Abrupt Software Cost Estimation Technique Based on Basic Requirement

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Abstract—Software cost estimation is the process to measure the required effort and cost to build system. In the project management still it is one of the most difficult tasks. There is a lack of reliable estimation technique and remains on going challenge to software developer. Trustworthy estimation techniques give proper schedule, budget, effort, risk, resource. Software cost estimation more challenging to IT industry because of continuous changing resources and involvement of different customer. Both software project management and customer are suffering in this issue. In many cases it is necessary to estimate cost urgent for customer without advance requirements. Most of the estimation techniques develop based on details requirement. In reality customer wants to know the cost of the system immediately before giving them full requirement of the system. We are going to propose an Abrupt Software cost estimation technique based on basic requirement. The main focus of this model to calculate primary cost to solve immediate problem of cost needed to develop system. Our model calculates cost by considering parameters like feasibility study, basic requirement, time duration, risk management, project analysis and others. This model is flexible because estimated cost varies with change of requirement.

Index Terms — cost estimation;software cost; software model; software techniques; software development problem;

I. INTRODUCTION
Cost estimation is one of the most significant proceedings in software project management or software development industry [1][2][3][4]. Accurate Software cost estimation is most important for every kind of project. Software Cost estimation helps us to complete the project within time and budget [5].

Most software projects fail to deliver the software product within estimated budget and time due to lack of planning, unachievable technical objectives, failed technology or unachievable requirements. Software cost estimation becomes very difficult for customers and developers [6].

So exact cost estimation is very important because:
- Software cost estimation is mostly needed for both the customers and developers.
- To make good understanding and good satisfaction.
- It supports the project manager and the development team.
- Easily determines what resource will be used with respect to an overall business plan.
- Easily identifies development risk and others problems.
- Developer easily determines how to develop, which design used this project.
- Customers expect real development costs to be in line with estimated project costs.

Without requirement collections software Cost estimation is not possible. So it is very important. Recently we find many problems about software development because clients want to know the cost
they have to bear to make software (without expressing their requirement). So in this paper we have come up with a new model and a formula. This Model name is AET (Abrupt Estimation Technique) model. The AET model is originally used in the software development cost estimation field (Web application, Management Software, desktop based software etc.). First attribute of this model is, software cost estimation without collecting full requirement. So by using this model we can estimate the cost that will be required for developing the software before full requirement collection.

For determining Software cost estimation the required estimates are to be followed:
- Effort (usually in person-months)
- Project duration (in calendar time)
- Cost (in dollars)

Generally a project begins with a basic idea and then requirements are collected after discussing with the customer. Software cost estimation is dependent on attributes like customer requirements, Organizers, worker, programming language, database, salary, network etc. After collecting all the requirements we use the estimating model for software development. Almost all the models or techniques are built up based on software size, software requirements, and Software parameters. Recently many software industries use popular software cost estimation like COCOMO 81, COCOMOII, FP and Delphi Model [7]. Presently every estimation processes are done after completing overall requirements collection. But situation arises where some customers want to know the estimated cost of the Software before requirements collection. So it is a problem to any software industry for software developing. So we are putting forward a new model which estimates the software just based on basic requirements that’s means software cost estimation before full requirements collection. There are six steps in our proposed model like Feasibility study, Established Estimation Scope, Basic Requirements, Time duration, Risk Management, Project Analysis. Our proposed model has a formula. If any software industry uses our formula then they will be able to say cost estimation before full requirements collection.

The remaining part of this paper is organized as follows:
Section2: Background: The research related work.
Section3: Problem statement: Describes software cost estimation problem.
Section4: Discussions and research questions.
Section5: we present the process of estimation.
Section6: we present our propose model, how our research is designed and how the information are collected.
Section7: Propose model analysis.
Section8: Formula description.
Section9: Case study.
Section10: Discusses the results and analysis.
Section11: Discussions on Future work and planning.

II. BACKGROUND
Software estimation is the most essential part of the software development [5]. Many software cost estimation models and techniques have been developed over the last four years [8]. Software development project many times it fails to the case of software cost estimation, regarding software cost estimation project planning on another important fails is requirement [9].

The software development & software business mostly depends on software cost estimation. Software estimation is an essential part of the software development process, where Software project failure is an important issue for software developers. Despite going to over time and cost, approximately between 30% and 40% of the software projects are completed and the others fail [4]. Traditionally researchers such as COCOMO (Boehm, 1981) [9], as a function of effort on the expected size of the shelf where the algorithmic models estimated by using the mathematical relations. Using statistical techniques such as stepwise regression or improve local models. There is a lot of work , regression [11] based on [10] based , dynamic learning based model -based estimation techniques , expertise in the field has been conducted by several authors [12][13][14] and model -based techniques such COCOMO. Common Bayesian compound as a think, COCOMO, the checkpoint and see. That is common problem and they have available solution. Software cost estimation is a critical phase for all time, But now a days software engineers has to face many new problem. Software cost estimation immediately is a big issue for quickly software budget.

Related Study
a. COCOMO: Barry Boehm developed the COCOMO (Construcive Cost Model) in 1981. The COCOMO model is a regression based software cost estimation model. It is the most popular method, which is categorized in algorithmic models. The basic COCOMO model has a very simple form: Where K1 and K2 are two parameters dependent on the application and development environment. Estimation of COCOMO model can
accurately, which considers qualification and experience of the development team.

b. COCOMO-II: COCOMO-II determines the efforts (in Person-Months) required for a project based on software project's size in KSOLOC (Kilo Source Line Of Code) as well as other cost factors known as scale factors and effort multipliers by

\[ \text{Effort} = A \times [\text{Size}] E \times \prod_{i=1}^{17} Em \]

c. **Expert Judgment:** Experts generally estimate an average of the new and past information about the project is available on a new project and uses their experience and understanding [17]. The 'expert' is dependent on [18] another technique, namely the 'Delphi method.' Expert judgment approach tries to overcome some of the blame. Coordinator experts' estimates, and estimates another iteration of the rationale for the request and prepares a summary of responses from experts in a form [18]. Expert judgment techniques are in consultation with a specialist or expert groups involved in software cost estimation. They arrive at an estimate of the cost by their experience and understanding of the proposed project [18].

d. **Bottom-up Estimating Method:** Every software component, cost estimates, and then combines the results to arrive at an overall project cost is estimated. Different elements have a chance to balance out the error in the estimation, because it is more stable. But there is more time consuming [19].

e. **Top-down Estimating Method:** It is the opposite of the bottom-up approach [20]. An overall cost estimate for the project is derived from the properties of the global software projects. Then the project is partitioned into several lower-level components. It's fast, but easy to implement low-level issues [18].

f. **Estimation based on expert judgment:** Estimation based on expert judgment is done by getting advice from experts who have extensive experiences in similar projects. Examples of expertise based techniques include Delphi technique [21], [22], Rule Based Systems [22].

g. **Delphi:** The purpose of the Delphi method to combine expert opinion and prevent bias caused due to position, the tendency is to prevent or dominant personality or status. A special meeting of experts held in Delphi projects and tries to achieve true data.

III. **PROBLEM STATEMENT**

Is it possible to do software cost estimation before requirement collection [23]? Software development is a big issue in the price of the software. For example, say someone asked how much money it took to make shop management software (or any software). They did not say anything about this software but asked only how much it cost (without requirement). But what could be the answer, because without the necessary information it can't be answered. In the case of software development many have cost estimation but have no accurate way to do software development cost estimation before full requirement collection. Our Problem statement is Abrupt Software cost estimation technique based on basic requirement.

IV. **RESEARCH QUESTION**

<table>
<thead>
<tr>
<th>Question</th>
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<tbody>
<tr>
<td>1. How to be estimated software cost estimation before full requirements collection?</td>
</tr>
<tr>
<td>2. Do you think that price determination is difficult before software development?</td>
</tr>
</tbody>
</table>

V. **PROCESS OF ESTIMATION**

Software cost estimation process, the basic Nine-step:

1) The specific goals.
2) Feasibility of the software being tested.
3) Gathering the software basic requirements.
4) For information and resources necessary to create a sketch.
5) Analysis the software development time.
6) Using AET Formula to estimate the cost.
7) Risk management.
8) Balancing different estimates and restate the process.
9) Monitoring the estimated output.

VI. **PROPOSE MODEL**

We proposed a model to estimate software cost (show in figure 1). It contains is Feasibility study, Established Estimation Scope, Concept exploration, Basic Requirements, project module, software resource, Time duration, Risk...
VII. PROPOSE MODEL ANALYSIS

When we will make software cost estimation then we are to necessary full requirements; but our project model is making cost estimation before full requirements. So there six steps of our model to do software cost estimation. The six steps is provided below.

A. Feasibility study: During feasibility study we shall find out that where there the software is feasible or not. If not we shall abandon the idea. A feasibility study is valuable for Starting a new Project, Increase of an existing business. Feasibility study is a study made before committing to a project. Actually feasibility study determines three concerns; one is go ahead, do not go ahead and thinks again. A feasibility study is need when we start a new project. In this paper our new approach model first issue is feasibility study. So feasibility study is need for that when start a new project in any software industry, firstly needed to know that’s feasible or unfeasible for the software developing. Iffeasible, you need to start the project. Or If isn’t feasible, you don’t need to start the project.

B. Established estimations scope: When we start any project then we needed to established software estimation. In this step we discuss about the project in our meeting. In this meeting we will get some suggestion about what kind of elements are needed for this project.

C. Basic requirements: There are four categories of the basic requirements. They are first category project title, second is Interview, third is project module and four is software resource.

   a. Title Project: At first we are to search the title or project type from the client. The Type of project will depend on project title.

   b. Interview: We will take interview from client to know about basic requirements so that we can understand about the conception of the project. The questions are like 1. What is the period of the project? 2. What kind of category of the project? 3. What kind of server will be used there? 4. Is there any gateway in this project? 5. Is this project desktop based or online based? In this way we will collect some basic requirements from the client.

   c. Project Module: Module is very imperative for software development because module is a part of program. The module gives a broad overview of software development project. A different requirement by the client could be considered as a new module. This model, module is the part of basic requirements, when we will collect to the basic requirements then we need to know about concept of module for this project, how the module can be developed in this project.

Figure 1: AET Model
These experts will judge the project, how the project module will be developed.

d. **Software Resource**: Software resource is the major issue for developing software. In the step of basic requirements we shall find out all software resource when Expert consulting with clients. Software resources can be programming language, database, gateway, domain and hosting etc.

e. **Others**: If we have to mistake of some basic requirements for cost estimation then you are using O (Others) Option for includes requirements.

**D. Time duration**: Time duration is very significant for software cost estimate. Software development time duration may be fixed up by the opinion of client or by the discussion of development team or Expert. There two kinds of times duration one is person, two is day. Time duration defines slot of time on the data collection schedule on previous projects

a. **Person**: Time duration may be fixed on manpower. Experts in this field will determine how many people will work.

b. **Day**: Day that’s means working day of developer.

c. **Requirements Collection**: Time duration is any be fixed depending on item of requirement. This field Expert collects to the requirements for developing project. Experts in this field will collect the information requirements for developing projects

d. **Previous project**: Previous projects cannot help from experts if necessary. How many days will finish this project? So time duration may be fixed up on previous knowledge of previous project.

E. **Risk management**: Software risk management is one promising approach to deal with system or project failures. A project can have many types of risk. For example Size risks, Process risk, Technology risks, Tools risks, Customer risks, Estimation risks, maintenance risk, development risk, people risk. The specialists will follow this project did not have any risk. If there is a risk of the project then will take the cooperation of experts.

F. **Project Analysis**: There are five categories of the project analysis. They are first category Focus, second is Observation, three is software size, four is maintenance and five is brainstorming.

a. **Focus**: After interview with the clients Experts will come to contact and discusses with the development team by every point of project.

b. **Observation**: In the step of basic requirements we shall find out every matter by observation. For example, Focus, Interview, Project Conception etc.

c. **Software size**: The software size is the most significant aspect that affects the software cost [24]. The Software Project Size defines the measurement of problem complexity in terms of effort and time essential to develop the software product. Experts remember that, to accurately estimate the project size.

d. **Maintenance**: maintenance means, after development of software project how many times will be given to the client for this service.

e. **Brainstorming**: After understating about project type, software development team with research that if there any problem to complete the project. After brainstorming they will be able to decide it.

G. **Others**: If we have to mistake of some requirements or module for cost estimation then you are using OT (Others) Option for volatility of software requirements.

**VIII. FORMULA DESCRIPTION**

We get some function types in this model. The model function types is person (P), Day (D), Salary (S), Industrial cost (IC), Software Tools (ST), Others (O), Time (T), Risk (R). Now we are see the figure 2, which figure show the function types.
Figure 2: AET Formula

From this figure, we have a formula, that is \((P*D)*S + (IC + ST + O) + (P*M)*S + R + OT\). Now we divided to these model three categories one is Software Resources, Maintenance Service and Time.

SR: Software Resources
IC = Industrial Cost, ST = Software Tools, O = others,
SR = IC + ST + O

MS: Maintains Service
p = person, m = Month
MS = (P*M)*S

T: Time
P = person, D = Day, S = Salary
T = (P*D)*S

Let here, \(X = AET\) (Abrupt Estimation Techniques)
Formula: our proposed formula Abrupt Estimation Techniques is
\[ AET = (P*D)*S + (IC + ST + O) + (P*M)*S + R + OT = T + SR + MS + R + OT \]

IX. CASE STUDY

We are used to our model and formula some of web application for the cost estimation. That’s Online School Management System, E-commerce Site, Mobile Apps, Hospital Management System etc. Below are listed all.

Online School Management System

<table>
<thead>
<tr>
<th>Project Question/Discusses Expert &amp; Client</th>
<th>Yes</th>
</tr>
</thead>
</table>

1. This project is feasible or not feasible? Yes
2. Have any module in this project? Yes
3. How much time will the project last? 3 month
4. Is there any risk of this project? No
5. Measurement of software size of this project, you have the idea? Yes
6. Have no idea about the related previous project? Yes

<table>
<thead>
<tr>
<th>Functions Topics</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Resource = SR</td>
<td>5,000</td>
</tr>
<tr>
<td>IC</td>
<td>10,000</td>
</tr>
<tr>
<td>ST</td>
<td>0</td>
</tr>
<tr>
<td>O</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maintenance Service = MS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>1</td>
</tr>
<tr>
<td>M</td>
<td>3</td>
</tr>
<tr>
<td>S</td>
<td>2,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project Time = T</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>3</td>
</tr>
<tr>
<td>D</td>
<td>30 (Working day)</td>
</tr>
<tr>
<td>S</td>
<td>1,000</td>
</tr>
</tbody>
</table>
Risk (R) = 0
Other (OT) = 2,000

\[ AET = T + SR + MS + R \pm OT \]
\[ = (P \times D) \times S + (IC + ST + O) + (P \times M) \times S + R \pm OT \]
\[ = (3 \times 30) \times 1,000 + (5,000 + 10,000 + 0) + (1 \times 3) \times 2,000 + 0 \pm 2000 \]
\[ = 90,000 + 15,000 + 6000 \pm 2000 \]
\[ = 1,11,000 \pm 2000 \]

If OT (+) then, \[ = 111,000 + 2000 = 113,000 \]
If OT (-) then, \[ = 111,000 - 2000 = 109,000 \]

Here 2000 money is verify

<table>
<thead>
<tr>
<th>Name of Project</th>
<th>Verify</th>
<th>Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online School Management System</td>
<td>1.8 %</td>
<td>Yes</td>
</tr>
<tr>
<td>E-commerce Site</td>
<td>5 %</td>
<td>Yes</td>
</tr>
<tr>
<td>Mobile Apps</td>
<td>11 %</td>
<td>Yes</td>
</tr>
<tr>
<td>Game for Android</td>
<td>8 %</td>
<td>Yes</td>
</tr>
<tr>
<td>Hospital Management System</td>
<td>15.75 %</td>
<td>Yes</td>
</tr>
<tr>
<td>Parents Medical Technology Institute And MATS Student Admission System</td>
<td>12.50 %</td>
<td>Yes</td>
</tr>
<tr>
<td>Shop Management System</td>
<td>20 %</td>
<td>Yes</td>
</tr>
<tr>
<td>Library Management System</td>
<td>4.70 %</td>
<td>Yes</td>
</tr>
<tr>
<td>Online Hotel booking System</td>
<td>3 %</td>
<td>Yes</td>
</tr>
<tr>
<td>UPMS Management System</td>
<td>9.60 %</td>
<td>Yes</td>
</tr>
<tr>
<td>Bus Ticket booking system</td>
<td>6.90 %</td>
<td>Yes</td>
</tr>
</tbody>
</table>

X. RESULT AND ANALYSIS

\[ AET = T + SR + MS + R \pm OT \]
\[ = (P \times D) \times S + (IC + ST + O) + (P \times M) \times S + R \pm OT \]

We apply this AET (stands for Abrupt Estimation Technique) to estimate the software cost on different 11 Software Project. AET Formula develops based on some parameters. There are including all parameters on every software project.

XI. CONCLUSION

Recently Software Industry uses many methods and techniques for cost estimation but they are very complex and not easy to understand. In this paper we have approved a new model by which we can do software cost estimation very easily without full requirement collection. It is quite different from other software because still how we did not get any model by which software cost estimation may be done without full requirement collection. By this model though accurately cost estimation is not possible but approximately cost estimation is surely possible. Following points we must be consider for accurate cost estimation.

a. Software cost estimation team must contain most experience person of your development team. Likely many time most of parameter is depend on the prediction and an experience person can predict more accurately.

b. Must be expat discuss with development team for cost estimation.

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