PROJECT PLANNING & MANAGEMENT FORM

CMSE 201

PROJECT NO : 1

GROUP NO : 2

PROJECT NAME : Pressure Ulcer Prevention (PUP) OR BED SORE app.

PROJECT START DATE :18/10/2023

PROJECT END DATE : 12/25/23

SUPERVISOR : Prof.DR Duygu Çelik Ertuğrul

SEMESTER TERM :2023-2024 Fall Semester

The from is adapted from TÜBİTAK* The scientific and technological Research Council of TURKEY, https://www.tubitak.gov.tr/en

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Project Type: Software Design & Development Project

A.1. Preliminary Project Information

A.1.1

Project No	**1**
Project Name	**Pressure Ulcer Prevention (PUP) OR BED SORE app.**
Start Date	**18/10/2023**
End Date	**12/25/23**
Time	**3 Months**

A.1.2

Project Manager			
Name Surname	**Maaz Qureshi**	**ID No**	**21904531**
Title/Role	**Project Manager, System Analyst**		
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A.2 Group Information

A.2.1

Student 1			
Name Surname	**Saad Ahmed**	**ID No**	**22701636**
Title/Role	**Network Designer / Tester**		
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Student 2			
Name Surname	**Hasan Orkan**	**ID No**	**22331350**
Title/Role	**Database Developer/Lead Programmer/Administrator**		
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Student 3			
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Phone	0533 849 69 37		
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A.2.2

List of Completed / Ongoing Projects of Team

B.1 Introduction to Project

B.1.1

Summary of Project
The application, which is designed to help people who are suffering from Pressure Ulcers/Bed sores monitor their pressure ulcers. It allows patients to track pressure ulcers in high-risk areas and show tips/ recommendations for improvement of those areas, and suggest them drugs for healing.Send them daily remainders for pressure relief.

B.1.2

Key Words
Java,JavaScript,CSS,HTML,PHP,SQL , Tracking, medicine, drug, diagnosis, prescribed, disease, doctor,

B.1.3

Aim of Project
This project is based on developing and deploying a mobile application that offers medical services to patients with pressure ulcer disease who are confined to beds. This application's main purpose is to tell patients who are unable to access healthcare services about their disease sore by scanning the affected area of their skin and providing a report on the sore's treatment. Our goal is to make the task of accessing health care easier and reduce the cost for the patients by recommending them with decent medications.

B.1.4

Innovative Aspects/Contributions of Project
The main purpose of this project is aimed at the older generation of people who are bedridden or their movement has become limited. The project cuts down the process of going to the hospital and waiting there for hours, just to the comfort of their home, where they can easily diagnose their disease and get medication.

B.1.5

Methods to be Applied
For the software planning and analysis stage we will conduct meetings and interviews with medical experts of the area as well as doing online research about the disease and analyzing similar systems that perform similar task. All the scheduling will be documented using MS Project. For the design stage, we will use tools like Modelio and draw.oi to implement necessary diagrams that will help the development team in the coding stage. For the coding stage we will use different languages like HTML, CSS, JavaScript,Java and PHP to implement the requested functionalities and requirements and for the database system that will keep the user records will require some SQL tools like MySQL. For the testing stage which will be implemented side by side with the coding stage.We will use well-known testing tools, to cover more test cases, to reach the most efficient time to finish the task.We will also design unique cases observed in the domain that might have catastrophic effects on the application and which will help us improve the project. Different type of testing will be done including Security,Performance,Compatibility,Certification etc.

B.1.6

Economic and National Outcomes
This technique can decrease the number of patients at hospitals and enhance the number of beds available for other patients in addition to enhancing the quality of treatment provided to immobile patients. This illness often affects older people, and because they are unable to work or earn much money, the government aids them; thus, this application reduces governments' expectations of financial aid. As a result, health care is not a cheap commodity, and our application allows users to acquire medical treatment at a lesser cost.

B.2 Reason of Starting the Project, Methods and R&D Stages

B.2.1

1- Explain the reason of starting this project. (Max 500 charachter)

We have conducted some domain analysis based on the health-care applications for pressure ulcer tracking. As a result of this we didn't find any system that we were thinking to develop , so we come to the conclusion that there is not enough systems for tracking bedridden people's ulcers currently in the software market that serves, there There were a couple of information based web sites, but that wasn't the thing that we were searching for.So we started this project to make the daily lives of caregivers easy who have challenges while looking for bedridden patients at home. As we collected some information and more data about this project topic , we started to design this mobile application to be used by hospital and home caregivers with practical easy solutions for preventing pressure ulcers before they start occur and preventing them after they developed to next stages, all without the need for a doctor.Of course in risky stages there might be needed to surgery doctor to take care pressure ulcer.But nurses can detect if it need doctor to care the injury buy our program. Depending on these main reasons we decided that this kind of health programs should be invented to take care of bedridden old people.

2- Explain the purpose of this project.

The main purpose of the developing a such kind of application ,aims is to address pressing healthcare issues by emphasizing prevention, monitoring, and treatment the Pressure ulcers patient that are suffering form injuries in skin and underlying tissue.Anytime of the day with high quality work and delivery that best suits their individual demands .to all patients, with a special focus on people who do not have access to medical services and cannot afford to pay heavy hospital bills.so this application involve repositioning schedules,camera integration to show stage of Pressure ,suggest drug and patient education for recognition and management of pressure ulcers. This can include online resources, training programs, and guidelines..We are confident our software can take it a step further by delivering a new viewpoint and solution for Pressure ulcers patient .

3- Explain

- **output of project**
- **national / international standards if exist**
- **the specific objectives of the project**
- **success criteria**
- **realistic constraints**

Output of the project we aim to create mobile application for patients that have risk or had pressure ulcer which users can access safely, fast information/tips by professional doctors, how to prevent or tracking stages of their ulcers, and so more. We will include auxiliary functionality to support account and payment operations. We will also obey the international standards and constraints set by ISO below

ISO 13485 - Medical devices - Quality management systems - Requirements for

regulatory purposes.
ISO 14971 - Medical devices - Risk management of medical equipment.
ISO 9001 - Requirements of quality management systems.ISO 17665 - Moist heat sterilization of health care items - Requirements for developing, validating, and routinely controlling a sterilization process for medical devices

4- Explain

- **the methods to be applied during R&D activities**
- **applications**
- **technician and tools to be used**
- **standards to be followed under the workflow**

We decided to follow an Agile development model for our project as it is an iterative and flexible approach to creating and managing projects.Our project requires a strong emphasis on understanding and meeting customers needs to deliver the final product. Our topic is not something new in the application world, there are many companies trying to takeover the market for online heath services. That is why it is important for us to take the best route to develop our software which will help us deliver the product to the mark with the highest quality in both core and supplementary features.another reason to choose agile model is that it provides a lot of flexibility. Agile development is designed to be adaptive to changing requirements. If new information or priorities come up they can easily be adjusted and integrated into the project.

Explain, Project Workflow:

1. **Feasibility and Pre-teach:**

At this stage of our project, we will conduct some domain and market analysis to obtain a better understanding of our end product. We will gather a more detailed information of our topic. We will get in to contact with users who are using similar systems in order to obtain their feedback and hear about their requests and suggestions.We will also talk to field professionals about this project to be able to make the best product as possible for our customer. We will also conduct some cost-estimations using some models like COCOMO and function-point analysis as well as resource analysis, both human and material point of views, in order to understand if taking this project is profitable or not.If we come to the conclusion that our team can benefit from this project, we will move on to the next phase of the development cycle. We will mainly use MS Project at this stage.

2. **System Design:In this stage, since we are using the agile model, we will first prioritize the requirements and features that we have designed and selected. Once we group the requirements from most important to least important, we will repetitively follow the cycle of design, code, testing, and delivery until we reach the end product that satisfies both the developers and customers. When we are conducting the design phase of the cycle, we will mainly focus on algorithms in which we can keep performance, memory usage, and user friendliness at maximum while providing the most efficient solution. If we come up with new creative ideas at this stage, we can take advice from health professionals; if the idea works and they are satisfied, we will apply them to our development. The output of this stage will include much documentation.**

3. **Software development: In this part, coding will be done. As we are interacting with an online service application for pressure ulcers, we are going to use HTM5 multimedia features to design and modify the application's visual look using CSS and JavaScript, which we also use to run on operating systems (iOS,Android). also Java and PHP, and by using all of these tools, we will build reliable applications to attract user attention. System database: in order to keep our user records, we will use the SQL database and use it for both storage and statistical functions in order to improve user satisfaction.**

4 .Prototype implementation and testing work:At the end of software development, we are going to do unit testing. First-level testing will be performed by our developers to check the components and functions of the software, then integration testing will see different parts of the software work together as expected. Acceptance testing involves feedback from medical experts, etc., and we will do user acceptance testing to ensure that it meets their needs and expectations. waiting for their feedback, as well as security testing to ensure the data of our users is safe.

4. **Maintenance: In order to keep our software reliable and usable and ensure the system functionality,performance,and security are doing as well as user needs, we will update our software after getting feedback from our users, like correcting defects, bugs, and issues identified by users. We will improve performance as time passes, so our software should be outdated. We will add new features and update our security against evolving threats.**

5- Explain

- **the contribution of national/international technological development if exist**
- **starting a new research and development projects within or outside the team**
- **launch new applications or research studies in different technology areas**

With whom we can cooperate?
Expectations:
Published work:
Can your output be an input for other similar national/international projects?

This system application for bedridden patients who are suffering from pressure ulcers and will be suitable for their healthcare nurses, who are responsible for looking after them. This project will be developed for mobile applications since they are easy to use for most nurses. And it is possible to maintain interaction with hospitals and professional doctors. Because of this, this program might get the attention of the government, hospitals, or nurses.

B.3 Innovative and Unique Aspects

B.3.1

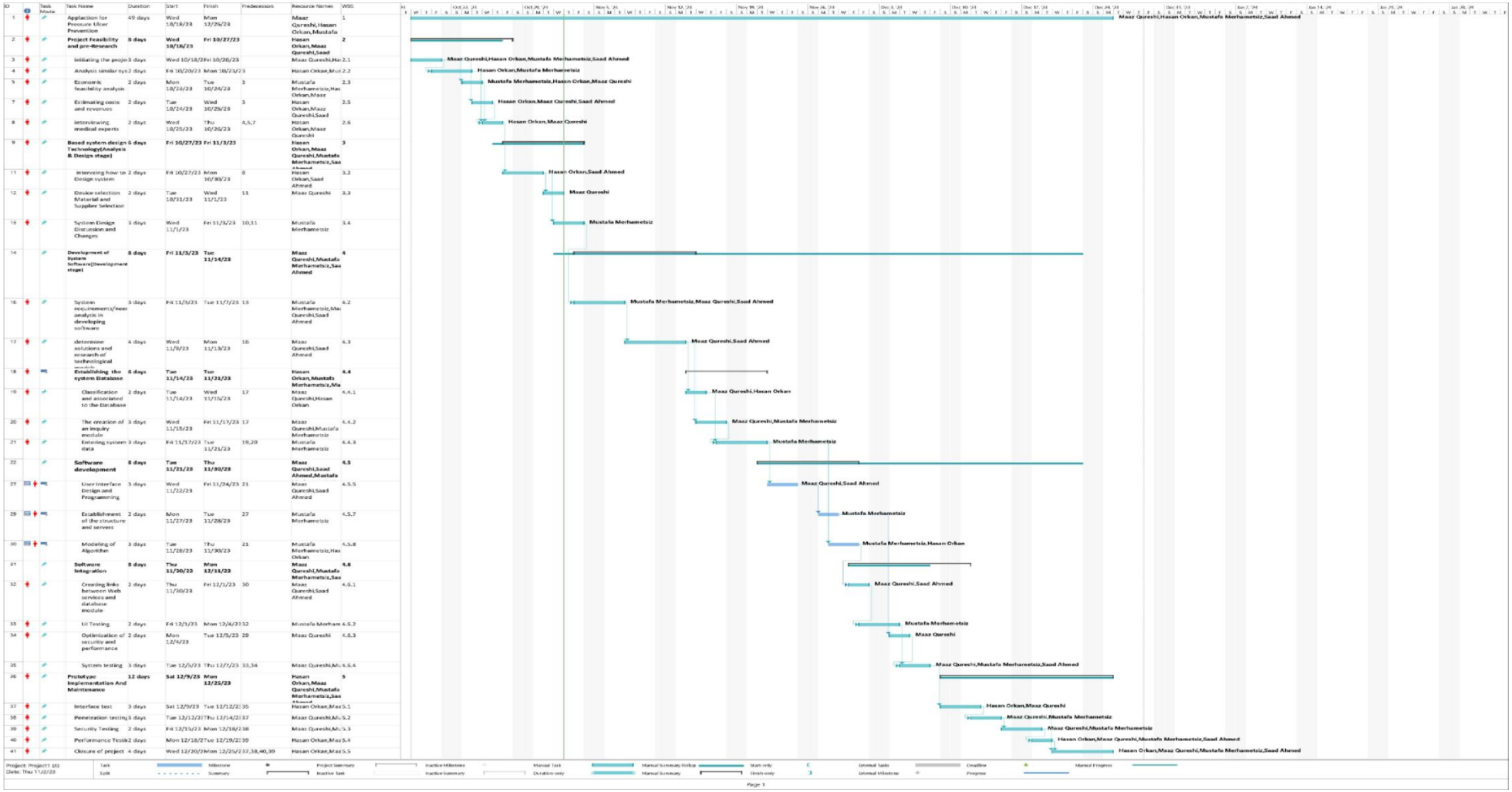
1- Describe ○ differences ○ advantages ○ superiority compared to other similar projects.
The system's interface, while maintaining its simple aesthetics, will have a user-friendly application that caregivers of all ages can easily use. In our system, tracking, feedback mechanisms, and usability will be prioritized, and this will provide a significant advantage to our project. As our main goal is to increase accessibility for patients, we will also put hard work into risky issues that bring the end product to the next level.

B.4.1

2- Who can contribute to this project in your team?
• Project Manager/Lead Systems Analyst • Database Developer/Administrator/Lead Programmer • Programmers • User Interface Designer/Web developer • Tester/Network designer/Hw Designed

C.1 Gantt Chart

C.1.1 Gantt Chart



C.1.2 List of Work Packages

Work Package No	**1**
Work Package Name	**Project Feasibility and pre-Research**
Start-End Date and Time	**18/10/2023- 27/10/2023**
Related Organizations	

1- List the activities of work packages.
1.1 Project Process and Economic Feasibility: **-In order to improve and streamline the tracking process,we looked into it.** **-market research to find similar systems and analyze the potential need for this system.** **-determining how the system works in order to have a correct idea of its advantages and costs.** **-Analyzing possible risks was evaluated.** **-We started this project to improve patient care and make it clear for mobile applications.** **1.2 Technological Feasibility:** **-Deciding technical and technological requirements needed to make this project.** **-looking for concept designs** **-Analysis of software requirements for mobile applications** **-Patent and academic resource search**
2- Describe the methods and parameters that will be used for work package.
Technical, legal, academic, functional, and meetings with professionals Ms Project will be used to perform stages.
3- List the experiments, tests and analysis in the work package.
-Risk estimations **-Technological requirements and user needs' test** **- Project process flow test**

- Selection of experienced group members and deciding on work distribution **-Interview with possible users for better requirement specifications**
4- List the output of work package and its success criterias.
Outputs:The output of the feasibility study will allow our team members to have an idea of similar projects and understand the general idea of pressure ulcers. **Success Criteria:If our system is to track pressure ulcers' stages correctly, our project will deserve to work on it.**
5- Explain the relation of output with other work packages
This feasibility study package must be completed successfully as it is; it is also valid for our other project packages. If it is completed successfully, we can move on to the next stage without problem.

Work Package No	**2**
Work Package Name	**Based System Design Technology (Analysis & Design stage)**
Start-End Date and Time	**10/27/23- Tue 11/7/23**
Related Organizations	

1- List the activities of work packages.

-plan stakeholders for the system

-determine the necessary resources

-define roles and responsibilities for each stakeholders.

-Maintain team members and assign roles

-Create visual diagrams

2- Describe the methods and parameters that will be used for work package.

-Frequently meeting with all team members

-giving tasks for their free time.

-Incremental modelling

-Making prototypes

3- List the experiments, tests and analysis in the work package.

-During the meeting, use all of the members experience

-create samples

4- List the output of work package and its success criterias.

Outputs:
Fully ready system to go to the next stage

Success Criteria:

If stake holders must be approved by the customer and the system architecture is well designed, can go to the next stage.

5- Explain the relation of output with other work packages

Stakeholder approval is important, and a well-designed system is needed for this project.

Work Package No	**3**
Work Package Name	**Development of System Software (Development Stage)**
Start-End Date and Time	**11/7/23- 12/15/2023**
Related Organizations	

1- List the activities of work packages.

-Design user interface by taken analysis of the project

-Create database

-Software development

-Implement requirements to system

- determine solutions and research of technological models

- The creation of an inquiry module

- Establishment of the structure and servers

-links created between database module and web services

-User interface and system test

2- Describe the methods and parameters that will be used for work package.

-SQLite for database(storing data)

-Java to create the main structure of the system

-XML for styling the system.

- GraphQL to connect our mobile application to database

3- List the experiments, tests and analysis in the work package.

- Develop enough space for database

-Unit test for strong codes

-Interface design and programming with professional tools

-Check function-ability of the system

-Modelling algorithm

-Analysis of system requirements

- Optimization of security and performance

4- List the output of work package and its success criteria s.

Outputs:

- Ready and functional sample of system

-Ready for prototype implementation

-Ready to see our working program

Success Criteria:

Well-coded and properly working database well-designed,understandable user interface

5- Explain the relation of output with other work packages

In the end, if this stage of the package works well and is done exactly as we were looking

Our program's most critical parts are done, and we can see your project.

Work Package No	**4**
Work Package Name	**Prototype Implementation and Test Study and Maintenance (Test & Maintenance stage)**
Start-End Date and Time	**12/15/233- 12/25/23**
Related Organizations	

1- List the activities of work packages.

-Security test

- Penetration testing

-Performance testing

-Closure of project

2- Describe the methods and parameters that will be used for work package.

- security penetration tests for black-box and white-box

- User acceptability testing for requirements

- Model-based testing

- Unit testing

3- List the experiments, tests and analysis in the work package.

-External hacking attacks will be simulated by white-box and black-box

- Unit testing will check the design and behavior of the applications and make sure that they are

-working as we wanted to be

-Model-based testing will check the behavior of the system to see if it performing well.

4- List the output of work package and its success criteria.

Outputs:

-Error reports of test

- finished fully working product

Success Criteria:
-Minimum error

-Trustable product

-Success the aim of the project

-Ready to use anytime

5- Explain the relation of output with other work packages

If this stage works well without any errors or unwanted behavior, we can end this work package.

And this means that we will get what we wanted, so it is almost ready to use.

C.1.3 List of Milestones

	Description of Output	Expected Time Interval
1	**Pre-Research and Project feasibility**	**18/10/2023- 27/10/2023**
2	**Based System Design Technology (Analysis & Design stage)**	**10/27/23- Tue 11/7/23**
3	**Development of System Software (Development Stage)**	**12/15/233- 12/25/23**
4	**Prototype Implementation and Test Study and Maintenance (Test & Maintenance stage)**	**12/15/233- 12/25/23**
5		

C.1.4 List of Risks *(see following example, write possible risks for your project!)*

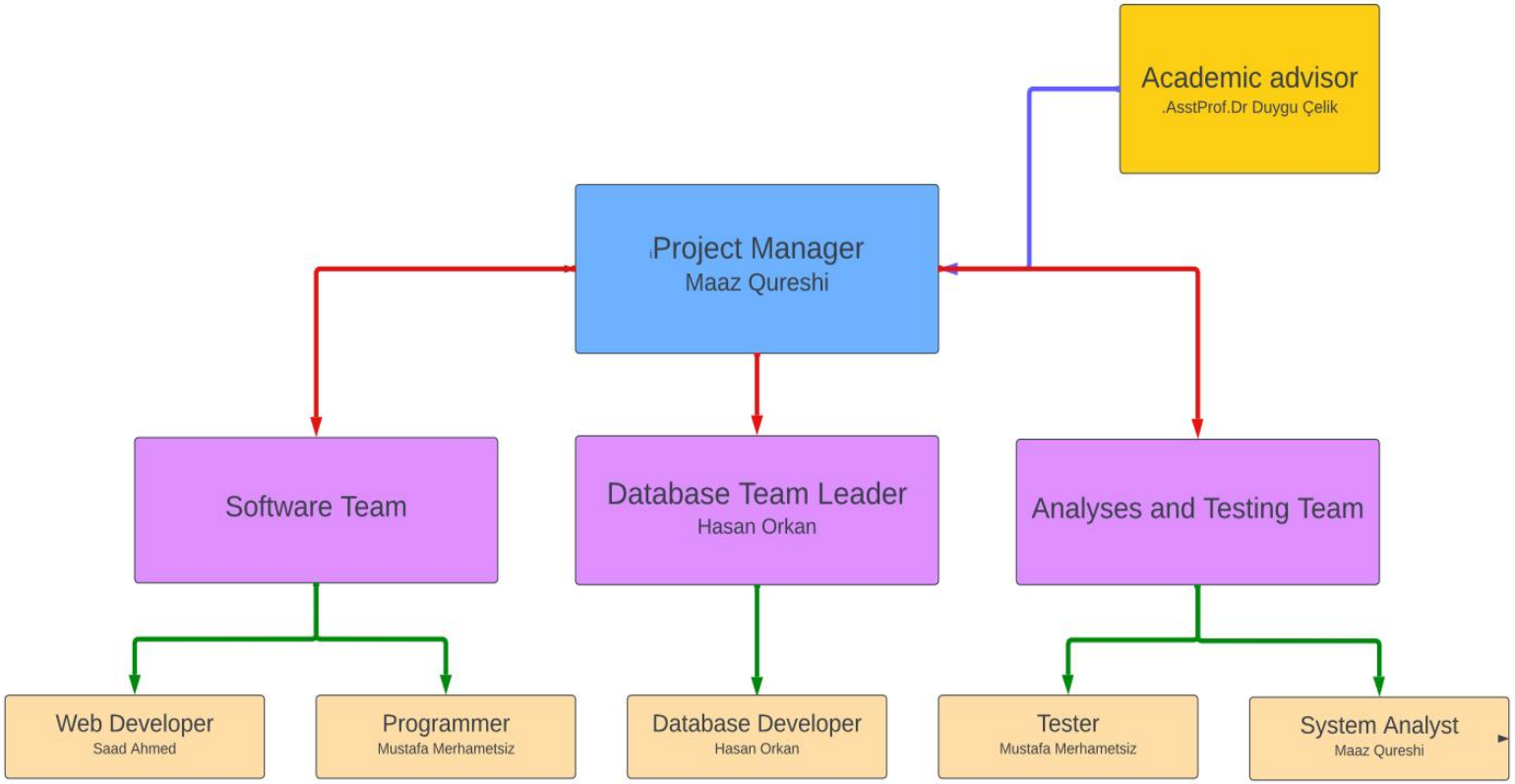
Risk	Probability	Effects	Your Strategy
he duration of time required to develop the program is underestimated.	**High**	**Serious**	***Increasing the frequency of teamwork with meetings***
Software instruments cannot work together in an integrated manner.	**High**	**Tolerable**	**Can find new professional tools**
Customers are unaware of the consequences of requirement changes.	**Moderate**	**Tolerable**	**Requirements can change with basic language**
The rate of error repair is significantly underestimated.	**Moderate**	**Tolerable**	**Replace potentially defective parts with reliable purchased-in components.**
The software's size has been underestimated.	**High**	**Serious**	**Think about buying SW components; consider using a software generator.**
Code generated by code generation tools is inefficient.	**Moderate**	**Insignificant**	**Code can be written from another tool or language**
The system's database is unable to process as many transactions per second as planned.	**Moderate**	**Serious**	**Think about buying a more reliable, higher-performance database.**
Team members might be ill	**Moderate**	**Serious**	**Work together with other team members until they comeback**
Key team members might leave	**High**	**Serious**	**Find new team member with**

C.2 Project Management and Organization

C.2.1 Project Team

Personnel Name	Title	ID	Education Status	Graduation Date	Date of Starting Work	Idea Owner
Maaz qureshi	Project Manager / System Analyst	21904531	Undergraduate	2026	18/10/2023	Yes
Saad Ahmed	Network Designer / Tester	22701636	Undergraduate	2026	18/10/2023	Yes
Hasan Orkan	Database Developer	22331350	Undergraduate	2026	18/10/2023	Yes
Mustafa Merhametsiz	Network Designer / Tester	22331342	Undergraduate	2026	18/10/2023	Yes

C.2.2 Organization Scheme (an example is given below!)



D.1 Economic Forecasts

1- Evaluate the commercialization potential of project outcomes. List possible risks here?
In the modern world, a lot of industries decide whether to commercialize innovative technologies based on tried-and-true financial methods like net present value (NPV). You can use the same tactics for this assignment. Our first objective is to make sure that everyone on the planet has access to pressure ulcer therapy when we launch this project into pressure ulcer healthcare software. market. The project's commercialization could result in a number of positive effects, such as improving treatment accessibility and broadening our services offered, which could ultimately provide substantial operational or financial benefits. The initiative may have an effect on the distribution of income resulting from activities in the healthcare sector if it expands and takes on a more completed the form. It may also contribute to the advancement of beneficial ideas in the healthcare industry. The fact that it may not always be easy to distinguish between people with advanced pressure ulcers and those who have just been diagnosed is one of the risks associated with the commercialization of this project. This could result in the neglect of some patients with pressure ulcers who need assistance.

2- List your expectations to your team which are come by your project	
Time-to-market (month):	January 2024
The expected increase in sales revenue (%):	8%
The expected increase in market share (%):	10%
Time to start to gain:	October 2025

D.2 National Outcomes

1- Specify the output that may be subject to patent, utility model and industrial design registration in the project.
Though there aren't many systems like this on the market right now, we'll add some more features just in case, which might be covered by a patent. Utility models and industrial design registration do not apply to our system because this is a software project. The management of such matters will apply to any collaboration with other companies.
2- Explain the potential of project and its outputs that may have an effect on social life, education, health and etc.
Social life and the healthcare industry would greatly benefit from this application since everything may be handled from the comfort of one's own home. Instead of requiring human modifications, our system will perform operations and computations, enabling more accurate tracking and management of difficulties. Patients will no longer need to travel to hospitals in order to receive the care they need because they can simply consult with the physicians in our system. It also gives medical colleges a chance to look closely at pressure ulcers and patient information in the system.

3- Explain the positive and negative effects of project outputs for environment and human being.
The software we have designed will be monitored by the expert doctor,and every person that has pressure ulcers problem he are she can join our software,and We provide a premium functionality, so doctors can benefit financially. Some users who prefer to have a premium feature special online treatment can enroll in the Prime function,also we will have some people want to misuse this system may come up with problem that may concern human health.Every user should be aware of this issue while choosing the doctor Also, while watching education training videos, you need to be very focused. If you try the wrong movement on the patient, it will cause big problem

(M013) Instrument / Equipment / Software / RELEASE PURCHASES

Project Name										
Line no	Instrument / Equipment / Software / Publication Name	No. of Item	Capacity	Technical specification	Purpose of Project Activities	Post-Project Place of Use / Purpose		Unit Price (USD)	Unit Price (TL)	Total Amount (TL)
						R & D	Production			
1	laptop	4		1000gb minimum with 200gb unused spac e and Core i8/i7 Intel-core 3.0GHz or faster	Involved in every task of the project	YES	YES	800	22480	89600
2	Internet Connection	1		Min,25mbps	Connection	YES	YES	200	5600	5600
3	MS Project	1		Project Management Software	Planning	YES	YES	20	560	560
4	MS office	1		Collation of data	Management	YES	YES	100	2800	2800
5	Modelio	1		Tools for drawing	UML Diagrams	YES				

				diagrams						
6	Printer	1		For printing files	Database Operations	yes	Yes	150	4200	4200
7	MySQL	1		Tool for creating database	Coding Purposes	yes	yes	300	8400	8400
8	Php	1		Language for developing the mobile application	Coding Purposes	yes	yes			
9	JavaScript	1		Language for developing the mobile application	Coding Purposes	yes	yes			
10	HTML 5	1		Language for developing the design application	Coding Purposes	yes	yes			
	CS	1		Language for developing the design mobile application	Coding Purposes	yes	yes		TOTAL	TL

java	**1**	**Language for Coding Purposes yes developing the mobile a**	**yes**	**TOTAL**	**TL 111,160**

(M030) Quarterly Estimated Cost Form (TL)

Project Name :				
Cost Item	2023-2024		TOTAL (TL)	TOTAL COST RATE OF CONTENTS (%)
	I	II		
Personnel	36000	34000	70000	30
Travel	3000	3000	6000	15
Instrument / Equipment / Software / Publications	9000	6000	15000	25
Domestic Works Made By R & D and Testing Institutions	15000	15000	30000	5
International Works Made By R & D and Testing Institutions				
Domestic Services Procurement	15000	15000	30000	5
Overseas Service Procurement				
Material	20000	20000	40000	20
TOTAL COST	98000	93000	191000	100
CUMULATIVE COST				100
IN THE PROJECT TOTAL MAN-MONTH				

APPENDIX

Task ID	Task Name	Expected Duration	Dependency	Probability of Successful Completion Rate Of Each Path (%)
A	Initiating the Project	3	-	99
B	Analysis similar system	2	A	98
C	Economic feasibility analysis	2	A	98
D	Estimating costs and revenues	2	A	85
E	interviewing medical experts	2	B C D	85
F	Intervewing how to Design system	2	E	90
G	Device selection Material and Supplier Selection	2	F	85
H	System Design Discussion and Changes	3	G F	90
I	System requirements/needs analysis in developing software	3	H	95
J	determine solutions and research of technological models	4	I	90
K	Classification and associated to the Database	2	J	90
L	The creation of an inquiry module	3	K	90
M	Entering system data	3	L K	99
N	User Interface Design and Programming	3	M	90
O	Establishment of the structure and servers	2	N	90
P	Modeling of Algorithm	3	M	90
R	Creating links between Web services and database module	2	P	90
S	UI Testing	2	R	90
T	Optimization of security and performance	2	O	90
U	System testing	3	T S	90
V	Interface Test	3	U	
W	Penetration Testing	3	V	90
X	SecurityTesting	2	W	95
y	Performance testing	2	X	95
Z	Closure of the project	4	W X Y	95

Task ID	Task Name	Expected Duration	Dependency	Min(O) 0+4*A+ M/6	Avg	Max	Expected time
A	Initiating the Project	3	-	1.5	2.5	3	2.41666667
B	Analysis similar system	2	A	0.5	1	2	1.08333333333333
C	Economic feasibility analysis	2	A	1	1.5	2	1.3333333333
D	Estimating costs and revenues	2	A	1	1.5	2	1.3333333333
E	interviewing medical experts	2	B C D	1	1.5	2	1.3333333333
F	Intervewing how to Design system	2	E	1	1.5	2	1.3333333333
G	Device selection Material and Supplier Selection	2	F	1	1.5	2	1.3333333333
H	System Design Discussion and Changes	3	G F	1.5	2	3	2.5
I	System requirements/needs	3	H	2	2.5	3	1.66666667

	analysis in developing software						
J	determine solutions and research of technological models	4	I	2.5	3	4	1.666666667
K	Classification and associated to the Database	2	J	1	1.5	2	1.3333333333
L	The creation of an inquiry module	3	K	1.5	2.5	3	2.4166666667
M	Entering system data	3	L K	1.5	2	3	2.5
N	User Interface Design and Programming	3	M	2	2.5	3	1.666666667
O	Establishment of the structure and servers	2	N	1	1.5	2	1.3333333333
P	Modeling of Algorithm	3	M N	2	2.5	3	1.666666667
R	Creating links between Web services and database module	2	P	1	1.5	2	1.3333333333
S	UI Testing	2	R	0.5	1	2	1.0833333333333333
T	Optimization of security and performance	2	S	0.5	1	2	1.0833333333333333
U	System testing	3	P R S	2	2.5	3	1.666666667
V	Interface Test	3	U	1.5	2	3	2.5

W	Penetration Testing	3	V	2.5	3	4	3.0833333333
X	SecurityTesting	2	W	0.5	1	2	1.0833333333333333
y	Performance testing	2	Y	2	3	4	3
Z	Closure of the project	4	W X Y	1	2	3	2

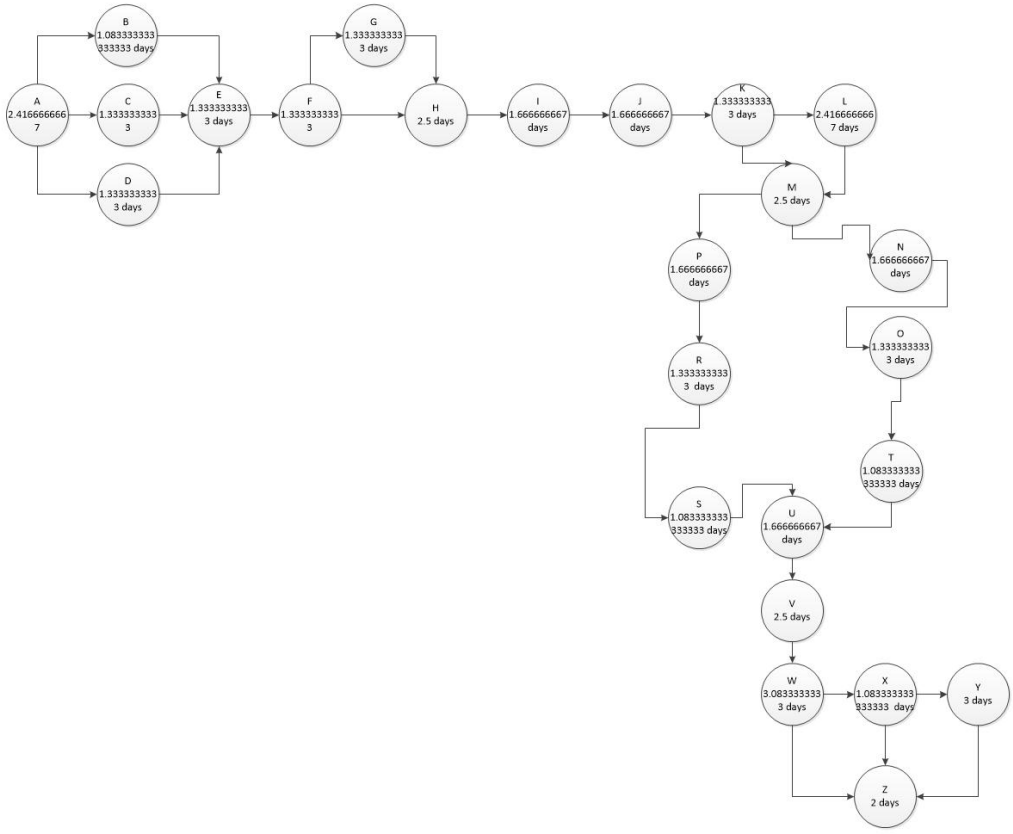
	Paths	Total Expected Time For Each Path	Variance Of Each Path	Standart Deviation Of Each Path
1	A B E F G H I J K L M N O T U V W X Y Z	32.5833333333	0.950617284	√ of 0.950617284 =0.975154246
2	A B E F G H I J K L M N O T U V W X Z	31.5	0.950617284	0.975154246
3	A B E F G H I J K L M N O T U V W Z	30.4166666667	0.950617284	0.975154246
4	A B E F G H I J K L M P R S U V W X Y Z	32.5833333333	0.981306762944187 6	0.990612104
5	A B E F G H I J K L M P R S U V W X Z	32.5833333333	0.981306762944187 6	0.990612104
6	A B E F G H I J K L M P R S U V W Z	32.5833333333	0.981306762944187 6	0.990612104
7	A B E F G H I J K M N O T U V W X Y Z	30.4166666667	0.974996043068893 7	0.987425886
8	A B E F G H I J K M N O T U V W X	29.3333333333	0.974996043	0.9874258

	Z		0688937	86
9	A B E F G H I J K M N O T U V W Z	28.25	0.974996043 0688937	0.9874258 86
10	A B E F G H I J K M P R S U V W X Y Z	31.5	1.0243938285 63995	1.01212613 5
11	A B E F G H I J K M P R S U V W X Z	31.5	1.0243938285 63995	1.01212613 5
12	A B E F G H I J K M P R S U V W Z	30.4166666667	1.0243938285 63995	1.01212613 5
13	A B E F H I J K L M N O T U V W X Y Z	32.5833333333	0.974996043 0688937	1.0088621 76
14	A B E F H I J K L M N O T U V W X Z	31.5	0.974996043 0688937	1.0088621 76
15	A B E F H I J K L M N O T U V W Z	30.4166666667	0.974996043 0688937	1.0088621 76
16	A B E F H I J K L M P R S U V W X Y Z	32.5833333333	1.0243938285 63995	1.03231417 5
17	A B E F H I J K L M P R S U V W X Z	32.5833333333	1.0243938285 63995	1.03231417 5
18	A B E F H I J K L M P R S U V W Z	32.5833333333	1.0243938285 63995	1.03231417 5
19	A B E F H I J K M N O T U V W X Y Z	30.4166666667	1.01778110968 87012	0.9751542 46
20	A B E F H I J K M N O T U V W X Z	29.3333333333	1.01778110968 87012	0.9751542 46
21	A B E F H I J K M N O T U V W Z	28.25	1.01778110968 87012	0.9751542 46
22	A B E F H I J K M P R S U V W X Y Z	31.5	1.0671788951 838033	1.0008073 86
23	A B E F H I J K M P R S U V W X Z	31.5	1.0671788951 838033	1.0008073 86
24	A B E F H I J K M P R S U V W Z	30.4166666667	1.0671788951 838033	1.0008073 86
25	A C E F G H I J K L M N O T U V W X Y Z	30.4166666667	0.9718253158 361332	0.9975005 15
26	A C E F G H I J K L M N O T U V W X Z	29.3333333333	0.9718253158 361332	0.9975005 15

27	A C E F G H I J K L M N O T U V W Z	28.25	0.971825315836133 2	0.997500515
28	A C E F G H I J K L M P R S U V W X Y Z	32.5833333333	1.001614794780319 5	1.021931097
29	A C E F G H I J K L M P R S U V W X Z	31.5	1.001614794780319 5	1.021931097
30	A C E F G H I J K L M P R S U V W Z	30.4166666667	1.001614794780319 5	1.021931097
31	A C E F G H I J K M N O T U V W X Y Z	32.5833333333	0.995002075904025 8	1.018692082
32	A C E F G H I J K M N O T U V W X Z	31.5	0.995002075904025 8	1.018692082
33	A C E F G H I J K M N O T U V W Z	30.4166666667	0.995002075904025 8	1.018692082
34	A C E F G H I J K M P R S U V W X Y Z	32.5833333333	1.044399861399128	1.032314175
35	A C E F G H I J K M P R S U V W X Z	32.5833333333	1.044399861399128	1.032314175
36	A C E F G H I J K M P R S U V W Z	32.5833333	1.044399861399128	1.032314175
37	A C E F H I J K L M N O T U V W X Y Z	30.4166666667	1.037787142523834 3	1.018692082
38	A C E F H I J K L M N O T U V W X Z	29.3333333333	1.037787142523834 3	1.018692082
39	A C E F H I J K L M N O T U V W Z	28.25	1.037787142523834 3	1.018692082
40	A C E F H I J K L M P R S U V W X Y Z	31.5	1.087184928018936 3	1.042823673
41	A C E F H I J K L M P R S U V W X Z	31.5	1.087184928018936 3	1.042823673
42	A C E F H I J K L M P R S U V W Z	30.4166666667	1.087184928018936 3	1.042823673
43	A C E F H I J K M N O T U V W X Y Z	32.5833333333	1.080572209143642 6	1.039582412
44	A C E F H I J K M N O T U V W X Z	31.5	1.080572209143642 6	1.039582412
45	A C E F H I J K M N O T U V W Z	30.4166666667	1.080572209143642 6	1.039582412
46	A C E F H I J K M P R S U V W X Y Z	32.5833333333	1.129969994638744 6	1.012126135

47	A C E F H I J K M P R S U V W X Z	32.5833333333	1.1299699946387446	1.012126135
48	A C E F H I J K M P R S U V W Z	32.5833333	1.1299699946387446	1.012126135
49	A D E F G H I J K L M N O T U V W X Y Z	30.4166666667	1.024393828563995	1.063175535
50	A D E F G H I J K L M N O T U V W X Z	29.3333333333	1.024393828563995	1.063175535
51	A D E F G H I J K L M N O T U V W Z	28.25	1.024393828563995	1.063175535
52	A D E F G H I J K L M P R S U V W X Y Z	31.5	1.054183307508181	1.060018287
53	A D E F G H I J K L M P R S U V W X Z	31.5	1.054183307508181	1.060018287
54	A D E F G H I J K L M P R S U V W Z	30.4166666667	1.054183307508181	1.060018287
55	A D E F G H I J K M N O T U V W X Y Z	32.5833333333	1.0475705886328873	1.084343696
56	A D E F G H I J K M N O T U V W X Z	31.5	1.0475705886328873	1.084343696
57	A D E F G H I J K M N O T U V W Z	30.4166666667	1.0475705886328873	1.084343696
58	A D E F G H I J K M P R S U V W X Y Z	32.5833333333	1.0969683741279893	1.080572209
59	A D E F G H I J K M P R S U V W X Z	32.5833333333	1.0969683741279893	1.080572209
60	A D E F G H I J K M P R S U V W Z	32.5833333	1.0969683741279893	1.080572209
61	A D E F H I J K L M N O T U V W X Y Z	30.4166666667	1.0903556552526956	1.104417218
62	A D E F H I J K L M N O T U V W X Z	29.3333333333	1.0903556552526956	1.104417218
63	A D E F H I J K L M N O T U V W Z	28.25	1.0903556552526956	1.104417218
64	A D E F H I J K L M P R S U V W X Y Z	31.5	1.1397534407477976	1.104804636
65	A D E F H I J K L M P R S U V W X Z	31.5	1.1397534407477976	1.104804636
66	A D E F H I J K L M P R S U V W Z	30.4166666667	1.1397534407477976	1.104804636

67	A D E F H I J K M N O T U V W X Y Z	32.5833333333	1.1331407218725039	1.128891
68	A D E F H I J K M N O T U V W X Z	31.5	1.1331407218725039	1.128891
69	A D E F H I J K M N O T U V W Z	30.4166666667	1.1331407218725039	1.128891
70	A D E F H I J K M P R S U V W X Y Z	32.5833333333	1.1825385073676059	1.124857717
71	A D E F H I J K M P R S U V W X Z	32.5833333333	1.1825385073676059	1.124857717
72	A D E F H I J K M P R S U V W Z	32.5833333	1.1825385073676059	0.975154246



CPM (Critical Path Management) Analysis By Using PERT (Defining Paths)

The calculation of the first path is shown, other paths are calculated in the similar way by checking the table values in PERT Calculation Section.

PERT CALCULATION

Expected time calculated using expected duration values.

Variance calculated by variance values of each process.

Standart deviation calculated by taking square root of variance.

You can also see all other possible paths.

The longest path "A B E F G H I J K L M N O T U V W X Y Z" have 32.5833333333 days is our critical path

Formulas :

Expected Time: (min. duration +4*avg. duration +max. duration)/6

Variance:
((max. duration−min.duration)/6)^2

Derivation:

√Variance

Function Point Calculation

Functions	Simple No	Simple Weight	Average No	Average Weight	Complex No	Complex Weight	Total
User Input	20	2	5	4	2	5	70
User Output	10	3	5	5	2	7	69
User Query	20	4	10	5	1	6	136
Internal Fıles	30	7	5	10	5	15	335
External Interfaces	30	5	10	8	5	10	280

Total: $\sum number * weightfactor$ **= 70+69+136+335+280= 890 Unadjusted Function Points**

Technical Complexity Factor (DI)

Factors	Complexity	Complexity Value
Data Communication	Essential	5
Performance Criteria	Essential	5
Online Data Entry	Significant	4
Reusability	Significant	4
Ease of Installation	Essential	5
Maintainability	Essential	5
Online Updating	Significant	4
Complex Calculations	Moderate	2
		DI=34

Function Points (FP) = UFP*(0.65+0.01*DI)=890*(0.65+0.01*34)=881.1

COCOMO Estimation

KLOC from FP = 881.1*53=46698.3 LOC =46.6983 KLOC

the team is new with the methods and languages used so we will follow an semi-detached type of development:

Effort =person-month = a*(KLOC)^b = 3.0*$46.6983^{1.12}$= 222.197

Total time Duration-in-month = c*(Effort)^d= 2.5*$222.197^{0.35}$=16.56 months

Number of Team Members=Effort/Duration= 222.197/16.56= 13.41 person required.

Crashing Approach

Z= (specified time – expected time) / path standard deviation

For each path in critical path management section we will calculate the z value :

0	Expected Time Of The Path	Specified Time	Standart Deviation Of The Path	Z value	Probability Of Finishing
1	32.58333333	35	0.975154246	1.586482634	0.96983
2	31.5	35	0.975154246	2.697417994	0.95089
3	30.41666667	35	0.975154246	4.295078726	0.95089
4	32.58333333	35	0.990612104	2.107878854	0.95089
5	32.58333333	35	0.990612104	2.107878854	0.9879
6	32.58333333	35	0.990612104	2.001742819	0.97215
7	30.41666667	35	0.987425886	4.19600033	0.97215
8	29.33333333	35	0.987425886	5.293129085	0.97215
9	28.25	35	0.987425886	7.088459113	0.99403
10	31.5	35	1.012126135	3.877396887	0.94602
11	31.5	35	1.012126135	3.877396887	0.94602
12	30.41666667	35	1.012126135	4.850523302	0.94602

13	32.58333333	35	1.008862176	2.702889346	0.98649
14	31.5	35	1.008862176	3.776706324	0.97215
15	30.41666667	35	1.008862176	5.535455772	0.97215
16	32.58333333	35	1.032314175	1.586482634	0.97215
17	32.58333333	35	1.032314175	2.697417994	0.96983
18	32.58333333	35	1.032314175	4.295078726	0.95089
19	30.41666667	35	0.975154246	2.107878854	0.95089
20	29.33333333	35	0.975154246	2.107878854	0.95089
21	28.25	35	0.975154246	2.001742819	0.9879
22	31.5	35	1.000807386	4.19600033	0.97215
23	31.5	35	1.000807386	5.293129085	0.97215
24	30.41666667	35	1.000807386	7.088459113	0.97215
25	30.41666667	35	0.997500515	3.877396887	0.99403
26	29.33333333	35	0.997500515	3.877396887	0.94602
27	28.25	35	0.997500515	4.850523302	0.94602
28	32.58333333	35	1.021931097	2.702889346	0.94602
29	31.5	35	1.021931097	3.776706324	0.98649
30	30.41666667	35	1.021931097	5.535455772	0.97215
31	32.58333333	35	1.018692082	3.436611525	0.97215
32	31.5	35	1.018692082	3.436611525	0.97215
33	30.41666667	35	1.018692082	1.586482634	0.96983
34	32.58333333	35	1.032314175	3.808353354	0.95089
35	32.58333333	35	1.032314175	4.919288714	0.95089
36	32.5833333	35	1.032314175	6.772790254	0.95089
37	30.41666667	35	1.018692082	3.525412142	0.9879

38	29.33333333	35	1.018692082	3.525412142	0.97215
39	28.25	35	1.018692082	4.507116829	0.97215
40	31.5	35	1.042823673	4.507116829	0.97215
41	31.5	35	1.042823673	5.593164723	0.99403
42	30.41666667	35	1.042823673	7.356257596	0.94602
43	32.58333333	35	1.039582412	3.115919528	0.94602
44	31.5	35	1.039582412	4.176004045	0.94602
45	30.41666667	35	1.039582412	5.141451765	0.98649
46	32.58333333	35	1.012126135	3.01454148	0.97215
47	32.58333333	35	1.012126135	4.077996623	0.97215
48	32.5833333	35	1.012126135	5.535455772	0.97215
49	30.41666667	35	1.063175535	3.436611525	0.94602
50	29.33333333	35	1.063175535	3.436611525	0.94602
51	28.25	35	1.063175535	3.014541513	0.98649
52	31.5	35	1.060018287	5.141451765	0.97215
53	31.5	35	1.060018287	6.204906908	0.97215
54	30.41666667	35	1.060018287	7.91008947	0.97215
55	32.58333333	35	1.084343696	4.793551091	0.97215
56	31.5	35	1.084343696	4.793551091	0.96983
57	30.41666667	35	1.084343696	5.741457035	0.95089
58	32.58333333	35	1.080572209	3.657286852	0.95089
59	32.58333333	35	1.080572209	4.699371944	0.95089
60	32.5833333	35	1.080572209	4.947750962	0.9879
61	30.41666667	35	1.104417218	2.807042812	0.97215
62	29.33333333	35	1.104417218	2.807042812	0.97215

63	28.25	35	1.104417218	4.35281877	0.97215
64	31.5	35	1.104804636	6.390738721	0.97215
65	31.5	35	1.104804636	7.409698711	0.96983
66	30.41666667	35	1.104804636	8.349516375	0.95089
67	32.58333333	35	1.128891	5.283531533	0.95089
68	31.5	35	1.128891	5.283531533	0.95089
69	30.41666667	35	1.128891	6.949238255	0.9879
70	32.58333333	35	1.124857717	4.951101801	0.97215
71	32.58333333	35	1.124857717	5.950170028	0.97215
72	32.5833333	35	0.975154246	6.851333568	0.96983

Probabilities obtained from the z-table.

So depending on these values assume we want to reduce our project time by 1 week, then :

Tasks	Normal Time (day)	Crash Time (day)	Normal Cost ($)	Crash Cost ($)	Reduce Cost Per Day ($)
A	1	1	30	35	5
B	2	1	30	35	5
C	2	1	35	40	5
D	3	2	20	15	5
E	4	3	35	40	5
F	3	2	40	70	30
G	2	1	35	40	5
H	1	1	30	35	5
I	1	1	30	35	5
J	6	5	60	80	10
K	2	1	35	50	5
L	2	1	30	50	10
M	2	1	30	35	5
N	2	1	30	42	4
O	3	2	40	90	9
P	3	2	50	90	15
Q	11	10	100	160	12
R	10	9	100	160	10
S	10	9	100	140	5
T	5	4	50	58	4

U	**5**	**4**	**50**	**71**	**7**
V	**3**	**2**	**40**	**50**	**5**
W	**2**	**1**	**20**	**60**	**10**
X	**2**	**1**	**30**	**38**	**4**
Y	**2**	**1**	**30**	**35**	**5**
Z	**4**	**3**	**70**	**80**	**5**

Normal Total Cost : 1150 per day = 1150*7= 8050 per week

Chosen activities for reduction : B,C,D,E,F,G,H

New Cost : 1150+5+5+5+5+30+5+5=1210 per day = 8470 per week

So with additional 30 per day we can recover from a crash of 1 week. (30*7=210 per week)