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Improved Cost Estimation Tool Using Work Breakdown Structure with COCOMO II

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Abstract — In any industry, the cost and effort estimation for any production plays a vital role in the success of that particular business and the same is applicable for the software industry. The wrong software cost estimation may lead any software company to a major loss. There are some standard variants of COCOMO available for the software cost estimation. But still there is a scope of improvement in them, as they alone are not that much sufficient for the proper cost estimation. Here we have developed an easy-to-access software cost estimation tool which will use the work breakdown structure along with COCOMO II for the more accurate software cost estimation and it ensures an effective and faster approach for estimating software project development cost and effort.

Keywords-Software Engineering; Constructive Cost Model II (COCOMO II); Cost Estimation; Work Breakdown Structure (WBS); Effort Estimation

I. INTRODUCTION

Sustainability for any business in market place is having crucial dependency of product price if we don't have proper ability to estimate the product development cost then it will lead the business to major economical loss and degradation in market reputation and company can decide their selling price by the raw material and effort used in production for the software industry the cost estimation relies on the complexity and the efforts done to develop that software. Software project cost estimation must needed to be done in accurate way otherwise it may cause a huge loss according to a study in 2012 approximately 3 trillion dollars got wasted due to wrong software cost estimation worldwide [12] and in 2007 well reputed companies like TATA consultancy services caused 62% of organizations experienced IT projects that failed to meet their schedules, 49% suffered from budget overruns, 47% had higher-than-expected maintenance costs, 41% failed to deliver the expected business value and ROI, 33% fail to perform against expectations [13]. In spite of this importance of software cost estimation in software engineering the awareness of proper software project cost estimation is very less and also sometimes get neglected due to complex calculations. So the improvement and awareness in the area of cost estimation scenario caught the researcher's eyes. In 1981 COCOMO was developed and its last variant was published in 2000 and it has been accepted as standard cost estimation methodology [6][7]. But COCOMO II is having 16 cost drivers and 5 scale drivers for each scenario which generate the more complex calculations and sometimes ambiguity. So to get rid of this problem and remove ambiguous calculation we have used work breakdown structure with COCOMO II and developed software project cost estimation tool which will take some basic input and automatically calculate the software project cost. It is easy to access tool which can be accepted universally.

II. BACKGROUND THEORY

COCOMO is an acronym for constructive cost model. It was founded by an American software engineer named "Dr. Barry W. Boehm" in 1981 and that's why it is also known as COCOMO 81. COCOMO is applicable to 3 major classes of software projects: organic, semi-detached and embedded projects [6]. The uppermost extension of the original COCOMO 81 is COCOMO II. It consists of some sub-models such as application composition, early design and post architecture models. COCOMO II plays a vital role in critical decision making situations such as investments, setting project budgets, estimating software cost and schedule risk etc. COCOMO II is composed of 16 cost drivers and 5 scale drivers, out of which the cost drivers depends on the rating of values corresponding to real numbers which are known as the Effort Multipliers(EM). This rating values ranges from very low, low, nominal, high, very high and extra high [7]. Work Breakdown Structure (WBS) can be defined as "The process of dividing complex projects to make it manageable". In WBS, the larger tasks are divided into number of small tasks which we call as a chunk in software terms. They are easy to manage and estimate. Major reasons behind creating WBS project are: (a) accurate and readable project format, (b) proper assignment of role to project team, (c) milestones and check points can be established and (d) define scope of project [8]. Software cost estimation can be defined as the process of predicting the approximate cost for any software project. It can never be measured accurately it is always based on approximation because there are multiple factor which affect the calculation such as human, technical, environmental, political etc. It is usually measured in terms of effort. The most widely used metric used for these purpose is person months or years. Basic cost estimation process is as follows:

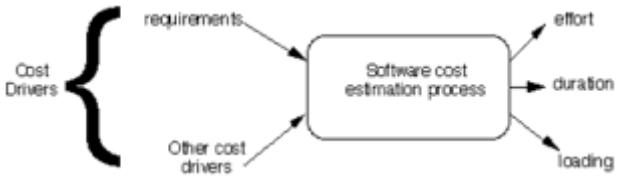

Figure 1. Classical view of software estimation process [9].

Techniques of cost estimation are: Algorithmic model, expert judgment model, top-down, bottom-up, estimation by analogy etc [9]. Software effort estimation indicates the amount of workforce required and can be defined as the total time taken by the development team members to complete a given assignment. It is expressed in terms of man-day, man-month, man-year etc. Effort can vary from time-to-time. The reasons behind that are project approve, project management, understanding of project task [11].

III. METHOLOGY

Here is the detailed explanation of the algorithmic flow for the estimating effort and cost.

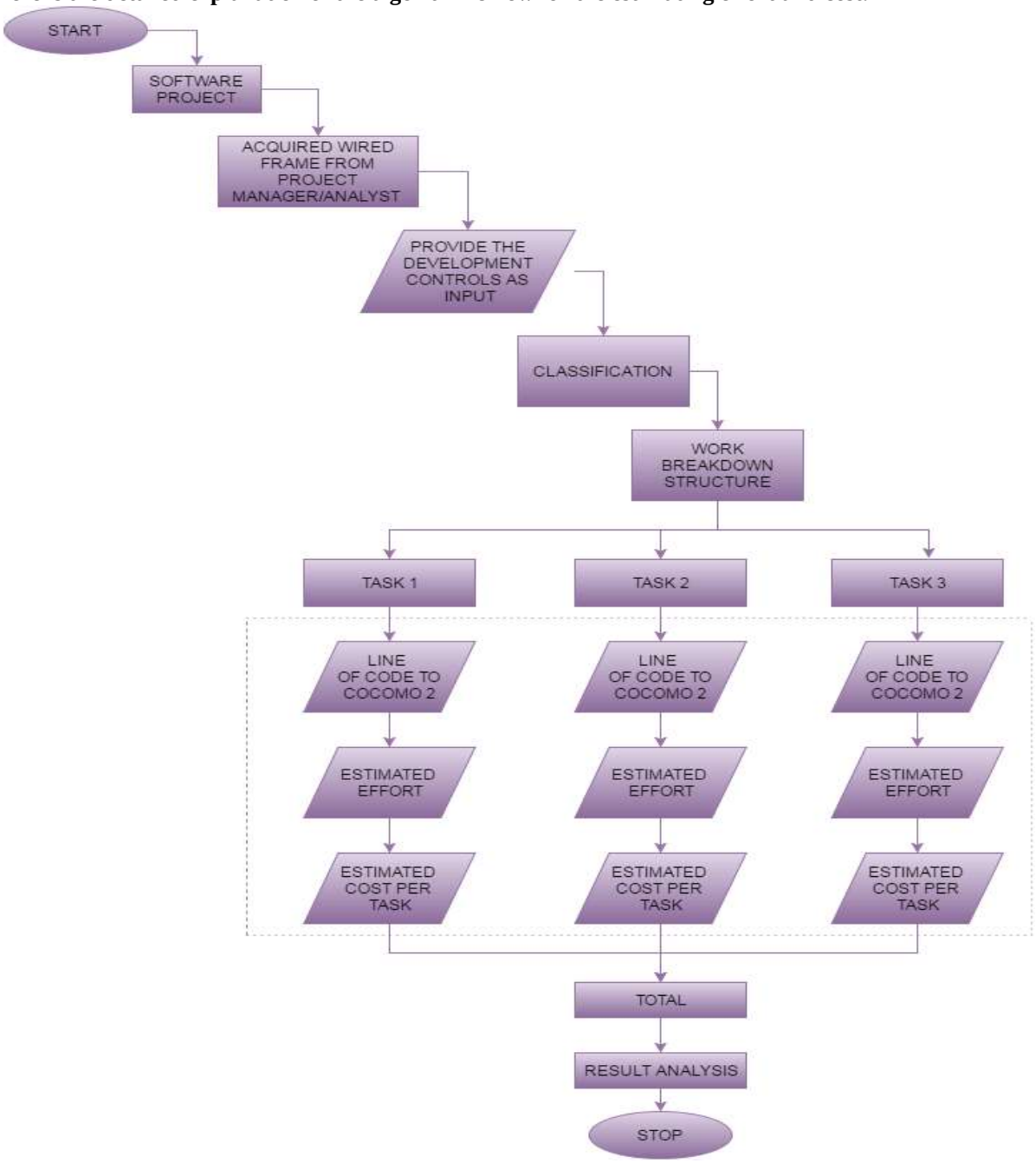

Figure 2. Proposed sytem flow chart.

Steps:

- From the requirement analysis project manager or analyst prepare a wired frame of project of software project.
- Inside the wireframe it has been clearly stated that how many controls will be used what will be its location and how they will interact.
- By considering this controls as our initial input we will classify them into several classes.
- (1) Standard, (2) Data, (3) Validation, (4) Navigation, (5) Login, (6) Web Parts, (7) AJAX Extension, (8) Dynamic Data, (9) Reporting.
- And we have calculated average line of code for each class
- Now further we will use WBS and divide the whole project into the small tasks.
- Then calculated the effort using COCOMO II then calculated cost per task and finally the summation of cost of each and every task give the cost of overall project.

IV. RESULTS

Here is the visual representation of how the tool is actually going to work is shown with the self-explanatory figure names:

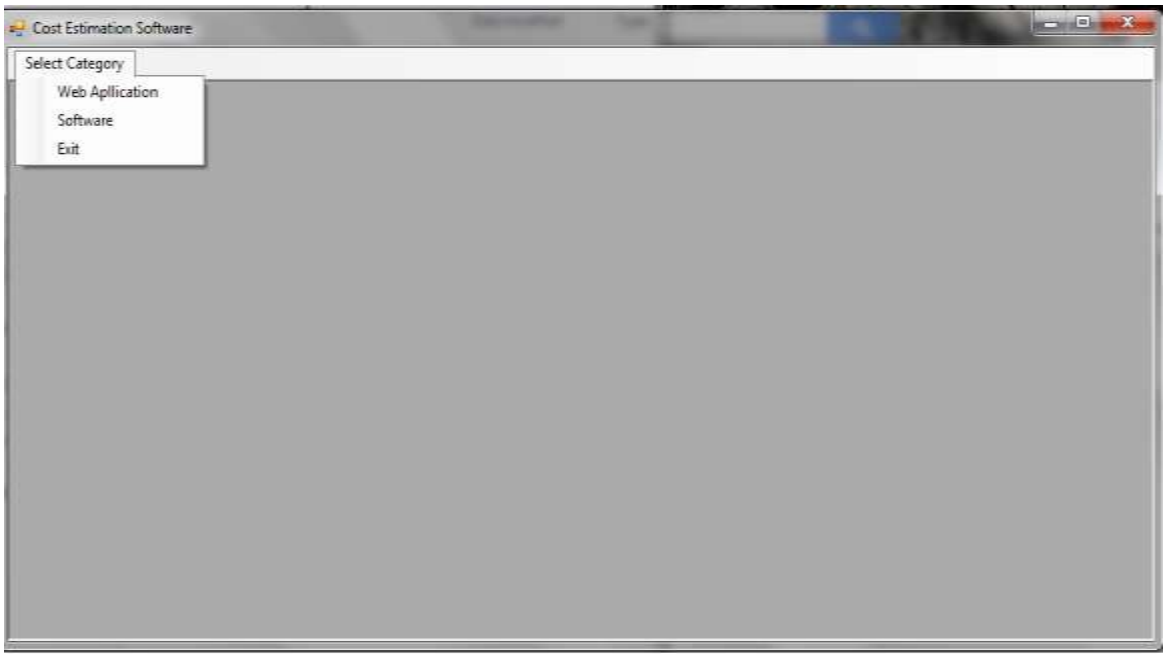

Figure 1. Home Screen of the Tool

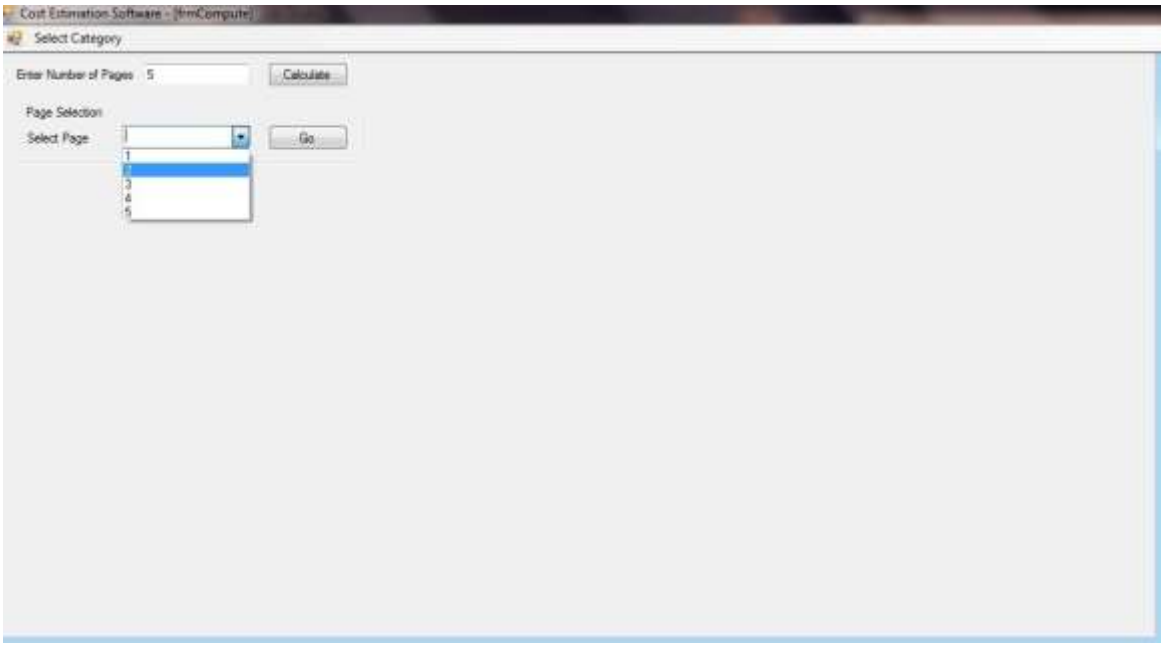

Figure 2. Enter the desired number of pages and then select the page number where you have to add controls.

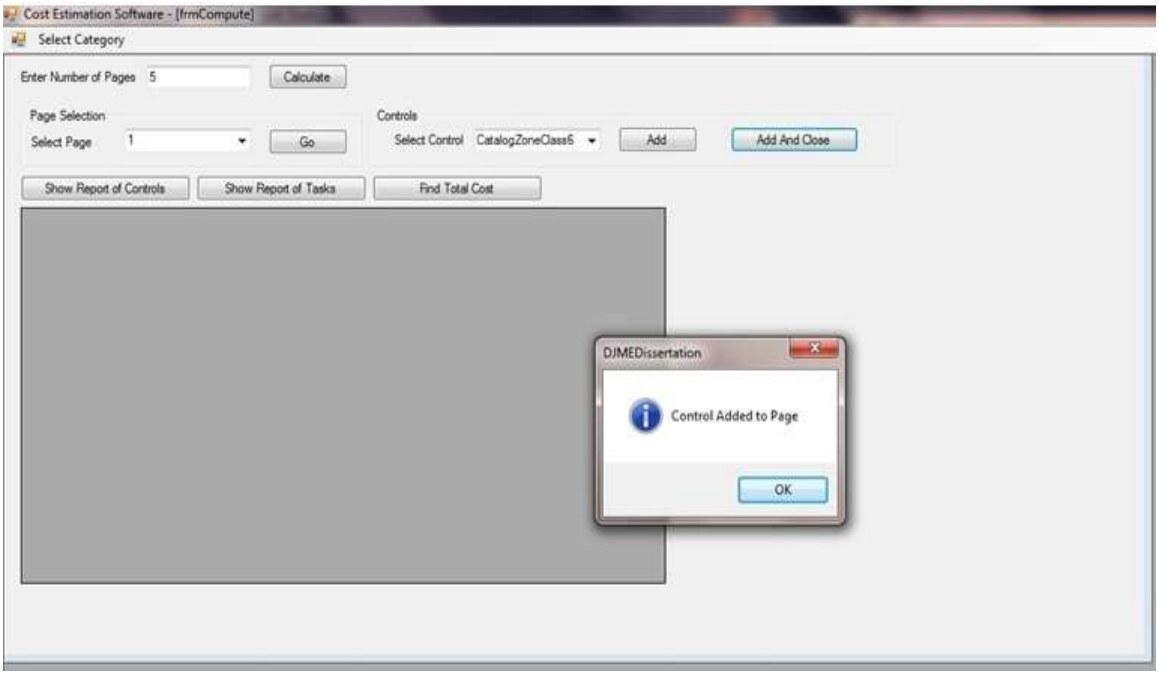

Figure 3. Notification about control added to particular page.

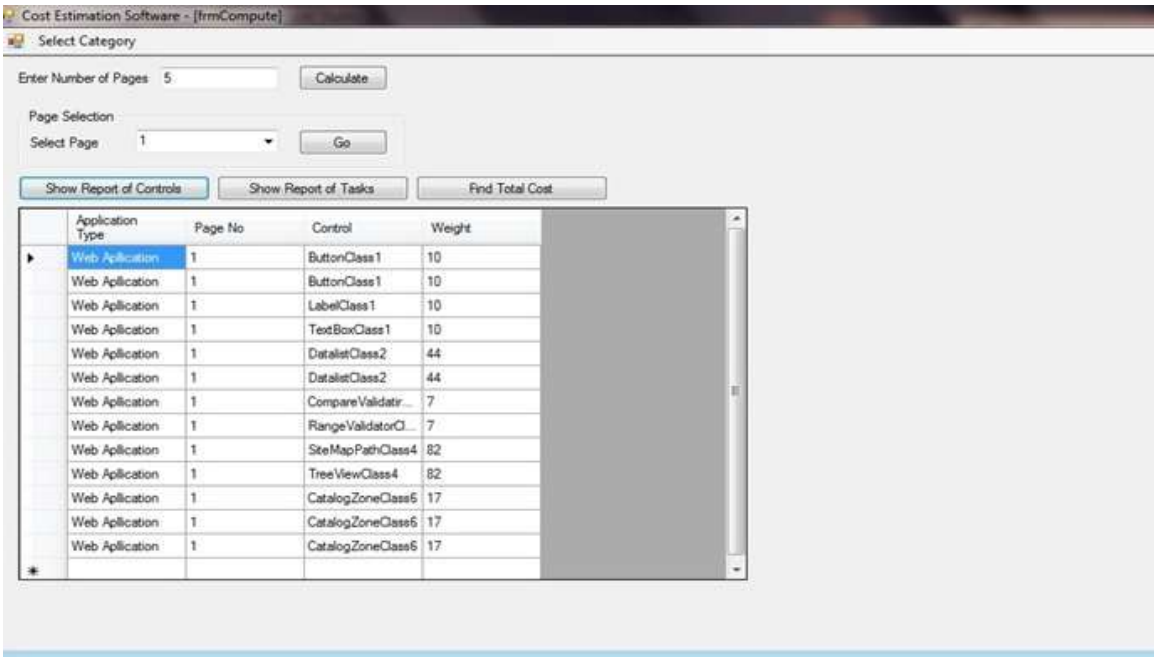

Figure 4. Report about each control which is added on the page with its classified weight.

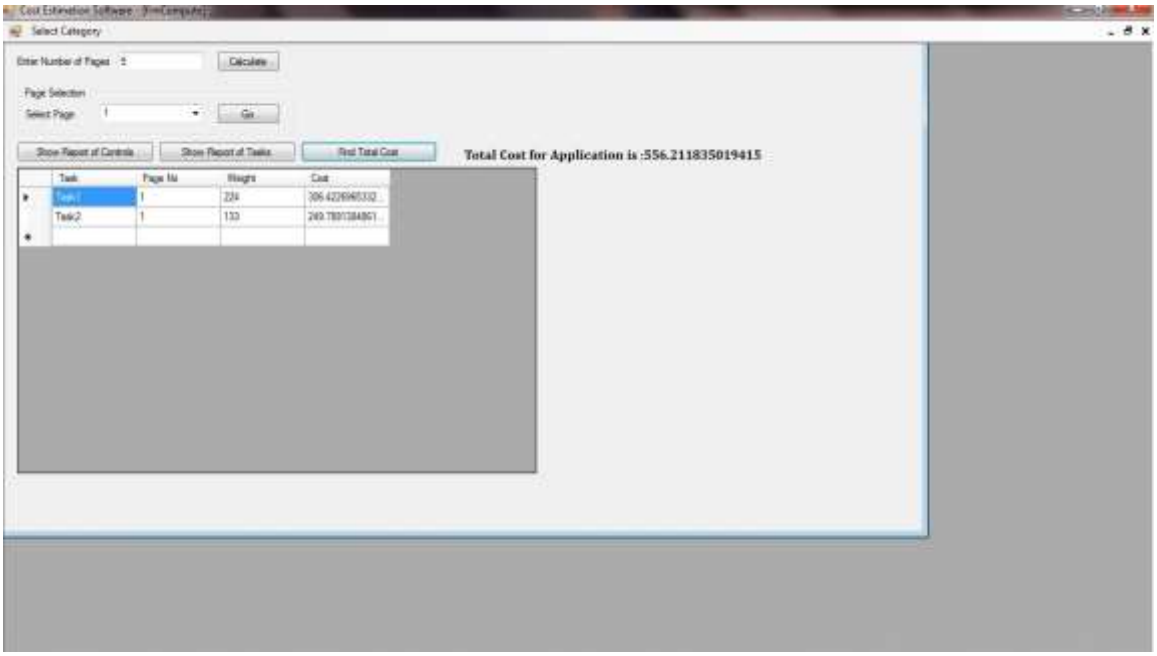

Figure 6. Final estimated cost of each task and whole project.

V. CONCLUSION

The tool we have developed is easy to access and provide the proper cost estimation without any manual calculation headache. It generates more accurate results because it uses the work breakdown structure and only apply appropriate related to relevant tasks.

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