

IT-632-Software Engineering

# **Cafeteria Management System (Cashless Canteen)**

Cost Estimation 1.0

Team-2

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### Document Revision History

Version	Primary Author(s)	Description	Reviewer(s)	Date
1.0	Team #2	First Draft		25 October, 2013

**Brief Description of the cost estimation method used:**

Use case modeling is an accepted and prevalent technique to capture the business processes and requirements of a software application. Since they provide the functional scope of the application, analyzing their contents provides valuable insight into the effort and size needed to design and implement the application. In general, applications with large, complicated use cases take more effort to design and implement than small applications with less complicated use cases. Moreover, the time to complete the application is affected by:

- The number of steps to complete the use case.
- The number and complexity of the actors.
- The technical requirements of the use case such as concurrency, security and performance.
- Various environmental factors such as the development teams' experience and knowledge.

Use Case Points (UCP) is an estimation method that provides the ability to estimate an application's size and effort from its use cases.

The equation is composed of five variables:

1. Technical Complexity Factor (TCF).
2. Environment Complexity Factor (ECF).
3. Unadjusted Actor Weight (UAW).
4. Unadjusted Use Case Weight (UUCW).
5. Productivity Factor (PF).

Each variable is defined and computed separately, using perceived values and various constants. The complete equation is:

$$\text{UCP} = (\text{UUCW} + \text{UAW}) \times \text{TCF} \times \text{ECF}$$

$$\text{UCP} = \text{UCP} \times \text{PF}$$

The necessary steps to generate the estimate based on the UCP method are:

1. Determine and compute the Technical Factors.
2. Determine and compute the Environmental Factors.
3. Compute the Unadjusted Use Case Points.
4. Determine the Productivity Factor.
5. Compute the product of the variables.

**Unadjusted Use case Points (UUCP):****Unadjusted Use Case Weight (UUCW):**

<b>Unadjusted Use Case Points</b>		<b>Multiplier</b>	<b>Number of Use Cases</b>	<b>Description</b>
1	Simple	5	13	Simple Use Case - up to 3 transactions.
2	Average	10	5	Average Use Case - 4 to 7 transactions.
3	Complex	15	0	Complex Use Case - more than 7 transactions.
Calculated UUCW			115	

UUCW = (Total No. of Simple Use Cases x 5) + (Total No. Average Use Case x 10) + (Total No. Complex Use Cases x 15)

<b>Individual Use Cases</b>		<b>Multiplier</b>	<b>Use Case Name</b>
1	Simple	5	Login View Transaction log by User Check Balance by User Post feedback and complaint Disable the card View Canteen Menu Pay to canteen View the sales of all Canteen Check total deposit balance Edit user details View customer details Edit Menu View Transaction Log and balance by Canteen
2	Average	10	Place an order to canteen Transfer Balance to other account Sign up Recharge an account Take an Order by canteen
3	Complex	15	None

**Unadjusted Actor Weight (UAW):**

<b>Actor Summary</b>		<b>Multiplier</b>	<b>Number of Actors</b>	<b>Description</b>
1	Simple	1	2	Simple actors are other systems that communicate with your software through Application Programming Interface.
2	Average	2	1	Average actors can either be human beings interacting in a well-defined protocol.
3	Complex	3	3	The original definition of complex actors specifies that users who interact with the software through a graphical user interface are complex actors. While that is true, the same classification should apply to users who interact with the system in unpredictable ways.
Calculated UAW			13	

$$\text{UAW} = (\text{Total No. of Simple actors} \times 1) + (\text{Total No. Average actors} \times 2) + (\text{Total No. Complex actors} \times 3)$$

<b>Individual Actor</b>		<b>Multiplier</b>	<b>Actor Name</b>
1	Simple	1	Database, RFID Reader
2	Average	2	Customer
3	Complex	3	Admin, CMC Members, Canteen Owners

**Technical Complexity Factor (TCF):**

Description	Weight	Relevance (0-5)	Calculated Factor (Weight*Relevance)
Distributed System	2	2	4
Performance	1	2	2
End User Efficiency	1	2	2
Complex Internal Processing	1	3	3
Reusability	1	2	2
Easy to Install	0.5	2	1
Easy to Use	0.5	2	1
Portable	2	2	4
Easy to Change	1	2	2
Concurrent	1	1	1
Special Security features	1	2	2
Provides Direct access to third parties	1	2	2
Special user training facilities are required	1	2	2
<b>Total Factor (TF)</b>		28	

$$TCF = 0.6 + (TF/100) = 0.6 + 0.28 = 0.88$$

**Environmental Complexity Factor (ECF)**

Description	Weight	Past Experience (0-5)	Calculated Factor (Weight*Past Experience)
Familiarity with development process used	1.5	2	3
Application Experience	0.5	3	1.5
Object Oriented Experience	1	3	3
Lead analyst capability	0.5	3	1.5
Motivation	1	4	4
Stable Requirements	2	4	8
Part-time workers	-1	0	0
Difficult Programming language	-1	0	0
<b>Total Factor (EF)</b>		21	

$$ECF = 1.4 + (-0.03 \times EF) = 1.4 - 0.63 = 0.77$$

$$\begin{aligned}\text{UCP} &= (\text{UUCW} + \text{UAW}) \times \text{TCF} \times \text{ECF} \\ &= (115 + 13) * 0.88 * 0.77 \\ &= 86.73\end{aligned}$$

**Productivity Factor (PF)**

It is the number of hours per Use Case Point (UCP).

The “complex projects” have a higher PF (28 to 1) than “simpler projects” (20 to 1).

The following calculation determines if a project is complex:

For each of the following environmental factors that have a value below 3, add a point.

1. Familiarity with the project.
2. Application experience.
3. Object oriented programming experience.
4. Lead analyst capability.
5. Motivation.
6. Stable requirements.

For each of the remaining environmental factors that have a value above 3, add a point.

7. Part time staff.
8. Difficult programming language.

Add up the points. If you have fewer than 3 points, use 20 hrs. per UCP. If you have 3 or 4 points, use 28 hrs. per UCP. If you have 5 or more points, restructure the project.

We have 2 points, suggesting our project to be simple.

So, PF = 20

$$\begin{aligned}\text{Estimated Effort} &= \text{UCP} \times \text{PF} \\ &= 86.73 * 20 \\ &= 1734.6\end{aligned}$$

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