

Experiment No: 05

● **Aim:** Use of metrics to estimate the cost.

● **Theory:**

● **Project Name: - The QR CODE SCANNER**

Software Cost Estimation

For any new software project, it is necessary to know how much it will cost to develop and how much development time will it take. These estimates are needed before development is initiated, but how is this done? Several estimation procedures have been developed and are having the following attributes in common.

- Project scope must be established in advanced.
- Software metrics are used as a support from which evaluation is made.
- The project is broken into small PCs which are estimated individually.
- To achieve true cost & schedule estimate, several options arise.
- Delay estimation
- Used symbol decomposition techniques to generate project cost and schedule estimates.
- Acquire one or more automated estimation tools.

Uses of Cost Estimation

During the planning stage, one needs to choose how many engineers are required for the project and to develop a schedule.

In monitoring the project's progress, one needs to access whether the project is progressing according to the procedure and takes corrective action, if necessary.

A model may be static or dynamic. In a static model, a single variable is taken as a key element for calculating cost and time. In a dynamic model, all variable are interdependent, and there is no basic variable.

Software Cost Estimation

Static, Single Variable Models: When a model makes use of single variables to calculate desired values such as cost, time, efforts, etc. is said to be a single variable model. The most common equation is:

$$C=aL^b$$



Jawahar Education Society's Annasaheb Chudaman Patil College of Engineering,
Kharghar, Navi Mumbai

Where C = Costs

L = size

a and b are constants

The Software Engineering Laboratory established a model called SEL model, for estimating its software production. This model is an example of the static, single variable model.

$$E = 1.4L^{0.93}$$

$$DOC = 30.4L^{0.90}$$

$$D = 4.6L^{0.26}$$

Where E = Efforts (Person Per Month)

DOC = Documentation (Number of Pages)

D = Duration (D, in months)

L = Number of Lines per code

Static, Multivariable Models: These models are based on method (1), they depend on several variables describing various aspects of the software development environment. In some model, several variables are needed to describe the software development process, and selected equation combined these variables to give the estimate of time & cost. These models are called multivariable models.

WALSTON and FELIX develop the models at IBM provide the following equation gives a relationship between lines of source code and effort:

$$E = 5.2L^{0.91}$$

In the same manner duration of development is given by

$$D = 4.1L^{0.36}$$

The productivity index uses 29 variables which are found to be highly correlated productivity as follows:

Software Cost Estimation

Where W_i is the weight factor for the i th variable and $X_i = \{-1, 0, +1\}$ the estimator gives X_i one of the values -1, 0 or +1 depending on the variable decreases, has no effect or increases the productivity.

COCOMO Model

Boehm proposed COCOMO (Constructive Cost Estimation Model) in 1981. COCOMO is one of the most generally used software estimation models in the world. COCOMO predicts the efforts and schedule of a software product based on the size of the software.

The necessary steps in this model are:

- Get an initial estimate of the development effort from evaluation of thousands of delivered lines of source code (KDLOC).
- Determine a set of 15 multiplying factors from various attributes of the project.
- Calculate the effort estimate by multiplying the initial estimate with all the multiplying factors i.e., multiply the values in step1 and step2.

The initial estimate (also called nominal estimate) is determined by an equation of the form used in the static single variable models, using KDLOC as the measure of the size. To determine the initial effort E_i in person-months the equation used is of the type is shown below

$$E_i = a * (KDLOC)^b$$

In COCOMO, projects are categorized into three types:

- **Organic**
- **Semidetached**
- **Embedded**

1. **Organic**: A development project can be treated of the organic type, if the project deals with developing a well-understood application program, the size of the development team is reasonably small, and the team members are experienced in developing similar methods of projects. Examples of this type of projects are simple business systems, simple inventory management systems, and data processing systems.

2. **Semidetached**: A development project can be treated with semidetached type if the development consists of a mixture of experienced and inexperienced staff. Team members may have finite experience in related systems but may be unfamiliar with some aspects of the order being developed. Example of Semidetached system includes developing a new operating system (OS), a Database Management System (DBMS), and complex inventory management system.

3. **Embedded**: A development project is treated to be of an embedded type, if the software being developed is strongly coupled to complex hardware, or if the stringent regulations on the operational method exist. For Example: ATM, Air Traffic control.

Software Cost Estimation:

Item	Unit/hr	Cost/hr	Subtotal	level	% of total
Project Management				15000	15%
Project Manager	2	1500	3000		
Project team	60	1000	6000		
Contractors			500		
Hardware				1500	
Hardware Device	5	150	750		60%
Servers	1	10	100		
Software				3000	50%
Licensed Software	1	500	500		
Software development			1000		
Training and Support				7000	
Training cost	10	450	4500		90%
Travel cost	5	10	500		
Reserves (10%)				10000	10%
Total Project Cost Estimate				50000	

● Conclusion: -

We successfully Understanding **of metrics to estimate the cost.**