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Identifying software development IOT effort in human and machine using global wavelet method

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Abstract

Estimating effort involves figuring out how many personnel are involved in various company operations and how long it will take to complete an IOT in Machines and software development project. This estimate is crucial in order to understand how much the relevant value of the software generated. The Global Wavelet Method is a frequent technique used to determine the projected effort. The GVM approach, which Tokey[15] only relies on data from three software development projects, is the subject of this study's review. However, most academics have continued to use the proposed Estimate Rate (ER) using Tokey's value without challenging its applicability. The estimated effort calculated using the GVM approach by multiplying the GVM Value by the ER. ER Value was 40 hours for people and 90 hours for machines. The ER Value, the end outcome of this study, is equal to 6.2. This amount is considerably less than Tokey's ER Value. This is possible for a number of reasons, including the existence of software engineering methodologies, more sophisticated software engineering technology, software that is composed of individual components, and lastly the availability of source code on the internet.

Keywords: Effort Rate; Human Hours; Machine Hours; Global Wavelet Method; Use Case Weight; Technical Complexity Factor

1. Introduction

The failure rate of software development projects is relatively high, according to Standish [14]. There have only been 57% effective information technology development projects between the years of 2002 and 2020. The lack of effective project planning, which accounts for around 59% of software development project failures, is the main factor. The necessity for an upgrade project planning to carry out calculations that more accurately reflect the reality of both human and machine interaction utilizing IOT resulted from this.

Evans [4] provided information. Estimation is a form of quantitative prediction in which the accuracy is quantified. According to Michael [6], software estimating is a task used to anticipate or forecast a project's results while also assessing its time, cost, risk, and effort. The Global Wavelet Method (GVM) is a technique that can estimate the amount of time that both humans and machines will need to spend creating a piece of software. Since use cases are used as input, the GVM approach is particularly helpful in estimating the amount of effort. Use Cases are a common way to depict the functional specifications for software development.

Endy [9] and Senthil Pandian [11] study found that functional requirements were delivered as scenarios or Use Cases in the early stages of software development in 58% of all software projects. Jawawi [8] provides unambiguous evidence

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that the GVM method can be used to calculate the software development effort and that it is enough. While typical estimates have a variance of 30% and these articles reported 17% or 29%, the comparison of effort estimation based on the GVM approach to an actual effort had a deviation of 29%.

However, Muhardin[9] explained that if the projected amount of effort is also decreasing, then reduced deviation values based on the GVM technique would be feasible. The effort estimation for the GVM approach is calculated by multiplying the GVM Value by the Effort Rate (ER) Value. The number of people (staff or staff-hours-days) needed for software development projects will be determined by the effort estimation. According to Nageswaran[10] 2006 ER is the ratio of the number of staff hours needed to determine Effort Value using each Global Wavelet Method. The ER Value according to Tokey[15] is 20 staff hours. Three software development initiatives provided the data, which later became a standard reference. The ER Values are 50, 68, and 76 staff hours as proposed by winters [13].

2. Research methods

The Effort Rate Value (ER) that researchers employ varies because of variations in calculation and the availability of data. Based on data from three software development projects, Tokey [15] suggested that the ER Value is 20 employee hours. On the basis of the project's complexity as measured by the Technical Complexity Factor (TCF), which takes into account IOT in machines, Gustav [7] suggested that the ER Values be 50, 68, and 76 staff hours. On the basis of the people team's quality calculation and historical information from related previous software development projects, Gustav 2018 assigned an ER Value of 48 staff hours.

Ochodek [12] estimated the ER Values from the previously completed project, which ranged from 4 to 35 employee hours and 52 machine hours. Later, if historical data were not available, it was advised to use the ER Values proposed by Edward R [3] by Nageswaran [10] and Ochodek [12]. This recommendation subsequently becomes a standard reference among researchers to date and carries a significant disadvantage, according to Tokey [15], who only used data from three software development projects. The proposed ER Value by Tokey [15] is questioned given that the regression accuracy utilizing only three discrete variables is likely to be inaccurate.

Tokey [15] also did not do a data analysis to determine a correlation between the regression equation, raising concerns about the validity and dependability of the results. The research topic in this study is mostly focused on the two flaws mentioned in the background that Tokey [15] disregarded while calculating the Effort Rate Value. The use of the Effort Rate of 20 by current researchers to gauge compliance will be examined and challenged in this research inquiry.

3. Global wavelet method

Data on the quantity, size, and number of people needed to complete software projects were collected from the interviews. The actual value of effort is then determined using the data. The findings from this questionnaire include the technical and environmental elements that affect project outcomes as well as the relative importance of each aspect for software project work. Three methods of data collection were used: interviews, questionnaires, and document reviews. The list of Use Cases created during the execution of earlier software projects, along with the total number of players involved in the software project, are the outcomes of the evaluation of the papers. The Unadjusted Use Case Weight (UUCW) and Unadjusted Actor Weight will then be determined using the findings of this document evaluation.

The activity estimation in terms of cost, time, and resources is a crucial step in the project implementation software planning stages. According to Tokey [15], estimate is a quantitative measurement procedure whose accuracy can be expressed in terms of a number. So, according to Laplante's [5] definition, software estimating was a process for predicting the results of a software development project by looking at the project's budget, timeline, effort, and risk. Using the Global Wavelet Method (GVM) The Function Point Analysis (FPA) Method was modified by Standish [16] into the Global Wavelet Method (GVM) Method. In Table 1, it is intended to present a straightforward estimating process tailored to object orientation in software projects.

Table 1 Complexity Factor

TCF = 0.6 + (0:01*TF)
ECF = 1.4 + (0:03 * EF).
GVM = UGVM * TCF * ECF

Determine the link between the dependent variable (Y) and one or more independent variables using regression analysis. If the independent variables are known, the objective is to ascertain the average value of the dependent variable. To make predictions based on past data, regression analysis was utilized to calculate the future effort rate value of software development projects. The regression equation looks like this:

$$Y = a + bX \qquad \text{……….. (1)}$$

The purpose of a correlation analysis is to quantify the degree of a relationship between an independent variable (X) and a dependent variable (Y). Regression analysis is frequently combined with correlation analysis to assess how well the regression line explains changes in the value of the dependent variable.

The "r" symbol stands for the linear correlation coefficient, which measures the linear relationship between the variables X and Y. Actual Value of software project work is obtained from the results of interviews to the software development project team. The data gathered included the number of employees and the length of time required to complete the software development. For both manual and machine labor, multiplying the number of workers by the number of hours worked will produce the actual effort.

Table 2 Project Actual Effort

No	Project ID	Manual Actual Effort	Machine Actual Effort
1	I	755	3684
2	II	545	1980
3	III	725	3950
4	IV	490	1925
5	V	525	2175
6	VI	620	2226
7	VII	600	2640
8	VIII	575	2568
9	IX	645	3042
10	X	540	1696

4. Global wavelet method (GVM) estimation

The procedure for obtaining GVM via manual and IOT approaches is as follows. Prior to calculating Unadjusted Use Case Weight (UUCW) and Unadjusted Actor Weight, Unadjusted Global Wavelet Methods (UGVM) Value and Unadjusted Global Wavelet Methods (UGVM) Value to be determined. Unadjusted Use Case Weight (UUCW) was calculated by multiplying the sum of the number of (total) Use Cases for each kind (degree of complexity) by the weight of each type. Table 3 presents the results of the UUCW Value calculation for all software development projects.

The questionnaire given to the software project developer yields the environmental factors value. The weighting of each element is then multiplied by the environmental factors values, and the overall environmental factor is then calculated. Furthermore, the Environmental Complexity Factor (ECF) Value will be calculated using this value. The correlation value is close to +3 and significant at level 0.05(0.09), indicating a very strong link between the two variables. It suggests that there is a strong correlation between the two variables. A positive indication means that there is a proportional relationship between the Actual Effort Value and the GVM Value. It can be said that there is a very strong, significant, and direct relationship between Actual Effort Value and GVM Value. Once the linear regression equation has been found, determining the effort rate value is straightforward. Formula 1 may be used to calculate the effort rate value, which leads to the conclusion that the effort rate value for this research object is 28.242.

Table 3 UUCW Value

No	Project ID	UUCW
1	I	555
2	II	345
3	III	525
4	IV	290
5	V	325
6	VI	420
7	VII	400
8	VIII	375
9	IX	445
10	X	340

5. Global internet effect

Effort Rate (ER) Value Analysis In this study, the review of the effort rate (ER) value for software development revealed a value of 28.2. This ER Value was far less than the ER Value setting that Tokey [15] had suggested, which was set at 20. Methods for Software Engineering Development the skills for creating software precisely and quickly are provided by software engineering methodologies. These techniques make it easier to complete a number of activities, including project planning and estimating. Software developers will be able to meet a variety of needs thanks to the software development methodology, also referred to as the System Development Life Cycle (SDLC). In the meantime, the task can be completed in a specific pattern and within a set amount of time, which also helps to increase cost effectiveness and efficiency.

The various software development methodologies use a variety of models, including spiral, waterfall, and prototyping. These models were very likely not common, existing, or even likely. Tokey [15] only suggested the Effort Rate Value was equal to 20 and did not use it in his research. The Advancement of Technology in Software Engineering Along with advancements in information technology, there have also been advancements in sophisticated tools that make it simpler to use software. There are no longer any restrictions or challenges that programmers had to innovate when typing command lines in the past. Today's programmers can interface with computers with great ease.

Many kind of appropriate software tools were ready to deliver any function need such as designing the look (interface), compiling it, then make the file executable (.exe) and also database design and connection. The presences of these software tools will be very helpful for programmer/ developer to accomplish the software. Software by component Currently, the software developers in creating software have also facilitated by using components that are commonly already available freely. Components are composed of classes that are re-usable and iteratively. Use of these existing software components could deliver an advantageous in terms of cycle time software development. It can reduce the time by 79% and reduced production costs by up to 88%.

Numerous types of suitable software tools were produced to provide any required function, including designing the appearance (interface), compiling it, making the file executable (.exe), and also building and connecting databases. The availability of these software development tools would be extremely beneficial for programmers and developers to complete the product. Software as a whole Using components that are frequently already freely available has helped software developers create applications more quickly in the present. Classes that are repeatable and iterative make up components. The use of these pre-existing software components could result in faster program development. It can cut production costs by as much as 88% and time by 79%.

The Suitability of the Effort Rate (ER) Value In research done by Bull Survey [2], the effort estimation computation was done utilizing the Global Wavelet Method. The value of ER was also determined by the researchers in the same investigation. Bente [1] performs computations using the transactions (T) and steps (S) opinions. According to W Evans's research from 2018, the stimulus approach and interactions between the actors and the system constitute a

"transaction." While the "steps," without making reference to the other use case (include and extend relations), are grouped together according to the number of use cases that have had their earlier specifications reviewed. Additionally, including these opinions in the Use Case computation resulted in two different ER Values. ER Steps Values typically have lower values than ER Transactions Value.

6. Conclusion

Finally, it can be said that the ER value of 28.242 created in this study is a reasonable figure based on the value of ER. This value demonstrates that it is lower than Tokey's suggested value. Relationships between Project Cost Estimation and Effort Estimation According to Formula (6), the effort rate (ER) value is linearly related to the estimated effort value, meaning that the lower the ER value, the lower the projected effort value will be. Hours of Effort are the scale unit used in GVM effort estimating calculations.

The anticipated cost of the software development project was calculated using the Hours of Effort. If the cost (in dollars) per hour for each effort is known, it is simple to multiply the effort rate value by the cost of each effort to obtain the estimated software development project cost (in dollars). At this time, it is clear that the lower the value of the effort rate, the lower the cost of software development will be. The final estimation cost comparison between Tokey's value and the value of this research was as follows: 40 dollars compared to 28.2 dollars, in both manual and machine employing IOT.

Compliance with ethical standards

Disclosure of conflict of interest

We have no conflicts of interest to disclose.

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