeen Ashraf,Shahir Zaoad,Sumaiya Kashmin Zim,Zannatul Ferdous,Eusha Khan
Sample collection for object Detection	Fardeen Ashraf,Shahir Zaoad,Sumaiya Kashmin Zim,Zannatul Ferdous,Eusha Khan
Sample Collection for Defection Detection	Shahir Zaoad,Sumaiya Kashmin Zim,Zannatul Ferdous,Fardeen Ashraf,Eusha Khan
Sample Collection Finished	
Development	
Buy Components	Camera,Eusha Khan,Fardeen Ashraf,Makeshift conveyor belt material[1],Servo motor[1],Shahir Zaoad,Sumaiya Kashmin Zim,Transport Cost,Web Camera[1],Zannatul Ferdous
Front End Design	Shahir Zaoad,Sumaiya Kashmin Zim,Zannatul Ferdous
Object Detection	
Image Pre Processing(Resizing Image, Background Subtraction)	Fardeen Ashraf,Shahir Zaoad,Transport Cost,Sumaiya Kashmin Zim,Zannatul Ferdous,Eusha Khan
Model train and test with binary classification algorithms to detect fruit	Eusha Khan,Fardeen Ashraf,Sumaiya Kashmin Zim,Zannatul Ferdous,Shahir Zaoad

Image preprocessing (Gaussian Filtering) + feature extraction of image (Geometrical feature, color feature) & Full Frontend	Fardeen Ashraf,Shahir Zaoad,Sumaiya Kashmin Zim,Zannatul Ferdous
Setting up Jetson Nano	Fardeen Ashraf,Sumaiya Kashmin Zim,Shahir Zaoad,Zannatul Ferdous
Connecting Live data from camera	Eusha Khan,Fardeen Ashraf,Sumaiya Kashmin Zim,Web Camera[1],Zannatul Ferdous,Camera,Shahir Zaoad
Integrating image processing models with web camera	Fardeen Ashraf,Shahir Zaoad,Sumaiya Kashmin Zim,Web Camera[1],Camera,Eusha Khan,Zannatul Ferdous
Result	
Freshness Detection	
Real time image Segmentation (Fuzzy segmentation, Refinement of defected region) + Real time image feature extraction (texture feature)	Eusha Khan,Fardeen Ashraf,Shahir Zaoad,Sumaiya Kashmin Zim,Zannatul Ferdous
Real time image preprocessing (background segmentation, filtering)	Fardeen Ashraf,Sumaiya Kashmin Zim,Web Camera[1],Camera,Shahir Zaoad,Zannatul Ferdous
Model train and test with binary classification algorithms to detect defection in fruit	Eusha Khan,Fardeen Ashraf,Shahir Zaoad,Sumaiya Kashmin Zim,Zannatul Ferdous
Setting up Jetson Nano	Fardeen Ashraf,Shahir Zaoad,Sumaiya Kashmin Zim,Zannatul Ferdous
Connecting Live data from camera	Fardeen Ashraf,Shahir Zaoad,Sumaiya Kashmin Zim,Web Camera[2],Zannatul Ferdous,Camera
Integrating image processing models with web camera	Eusha Khan,Fardeen Ashraf,Shahir Zaoad,Sumaiya Kashmin Zim,Web Camera[1],Zannatul Ferdous,Camera
Result	
Integration	
Connecting Jetson Nano and Arduino	Fardeen Ashraf,Web Camera[1],Camera,Jetson nano[1%],Shahir Zaoad,Sumaiya Kashmin Zim,Zannatul Ferdous

Configuration for sending info between Jetson Nano and Arduino	Fardeen Ashraf,Web Camera[1],Camera,Jetson nano,Shahir Zaoad,Sumaiya Kashmin Zim,Zannatul Ferdous
Fruit separator	
Adjusting the Pusher with conveyor belt and servo	Servo motor[1],Sumaiya Kashmin Zim,Makeshift conveyor belt material[1%],Fardeen Ashraf,Shahir Zaoad,Zannatul Ferdous
Automating the servo based on the result of Jetson Nano	Fardeen Ashraf,Servo motor[3],Sumaiya Kashmin Zim,Web Camera[3],Camera,Makeshift conveyor belt material[1%],Jetson nano[1%],Shahir Zaoad,Zannatul Ferdous
Development Finish	
Testing	
Real Time Testing Food Detection	Eusha Khan,Fardeen Ashraf,Shahir Zaoad,Sumaiya Kashmin Zim,Zannatul Ferdous
Real Time Testing of defection detection	Eusha Khan,Fardeen Ashraf,Shahir Zaoad,Sumaiya Kashmin Zim,Zannatul Ferdous
Overall Testing	Eusha Khan,Fardeen Ashraf,Shahir Zaoad,Sumaiya Kashmin Zim,Zannatul Ferdous
Final Testing	
Testing Complete	
Document	
SRS document	Eusha Khan,Fardeen Ashraf,Shahir Zaoad,Sumaiya Kashmin Zim,Zannatul Ferdous
UI design report	Zannatul Ferdous,Sumaiya Kashmin Zim,Shahir Zaoad
System development report	Shahir Zaoad,Fardeen Ashraf,Zannatul Ferdous
Project plan document	Fardeen Ashraf,Zannatul Ferdous,Shahir Zaoad
Article writing document	Shahir Zaoad,Zannatul Ferdous,Sumaiya Kashmin Zim
User manual document	Eusha Khan,Zannatul Ferdous,Shahir Zaoad

Help doc	Zannatul Ferdous,Sumaiya Kashmin Zim,Shahir Zaoad
Software testing document	Eusha Khan,Sumaiya Kashmin Zim,Shahir Zaoad,Zannatul Ferdous
Experiment design document	Sumaiya Kashmin Zim,Zannatul Ferdous,Eusha Khan,Fardeen Ashraf,Shahir Zaoad
Complete Project	
Deployment	Eusha Khan,Fardeen Ashraf,Shahir Zaoad,Sumaiya Kashmin Zim,Zannatul Ferdous

5. Work Plan

5.1. Work Breakdown Structure

Here is the project Groups & subgroups of work breakdown:

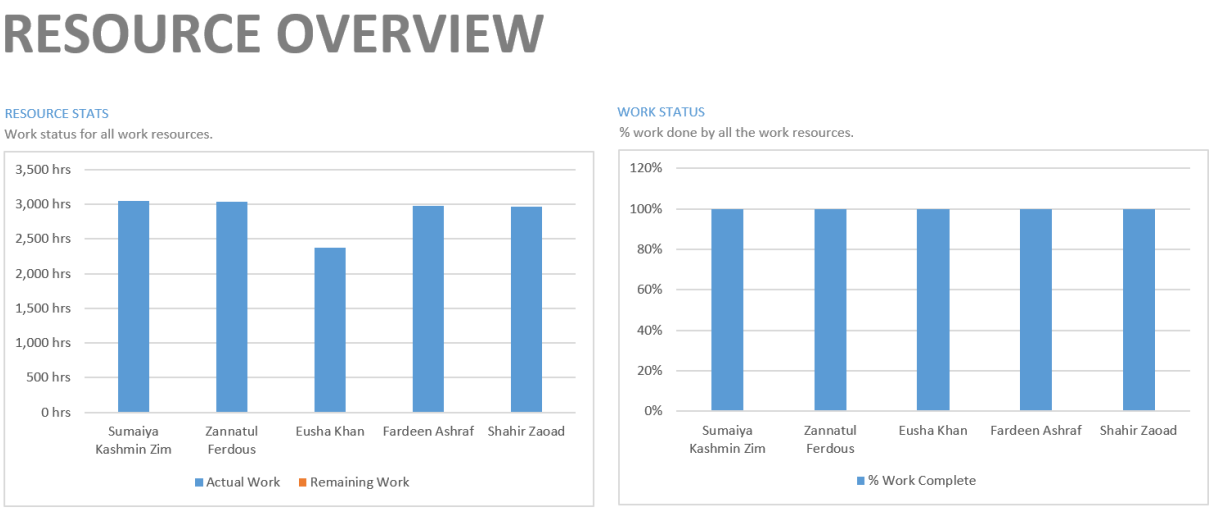
Task Name
Food Freshness & Defection Detector
Project Initialization
Group Forming
Initial Project Proposal
Modified Project proposal
Approval
Planning
Project Scheduling
Micro Plan
Micro Plan Session-1
Micro Plan Session-2
Detail Plan
Detail plan allocation
Detail plan presentation
Field Work
Hardware Allocation
Sample collection for object Detection

Sample Collection for Defection Detection
Sample Collection Finished
Development
Buy Components
Front End Design
Object Detection
Image Pre Processing(Resizing Image, Background Subtraction)
image preprocessing (Gaussian Filtering) + feature extraction of image (Geometrical feature, color feature)
Model train and test with binary classification algorithms to detect fruit
Setting up Jetson Nano
Connecting Live data from camera
Integrating image processing models with web camera
Result
Freshness Detection
Real time image Segmentation (Fuzzy segmentation, Refinement of defected region) + Real time image feature extraction (texture feature) + frontend(60%)
Model train and test with binary classification algorithms to detect defection in fruit
Setting up Jetson Nano
Connecting Live data from camera
Integrating image processing models with web camera
Real time image preprocessing (background segmentation, filtering)
Result
Integration
Connecting Jetson Nano and Arduino
configuration for sending info between Jetson Nano and Arduino
Defected food Pusher
Adjusting the Pusher with conveyor belt and servo
Automating the servo based on the result of Jetson Nano
Development Finish
Testing
Real Time Testing Food Detection
Real Time Testing of defection detection
Overall Testing

Final Testing
Testing Complete
Document
SRS document
UI design report
System development report
Project plan document
Article writing document
User manual document
Help doc
Software testing document
Experiment design document
Complete Project
Deployment

5.2. Resources

The resource distribution of the project is shown in the attached Gantt chart. Besides, documentations (project proposal, SRS, project plan, project scheduling, estimation of cost etc.) are attached with the project plan.



RESOURCE STATUS

Remaing work for all work resources.

Name	Start	Finish	Remaining Work
Sumaiya Kashmin Zim	Tue 7/14/20	Wed 6/30/21	0 hrs
Zannatul Ferdous	Tue 7/14/20	Wed 6/30/21	0 hrs
Eusha Khan	Tue 7/14/20	Wed 6/30/21	0 hrs
Fardeen Ashraf	Tue 7/14/20	Wed 6/30/21	0 hrs
Shahir Zaoad	Tue 7/14/20	Wed 6/30/21	0 hrs

6. Milestones

The milestones of the project are shown in the table.

Task Name	Finish
Food Freshness & Defection Detector	**Wed 6/30/21**
Project Initialization	**Wed 8/5/20**
Group Forming	Thu 7/16/20
Initial Project Proposal	Mon 7/27/20
Modified Project proposal	Wed 8/5/20
Approval	Wed 8/5/20
Planning	**Thu 9/3/20**
Project Scheduling	**Mon 8/24/20**
Micro Plan	Wed 8/19/20
Micro Plan Session-1	Mon 8/24/20
Micro Plan Session-2	**Thu 9/3/20**
Detail Plan	Thu 8/27/20
Detail plan allocation	Tue 8/25/20
Detail plan presentation	Thu 9/3/20
Field Work	**Thu 11/5/20**
Hardware Allocation	Tue 10/6/20
Sample collection for object Detection	Fri 9/25/20
Sample Collection for Defection Detection	Wed 9/30/20
Sample Collection Finished	Wed 9/30/20
Development	**Mon 6/28/21**
Buy Components	Wed 4/7/21
Front End Design	Tue 4/13/21

Object Detection	**Mon 5/31/21**
Image Pre Processing(Resizing Image, Background Subtraction)	Mon 4/12/21
image preprocessing (Gaussian Filtering) + feature extraction of image (Geometrical feature, color feature)	Mon 4/26/21
Model train and test with binary classification algorithms to detect fruit	Mon 5/3/21
Setting up Jetson Nano	Thu 5/6/21
Connecting Live data from camera	Mon 5/24/21
Integrating image processing models with web camera	Mon 5/31/21
Result	Mon 5/31/21
Freshness Detection	**Mon 6/21/21**
Real time image Segmentation (Fuzzy segmentation, Refinement of defected region) + Real time image feature extraction (texture feature) + frontend(60%)	Mon 5/17/21
Model train and test with binary classification algorithms to detect defection in fruit	Mon 6/21/21
Setting up Jetson Nano	Mon 5/24/21
Connecting Live data from camera	Thu 5/27/21
Integrating image processing models with web camera	Mon 6/7/21
Real time image preprocessing (background segmentation, filtering)	Mon 6/21/21
Result	Mon 6/21/21
Integration	**Mon 6/21/21**
Connecting Jetson Nano and Arduino	Thu 6/17/21
configuration for sending info between Jetson Nano and Arduino	Mon 6/21/21
Defected food Pusher	**Wed 6/16/21**
Adjusting the Pusher with conveyor belt and servo	Thu 6/10/21
Automating the servo based on the result of Jetson Nano	Wed 6/16/21
Development Finish	Wed 6/16/21
Testing	**Thu 6/24/21**
Real Time Testing Food Detection	Tue 6/22/21

Real Time Testing of defection detection	Wed 6/23/21
Overall Testing	Thu 6/24/21
Final Testing	Thu 6/24/21
Testing Complete	Thu 6/24/21
Document	**Tue 6/29/21**
SRS document	Fri 4/30/21
UI design report	Mon 4/12/21
System development report	Mon 4/19/21
Project plan document	Mon 4/26/21
Article writing document	Mon 5/3/21
User manual document	Mon 5/24/21
Help doc	Mon 5/24/21
Software testing document	Mon 5/31/21
Experiment design document	Mon 6/14/21
Complete Project	**Wed 6/30/21**
Deployment	Wed 6/30/21

MILESTONE REPORT

LATE MILESTONES

Milestones that are past due.

Name	Finish

MILESTONES UP NEXT

Milestones due in this month.

Name	Finish

COMPLETED MILESTONES

Milestones that are 100% complete.

Name	Finish
Group Forming	Thu 7/16/20
Approval	Wed 8/5/20
Detail plan presentation	Tue 8/25/20
Sample Collection Finished	Wed 9/30/20
Result	Mon 5/31/21
Result	Mon 6/21/21
Development Finish	Wed 6/16/21
Final Testing	Thu 6/24/21
Testing Complete	Thu 6/24/21

7. Risks, Constraints, Assumptions

7.1 Risks

The risks of the project are discussed on the risk table below:

Risk of Project					
Risk ID	**Risk Description**	**Mitigation Plan**	**Contingency plan**	**Impact**	**Likelihood of occurrence**
1.	Receiving inaccurate data	Achieving freshness detection CNN model accuracy as high as possible	Manually checking the not fresh basket fruit to check if any fresh fruits are wasted	The system will inaccurately dispose fruits that are fresh	rare
2	Conveyor belt breakdown	Designing the conveyor system as sturdy as possible	Admin will manually shutdown the system if this occurs	Breaking down of the belt system means the system won't be able to detect freshness continuously	rare
3	Loss of connection	Checking the connections between each device properly before starting up the system	The system will automatically shut down if any of the devices losses connection with the admin	Loss of connection means the system won't be able to work at all	medium

7.2 Constraints

7.2.1 Project Constraints

The following are identified as project constraints:

7.2.1.1 Fruit freshness detection dataset is only limited to apple, banana and orange presently. Due to pandemic on field data collection has not been possible and available online dataset is used

7.2.1.2 Lockdown restrictions further delayed the procurement of Jetson Nano.

7.2.2 Critical Project Barriers

The following are identified as critical project barriers:

7.2.2.1 Unavailability of Jetson Nano

7.3 Assumptions

7.3.1 Automation of food processing in the industry is needed for increasing production and lowering human labor cost and the industry is eager to welcome a homemade low costing solution.

7.3.2 Project members will have finished assigned task (e.g software or hardware) but will also communicate with other team members regularly and have an overall idea of the development

7.3.3 Team members will keep common code sharing methods (e.g GitHub) updated so that other team members don’t have to start any task from the beginning

8.Financial Plan

A proposed financial plan for the project is tabulated below:

Serial no	Category	Item	Quantity	Unit cost	Total cost
1	Material cost	NVIDIA Jetson Nano Developer Kit-B01	1	13,900	13,900
		L298N H-Bridge Dual Motor Driver, Stepper Motor Driver	1	150	150
		12V Gear Motor High Torque		300	300
		Tiger LiPo Battery 1100mAh 3S 25C	1	1050	1050
		RPM	1	990	990
		Arduino Mega 2560 R3	1	978	978
		Mini SG90 9g Micro Servo Motor	3	150	450
		Wires	1	200	200

		Adapter	1	690	690
	Total cost				18,708

Appendix

References

[1] About Midori Nediger Midori spreads visual communication tricks and tips as an Information Designer at Venngage. She's particularly interested in helping people communicate complex information. Connect with her on LinkedIn and on Twitter @MNediger. and A. M. Nediger, "How to Write a Project Management Plan [+ Examples]," *Venngage*, 07-Apr-2021. [Online]. Available: https://venngage.com/blog/project-management-plan/.

[2] T. C. on Saturday and T. Clarizen, "The Key to Success? Project Maintenance," *Clarizen*, 24-Sep-2019. [Online]. Available: https://www.clarizen.com/key-success-project-maintenance/.

[3] "Agile Methodology: What is Agile Software Development Model?," *Guru99*. [Online]. Available: https://www.guru99.com/agile-scrum-extreme-testing.html.