Project: ServeMeSystem (SMS)

CSE 5325 – Spring 2022

Project Management

Module: COCOMO

Deliverable: COCOMO Estimate Report

Version: [1.0] **Date: [04/12/2022]**

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TABLE OF CONTENTS

1. Introduction

Serve Me System (SMS) aims to design and implement a website and mobile application for a service company to help its users to initiate a service request for their small businesses and their homes. The use of this website and the mobile application will help customers requiring services to be connected to service providers directly. This project offers various services such as Appliances, Electrical, Plumbing, Home Cleaning, Tutoring, Packaging and Moving, Computer Repair, Home Repair and Painting, Pest Control.

This document estimates the cost of the project using COCOMO tool. COCOMO also referred as Constructive Cost Model is a cost estimation tool for most of software projects which helps in predicting various attributes such as size, effort, cost and duration. COCOMO works on past data and provides accurate results. Estimating the cost of the project helps us to build perfect team with good client-relationship, analyze the issues earlier and solve them and be flexible.

By analyzing the source lines of code and choosing the accurate values of scale drivers and cost drivers in COCOMO tool, it provides a new estimate for the project which is the accurate estimate. COCOMO's estimated value is dependent on various values that are set for scale drivers and cost drivers. Values of the drivers are set based on the needs and requirements of the project. These drivers help to understand the impact of different parameters that affect project failure. This document provides a detailed analysis of values set for Source Lines of Code, Scale Drivers, Cost Drivers along with reasons behind assigning those values. COCOMO calculates the values based on all the parameters and costs section and this new estimate provided by the COCOMO thus helps to compare the previous and current estimates that gives a clear understanding about what changes can be done to make the project deliver in a feasible way with better outcomes.

2. Estimating Factors

2.1 Source of Lines of Code

Source Lines of Code (SLOC) is defined such that:

- Only Source lines that are DELIVERED as part of the product are included -- test drivers and other support software is excluded
- SOURCE lines are created by the project staff -- code created by applications generators is excluded
- One SLOC is one logical line of code
- Declarations are counted as SLOC
- Comments are not counted as SLOC

SLOC | Source Lines Of Code	Value Chosen: 5000
Justification: This project is a full-stack application which is implemented as both web and mobile application. Application can reuse the code for all the functionalities by just adjusting to make it compatible with devices. Various functionalities involved in the project are: Login and Register, Service Provider page, Search functionality page, Customer request page, Payment and checkout api, GPS api functionality, approval functionality, update/cancellation feature and feedback page. By assuming that each functionality has its user interface and backend functionality, it takes like around 500-600 lines of code. As there are ten functionalities, SLOC can be approximated to 5000.	

2.2 Scale Drivers

The following is the list of scale drivers, the values applicable to this project and a justification for each value chosen:

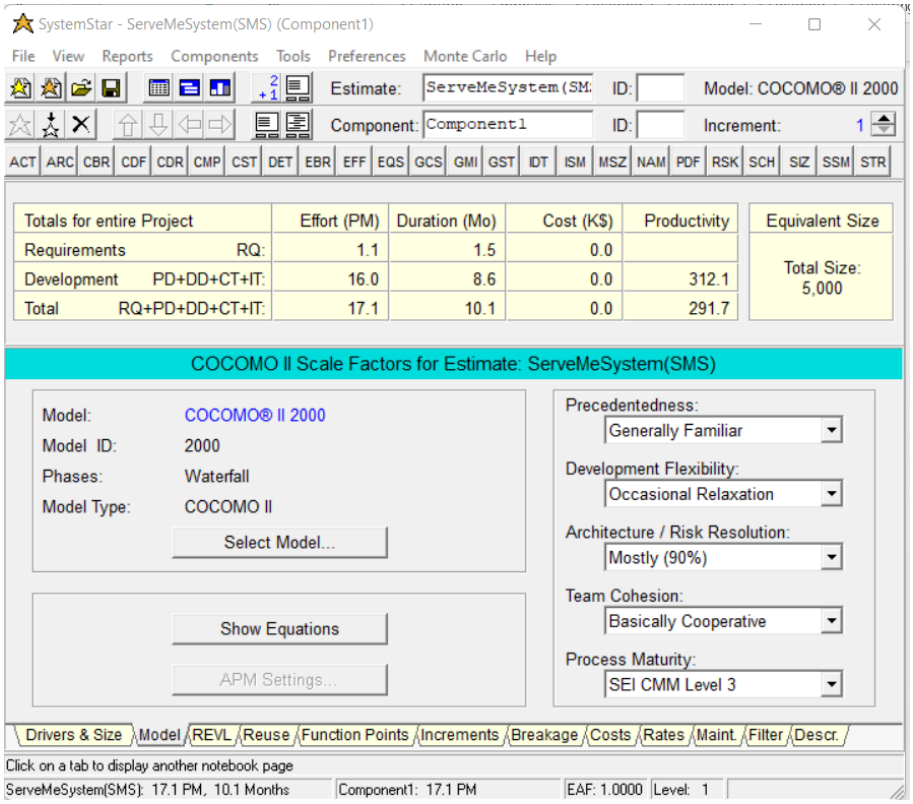
PREC | Precendentedness	Value Chosen: High (Generally familiar)
Precendentedness: Is the new project comparable to the projects that team has worked before? **Justification:** As stated in the risk and constraints, that the team is not trained in android programming and team has never worked together before. Although team is experienced and can learn faster as all are developers, takes some time to work together as they haven't done it before. Team can be trained in Android programming by having some temporary resources or by online learning resources. So have chosen the values as High (Generally familiar).	

FLEX | Development Flexibility	Value Chosen: Low (Occasional Relaxation)
Development Flexibility: Are your requirements flexible, or must you meet them all? **Justification:** Requirements relaxation is not met frequently as most of them were organized and fixed in requirements phase in life cycle model.	

RESL | Architecture/Risk Resolution	Value Chosen: Very High (Mostly 90%)
Architecture/Risk Resolution: To what degree have you already defined the architecture? Justification: Architecture is designed well and after each phase , there is verification in each phase to address the errors and there is testing phase separately which resolves the errors and there is frequent maintenance to resolve the chance of risks. This is going to avoid huge adjustments. Have chosen the value as Very High.	

TEAM | Team Cohesion	Value Chosen: Nominal (Basically Cooperative)
Team Cohesion: How would you describe the relationships among the stakeholders? **Justification:** As stated in the risk and constraints, team has never worked together before. All of them are developers and it takes some time to work together as it is their first time but they can be cooperative as they work together across the phases. Have chosen the value as Nominal.	

PMAT | Process Maturity	Value Chosen: High (SEI CMMI Level 3)
Process Maturity: How does your organization rate of SEI maturity scale? **Justification:** Software processes are standardized and continuous process improvement are also included. Maintenance phase is incorporated to address the improvements to the current application and to avoid the failures.	



2.3 COST DRIVERS

The following is the list of cost drivers, the values applicable to this project and a justification for each value chosen:

ACAP | Analyst Capability	Value Chosen: High
Analyst Capability: How capable are analysts for the project? Justification: The team is involved and aligned with all the requirements, methods, process, etc. Have chosen the value as High.	

APEX | Application Experience Cost Driver	Value Chosen: High
Application Experience Cost: How much experience does team have with the application? Justification: As the team is not trained with Android Programming, they can be capable gradually of android programming as well by various learning resources. But the team is experienced and are quick learners. Have chosen the value as High.	

PCAP | Programmer Capability Cost Driver	Value Chosen: High
Programmer Capability Cost Driver: How much capable are programmers for the project? Justification: All the members of the team are into web designing background and have experience in the same field and learning resources will make them well experience in android also. Have chosen the value as High.	

PLEX | Platform Experience Cost Driver	Value Chosen: High
Platform Experience Cost Driver: How much experience does team have with the platform? Justification: Since all the members of team are experienced, they have good experience with software and hardware tools during development and testing stages. Have chosen the platform experience value as High.	

LTEX | Language and Tool Experience	Value Chosen: High
Language and Tool Experience: How much experience does team have with languages and usage of tools? Justification: All the members of the team are experienced in web designing , they are also exposed to various programming languages and technologies and also with the usage of tools during development and testing phases. As they are not familiar with android programming, learning resources help them to gain experience with android as well. Have chosen the language and tool experience as High.	

PCON | Personnel Continuity Cost Driver	Value Chosen: Very High
Personnel Continuity Cost Driver: What would be annual turnover for the organization? Justification: All the members of the team are punctual and highly committed to deliver the project on-time and with higher turnover rate. Have chosen the values as Very High.	

Project:

TOOL | Use of software Tools Cost Driver	Value Chosen: High
Use of software Tools Cost Driver: How much experience does team have with usage of software tools? Justification: Coding platforms like Visual Studio Code, etc are used during the development phase and database is used to maintain store data and testing tools are used in testing phase. All the members of the team are well versed with these tools. Have chosen the value as High.	

SITE | Multisite Development Cost Driver	Value Chosen: Nominal
Multisite Development Cost Driver: How does the team communicate and where do they reside? Justification: As the members of team doesn't live in the same environment as stated in constraints, they communicate through regular meetings, conferences etc. Have chosen the value as Nominal.	

SCED | Development Schedule Cost Driver	Value Chosen: High
Development Schedule Cost Driver: Is the schedule too compressed with the default schedule? Justification: The duration is too short with tight schedule for its implementation and testing, but as the project must be delivered within the duration. Have chosen the value as Nominal.	

Platform:

TIME | Execution Time Constraint Cost Driver	Value Chosen: Very High
Execution Time Constraint Cost Driver: How much execution time is used by the software? Justification: Project functionalities have both front-end and back-end to validate, it takes more execution time and even test cases validation should also be taken care. So the execution time is chosen as Very High.	

STOR | Main Storage Constraint Cost Driver	Value Chosen: Nominal
Main Storage Constraint Cost Driver: How much main memory is used during its implementation? Justification: Most of the data is stored in database, so very less memory out of the available memory will be used. Have chosen value as Nominal.	

PVOL |Platform Volatility Cost Driver	Value Chosen: Low
Platform Volatility Cost Driver: How often does the platform changes? Justification: Platform Volatility doesn't occur frequently. Like software updates for IDE's, databases, and servers occur like once a year like that and is slow. Have chosen the value as Low.	

Product:

RELY | Required Reliability Cost Driver	Value Chosen: Low
Required Reliability Cost Driver: What are the consequences of software failure? Justification: The backups are used to store backup of the data, if the software failures happen, we can easily restore the data from the backup, so the required reliability is low and easily recoverable losses.	

DATA | Database Size Cost Driver	Value Chosen: High
Database size Cost Driver: How much data stored in database used to test the software? Justification: The project has nearly ten functionalities, and the data related to each functionality is stored in database from backend. The data stored in the database is used to test the software whether it is running according to the design. Have chosen the values as High.	

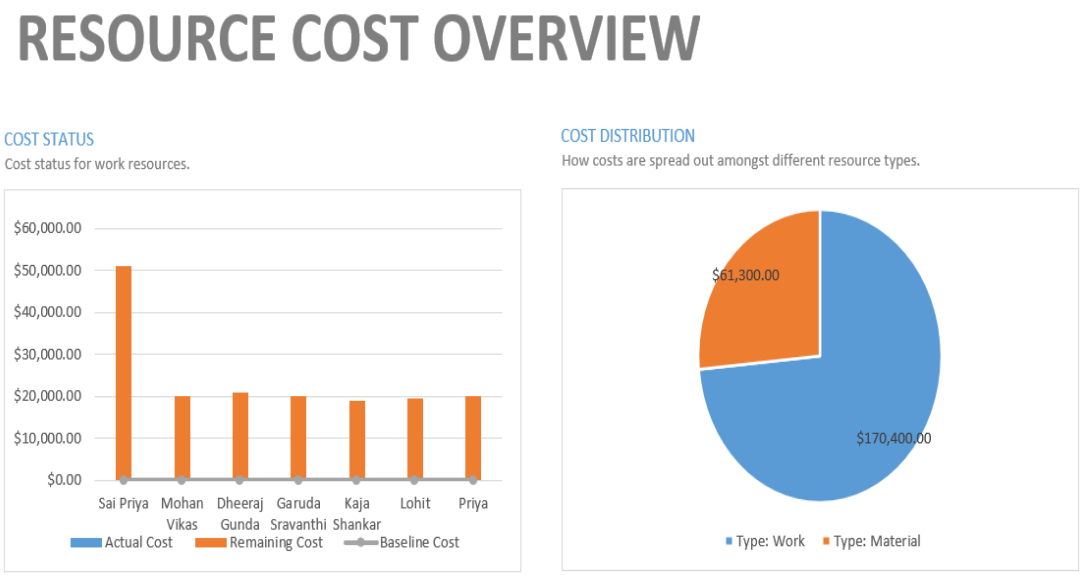
CPLX | Product Complexity Cost Driver	Value Chosen: Nominal
Product Complexity Cost Driver: How complex is the product to implement? Justification: The product is not so complex. Each functionality has its front end and back end page which are separated into various files. And some of the front-end and back-end functionalities can be reused for implementation of pages. Each page might contain simple api's , UI, routines etc. Have chosen the value as Nominal.	

RUSE | Required Reusability Cost Driver	Value Chosen: Nominal
Required Reusability Cost Driver: Are we developing software components that can be reusable? Justification: Software components developed for this project can be reused which will save a lot of time. Have chosen the value as Nominal.	

DOCU| Documentation match to life-cycle needs	Value Chosen: High
Documentation match to life-cycle: How much documentation is created? Justification: As we are following the waterfall model, it places emphasis on documentation (requirements documentation and design documentation). Have chosen the value as High.	

3 Project Final Timeline and Cost Structure

Cost estimation using Microsoft Project Plan:



Resource Sheet (Human and Non Human Resources):

Resource Name	Type	Material	Initials	Group	Max.	Std. Rate	Ovt. Rate	Cost/Use	Accrue	Base	Code
Sai Priya	Work		S	Project Ma	100%	$100.00/hr	$150.00/hr	$0.00	Prorated	Standard	HumanResour
Mohan Vikas	Work		M	Developer	100%	$50.00/hr	$75.00/hr	$0.00	Prorated	Standard	HumanResour
Dheeraj Gunda	Work		D	Developer	100%	$50.00/hr	$75.00/hr	$0.00	Prorated	Standard	HumanResour
Garuda Sravanthi	Work		G	Developer	100%	$50.00/hr	$75.00/hr	$0.00	Prorated	Standard	HumanResour
Kaja Shankar	Work		K	Developer	100%	$50.00/hr	$75.00/hr	$0.00	Prorated	Standard	HumanResour
Lohit	Work		L	Developer	100%	$50.00/hr	$75.00/hr	$0.00	Prorated	Standard	HumanResour
Priya	Work		P	Developer	100%	$50.00/hr	$75.00/hr	$0.00	Prorated	Standard	HumanResour
Servers and Databases	Material		S			$0.00		$22,000.00	Prorated		NonHumanRe
SSL Certificate for Data Encryption	Material		S			$0.00		$4,500.00	Prorated		NonHumanRe
Health Insurance	Material		H			$0.00		$15,000.00	Prorated		NonHumanRe
Operating System and IDE for implementation	Material		O			$0.00		$1,800.00	Prorated		NonHumanRe
Windows Security Softwares	Material		W			$0.00		$18,000.00	Prorated		NonHumanRe

Project Duration=3 months

Human Resources=$170,400.00

Non Human Resources include:

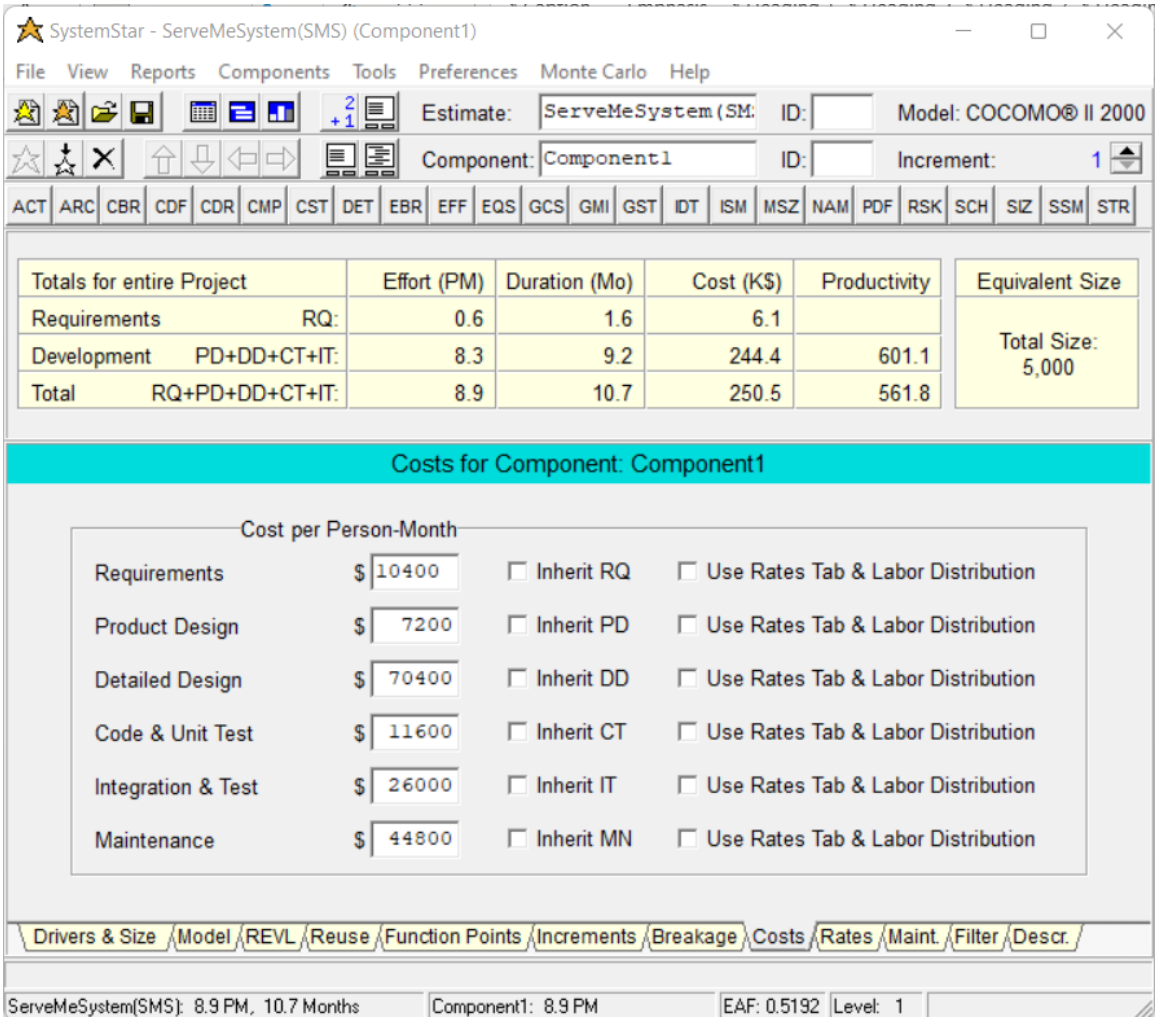
Servers and Databases	$22,000
SSL Certificate for Data Encryption	$4,500
Health Insurance	$15,000
Operating System and IDE for Implementation	$1,800
Windows Security Softwares	$18,000
Total	$61,300

Total Cost estimated from Microsoft Project Plan= $170,400+$61,300=$231,700

Assuming overhead cost=$231,700+$15,325(25% of non -human resources cost)=$247,025

After 50% profit, the cost estimates to $247,025+$123,512.5=$370,537.5

Cost estimation using COCOMO:



Duration=10.7 months

Human Resources cost=$250,500

Total cost estimated by COCOMO=$250,500+$61,300(non-human resources)+$15,325(overhead)

Total cost=$327,125

After adding 50% profit=$327,125+$163,562.5=$490,687.5

Comparisions:

Parameter	Estimates from Microsoft Project Plan	Estimates from COCOMO
Duration	3 months	10.7 months
Cost	$370,537.5	$490,687.5

Work Estimates:

From Microsoft Project Plan:

Task Name	Duration	Start	Finish	Predecessors	Resource Names	Work	Cost
1 ServeMe System(SMS)	64 days	Tue 2/1/22	Fri 4/29/22		Servers and Databases[1],SSL Certifi	2,896 hrs	$231,700.00
1.1 Requirements	7 days	Tue 2/1/22	Wed 2/9/22			152 hrs	$10,400.00
1.2 Design	4 days	Thu 2/10/22	Tue 2/15/22			112 hrs	$7,200.00
1.3 Implementation	25 days	Wed 2/16/22	Tue 3/22/22			1,208 hrs	$70,400.00
1.4 Testing	14 days	Wed 3/23/22	Mon 4/11/22			640 hrs	$37,600.00
1.5 Deployment	3 days	Tue 4/12/22	Thu 4/14/22			168 hrs	$9,600.00
1.6 Maintanence/Warranty Period	11 days	Fri 4/15/22	Fri 4/29/22			616 hrs	$35,200.00

From COCOMO:

Totals for entire Project		Effort (PM)	Duration (Mo)	Cost (K$)	Productivity	Equivalent Size
Requirements	RQ:	0.6	1.6	6.1		Total Size: 5,000
Development	PD+DD+CT+IT:	8.3	9.2	244.4	601.1	
Total	RQ+PD+DD+CT+IT:	8.9	10.7	250.5	561.8	

4. Conclusion and Recommendations

Cost Comparison:

Previous Cost Estimate (from Microsoft Project Plan): $370,537.5

New Cost Estimate (from COCOMO): $490,687.5

Difference: $120,150

Reasons behind the cost difference:

TOOL (Use of software tools): All the members of the team are experienced with web designing but they are not trained in Android programming. This would have been a significant factor.

Data Storage : Storage requirements are higher as there are a lot of functionalities which are taken into consideration. We missed out on that and it is higher than the anticipated values(fifty percent).

Schedule Comparison:

Previous Duration: 3 Months

New Duration(from COCOMO): 10.7 Months ~ 11 Months

Reasons behind the schedule difference:

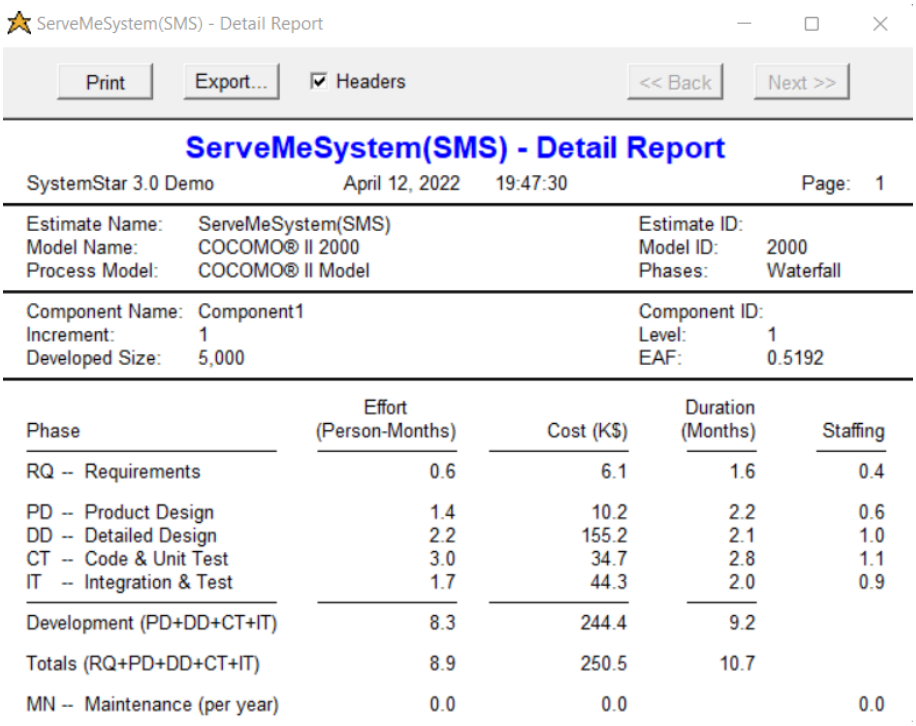
TOOL (Use of software tools): All the members of the team has never worked together and have not trained in Android programming, our calculation did not take these points into consideration, training in a new language and establishing cooperativeness among the members to establish a task might take some time. COCOMO has taken this into consideration.

Personnel Continuity: Despite of considering, staff turnover as risk previously, we haven't taken how to overcome this problem. There might be chances of team member's going on leave due to personal reasons, resigning from the organization, etc. COCOMO has taken all these into consideration.

Recommendations:

As we have a deviation of approximately $120,150 in terms of cost and 8 in terms of months, we can deliver the product to the customer with basic functionalities and make improvements in an iterative way if the client agrees to that. Basic functionalities which can be implemented initially can be finalized by discussing with the client and also by hiring temporary employees who are experienced in Android programming helps to reduce the duration taken for the team members to get exposure to work with Android. If the client is not happy with the new estimated cost, profit can be reduced by four to five percent. If client has an idea of improvements and developments in the future for the application, profit can be easily attained in the upcoming few years.

Appendices



ServeMeSystem(SMS) - Detail Report

Print | Export... | Headers | << Back | Next >>

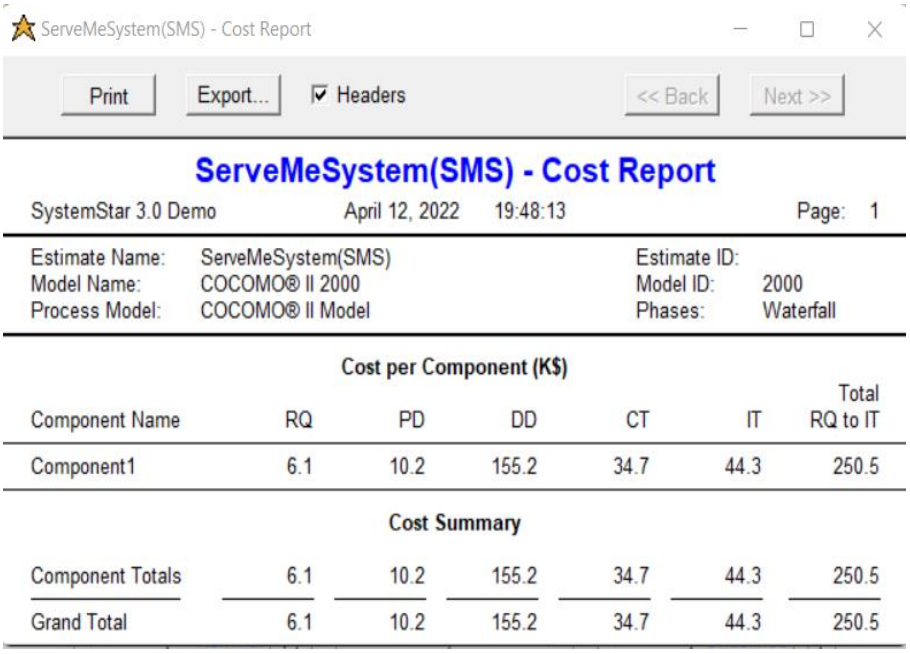
ServeMeSystem(SMS) - Detail Report

SystemStar 3.0 Demo April 12, 2022 19:47:30 Page: 1

Estimate Name:	ServeMeSystem(SMS)	Estimate ID:	
Model Name:	COCOMO® II 2000	Model ID:	2000
Process Model:	COCOMO® II Model	Phases:	Waterfall

Component Name:	Component1	Component ID:	
Increment:	1	Level:	1
Developed Size:	5,000	EAF:	0.5192

Phase	Effort (Person-Months)	Cost (K$)	Duration (Months)	Staffing
RQ -- Requirements	0.6	6.1	1.6	0.4
PD -- Product Design	1.4	10.2	2.2	0.6
DD -- Detailed Design	2.2	155.2	2.1	1.0
CT -- Code & Unit Test	3.0	34.7	2.8	1.1
IT -- Integration & Test	1.7	44.3	2.0	0.9
Development (PD+DD+CT+IT)	8.3	244.4	9.2	
Totals (RQ+PD+DD+CT+IT)	8.9	250.5	10.7	
MN -- Maintenance (per year)	0.0	0.0		0.0



ServeMeSystem(SMS) - Cost Report

Print | Export... | Headers | << Back | Next >>

ServeMeSystem(SMS) - Cost Report

SystemStar 3.0 Demo April 12, 2022 19:48:13 Page: 1

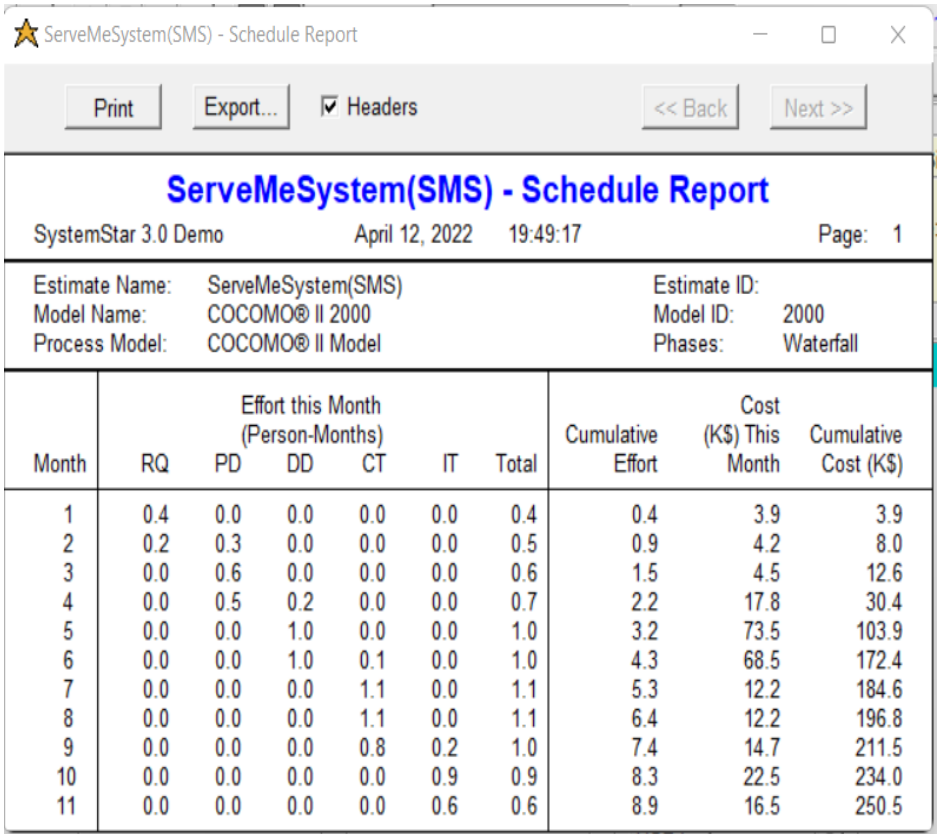
Estimate Name:	ServeMeSystem(SMS)	Estimate ID:	
Model Name:	COCOMO® II 2000	Model ID:	2000
Process Model:	COCOMO® II Model	Phases:	Waterfall

Cost per Component (K$)

Component Name	RQ	PD	DD	CT	IT	Total RQ to IT
Component1	6.1	10.2	155.2	34.7	44.3	250.5

Cost Summary

Component Totals	6.1	10.2	155.2	34.7	44.3	250.5
Grand Total	6.1	10.2	155.2	34.7	44.3	250.5

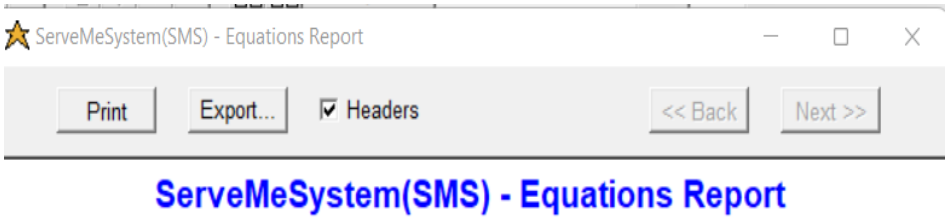


ServeMeSystem(SMS) - Schedule Report

SystemStar 3.0 Demo April 12, 2022 19:49:17 Page: 1

Estimate Name: ServeMeSystem(SMS) Estimate ID:
Model Name: COCOMO® II 2000 Model ID: 2000
Process Model: COCOMO® II Model Phases: Waterfall

Month	Effort this Month (Person-Months) RQ	PD	DD	CT	IT	Total	Cumulative Effort	Cost (K$) This Month	Cumulative Cost (K$)
1	0.4	0.0	0.0	0.0	0.0	0.4	0.4	3.9	3.9
2	0.2	0.3	0.0	0.0	0.0	0.5	0.9	4.2	8.0
3	0.0	0.6	0.0	0.0	0.0	0.6	1.5	4.5	12.6
4	0.0	0.5	0.2	0.0	0.0	0.7	2.2	17.8	30.4
5	0.0	0.0	1.0	0.0	0.0	1.0	3.2	73.5	103.9
6	0.0	0.0	1.0	0.1	0.0	1.0	4.3	68.5	172.4
7	0.0	0.0	0.0	1.1	0.0	1.1	5.3	12.2	184.6
8	0.0	0.0	0.0	1.1	0.0	1.1	6.4	12.2	196.8
9	0.0	0.0	0.0	0.8	0.2	1.0	7.4	14.7	211.5
10	0.0	0.0	0.0	0.0	0.9	0.9	8.3	22.5	234.0
11	0.0	0.0	0.0	0.0	0.6	0.6	8.9	16.5	250.5

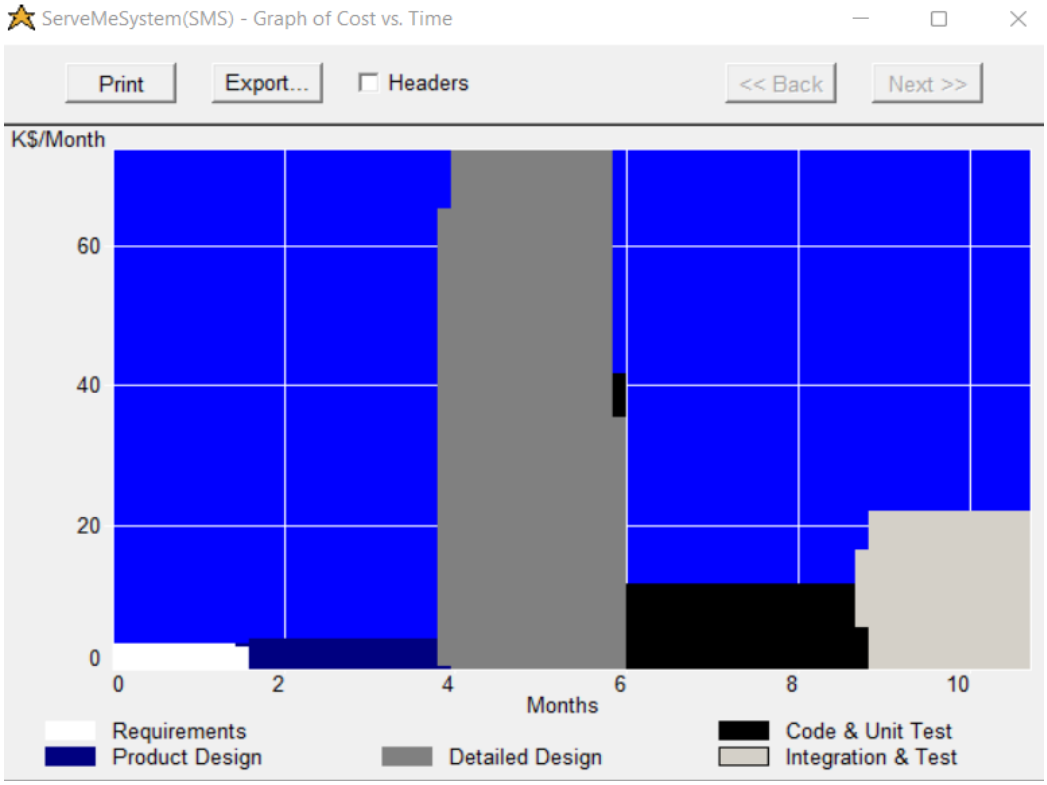


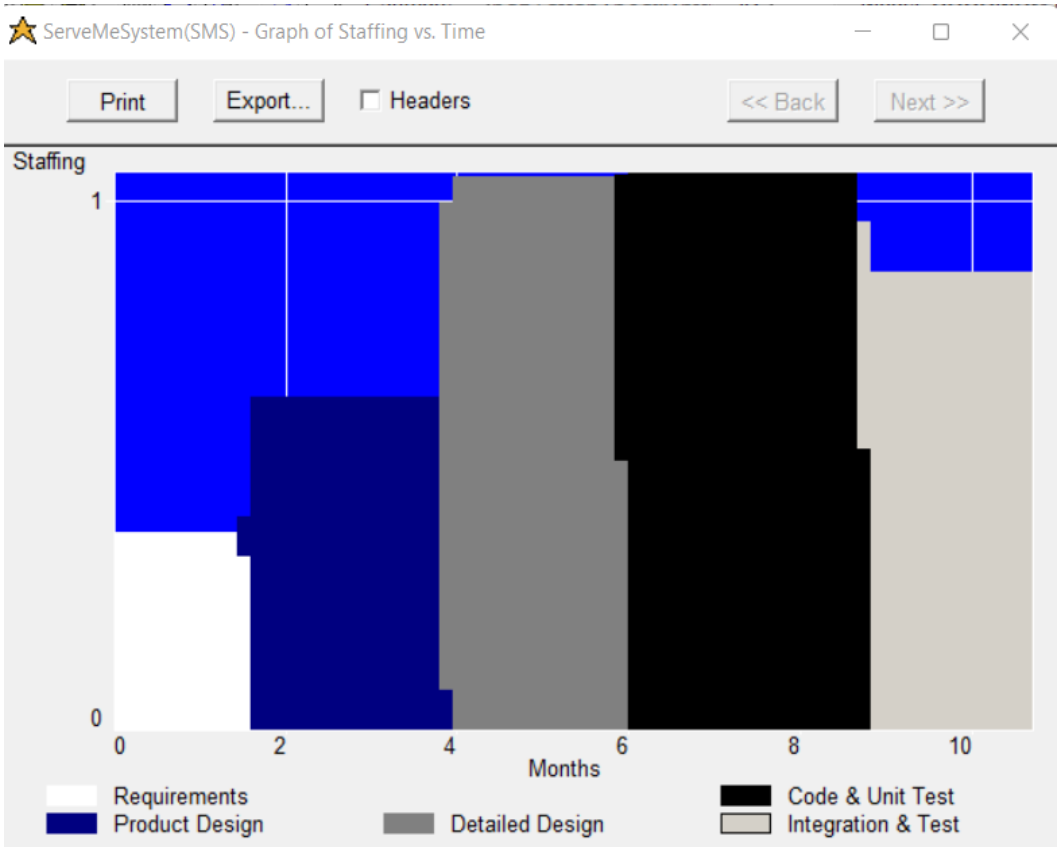
ServeMeSystem(SMS) - Equations Report

SystemStar 3.0 Demo April 12, 2022 19:50:47 Page: 1

Estimate Name: ServeMeSystem(SMS) Estimate ID:
Model Name: COCOMO® II 2000 Model ID: 2000
Process Model: COCOMO® II Model Phases: Waterfall

COCOMO Estimating Equations		
Effort	$= 2.9400 * EAF * (KSLOC)^{1.0535}$	EAF = 0.5192 = Effort in Person-Months
Schedule	$= 3.6700 * 1.300 * (Effort)^{0.3087}$	Based on effort with SCED = Nominal = Duration in Months
Maintenance Effort	$= 2.9400 * EAF * (KSLOC)^{1.0535}$	= Effort (per year) in Person-Months
152 hours per Person-Month		


ServeMeSystem(SMS) - Graph of Cost vs. Time
Print
Export...
Headers
<< Back
Next >>
K$/Month
60
40
20
0
0
2
4
6
8
10
Months
Requirements
Product Design
Detailed Design
Code & Unit Test
Integration & Test


ServeMeSystem(SMS) - Graph of Staffing vs. Time
Print
Export...
Headers
<< Back
Next >>
Staffing
1
0
0
2
4
6
8
10
Months
Requirements
Product Design
Detailed Design
Code & Unit Test
Integration & Test

REFERENCES

- http://www.softstarsystems.com/overview.htm
- https://en.wikipedia.org/wiki/COCOMO