Challenges and Implementation of Effort Tracking System

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ABSTRACT

Software project tracking is a dense and demanding task. It is difficult to measure effort spent on a project to determine a valid and concrete status since manual system of tracking effort suffers from loopholes and miscalculations which lead to ambiguous results. Ambiguity in information cannot be used to make strategic decisions. Measurement of effort spent on project is essential to predict to progress. This will further help to analyze the success factor of the project. An attempt is made in this paper to present the challenges faced in measuring effort exhausted in the project. This paper explores the innovative thoughts implemented to measure the efforts by developing RFID based effort tracking system. Effort Tracking System is designed to provide a transparent view of the organizational effort on a software project.

The paper discusses about the architecture of Effort Tracking System, the inputs and outputs generated from the system. This paper discusses and compares the manual system of tracking effort with the Effort Tracking System using test of hypothesis. Statistical analysis is performed on these two data sets to determine which system provides the actual efforts drawn from employees by software projects. We have tried to show how the system helps the project managers in estimation, planning, identifying the critical factor for the project. Finally this paper presents some of the lessons learnt and the major benefit achieved in cost, schedule, quality, customer satisfaction by the organization.

Keywords
Hypothesis Testing,

1. INTRODUCTION

Software project tracking encompasses the measurement of efforts invested on a project by the expert team. Manpower utilization is an important aspect of an organization’s goal for successful implementation and delivery of a software project. As the work force increases, the need to manage and monitor the work force becomes a critical task. Therefore it is necessary to ensure that the work is uniformly distributed among the employees to obtain high production. Additionally, the amount of time dedicated by an employee to his work is requisite to measure the performance in order to track the effort and progress of the software project. Thus a system to trace the employee activities and to determine project status is essential for large organizations. Organizational heads need a report format to view and make decisions based on the work progress which can be provided easily by Effort Tracking System.

In this paper, Section 2 and 3 discusses about the need for Effort Tracking System and the challenges faced by the system respectively. Section 4 specifies the architecture of Effort Tracking System and Section 5 explains test of hypothesis to measure the effectiveness of system. Section 6 give details about the major benefit achieved from the system.
2. NEED FOR EFFORT TRACKING SYSTEM

Effort tracking plays a significant role in project management. This activity is pain of approximately every project manager. Tracking of effort spent is an essential requirement from senior management. Tracking of effort will give a clear picture about the utilization of manpower in various projects. Effort Tracking System has been designed to monitor and track the time and effort invested on projects and other organizational activities by an employee.

1. The system helps to gain more insights about the set of tasks in which the employee is currently involved.
2. Effort Tracking System can be used as a workload management system where heavy and complex modules of a project can be detected by the time spent by the employees on the module. Job assignments can be adjusted based on the workload.
3. Software changes are implemented incrementally which further leads to issues of accurate effort tracking in projects.
4. Predicting effort variance in a project manually does not give a precise picture of project status and health of a project. Manual calculation of effort variance can misguide senior management. So corrective actions required to be taken in the project at right time will be missed which may impact project seriously.
5. The actual effort devoted by the employees can be compared with the estimated effort required for a task. Based on the comparison, effort variance can be determined which can be used for revising estimation of project.
6. Reports can be generated for the senior management to formulate appropriate decisions regarding manpower, project progress, cost invested, and investment decision on upcoming project.

3. MAJOR CHALLENGES FACED

Implementation of Effort tracking system faces some of major challenges which eventually lead to a further evolved system.

1. Major hurdle for designing and implementing effort tracking system is integration of data from different sources like RFID attendance system for capturing attendance, project plan from Microsoft plan.
2. There are shortages of experience of new project managers to prepare project plan in detail so that effort tracking will be more precise.
3. There is lack of understanding by team members to provide the efforts spent in the project accurately.
4. Team members fill efforts based on a summarized or abstract view of the project rather than breaking down the efforts to miniature level.
5. One of the major challenges is to guide project team to use effort tracking system because they are adapted to manual system. Implementation of system is successful only when it used by all project teams in the organization to fill the effort spent in project in precise manner.
4. ARCHITECTURE OF EFFORT TRACKING SYSTEM

The effort tracking system tracks employee working status using RFID attendance, Project PERT and timesheet as input and processes this data to generate Employee Utilization Report, Detailed Project Effort and Summarized Project Effort. This system will help quality assurance team and senior management to get the effort variance detail in each project in just few seconds.

![Figure 1: Architecture of Effort Tracking System](image)

Table 1: Relationship of Input and Output Items in Effort tracking system

<table>
<thead>
<tr>
<th>Input Sources</th>
<th>Input data to Tracking System Database</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFID Attendance</td>
<td>Working hours per employee per day</td>
</tr>
<tr>
<td>Project PERT</td>
<td>Planned Effort and planned schedule</td>
</tr>
<tr>
<td>Timesheet</td>
<td>Actual Effort</td>
</tr>
</tbody>
</table>

4.1 Input components of Effort tracking System

The major input components of Effort tracking System are:

1. RFID Attendance
   Attendance of the employees is captured through RFID Attendance System which is linked to the Effort Tracking System. The attendance is fed into the system to get information on daily working hours of the employees.
2. Project PERT

PERT chart is prepared by the Project Leaders to anticipate the effort and schedule required for a project. The Planned effort and schedule is achieved through the Project PERT which also provides insights about the project modules and tasks.
3. Timesheet
The actual effort in man-hours is filled by the employees individually through their login based on their role and project involved in. Thus the actual effort and schedule can be retrieved through timesheet application.

![Figure 4: Entry of efforts by employees in timesheet](image)

4.2 Output components of Effort tracking System
The major output components of Effort Tracking System are:

1. Employee Utilization Report
   Employee Utilization Report shows the number of hours worked on a task by an employee. This report not only depicts the productivity of the employee but also how much time similar tasks will need to complete. This report will help senior management to know the efficiency of a employee.

![Figure 5: Employee Utilization Report](image)
2. Detailed Project Effort
Detailed Project Effort displays the total effort put in by all the team members in the project segregated module-wise. Some projects require onsite efforts, such tasks and jobs are also detailed in this report. This report is most critical outcome of Effort tracking system is to predicate effort spent in the project. Based on analysis of this report senior management will decide about the corrective action or any proactive approach is required in the system.

![Figure 6: Detailed Project Effort Report](image)

3. Summarized Project Effort
A summary report of efforts invested on a project is easy to understand that shows the total efforts invested in a given time frame on the project. Such reports are generally used by senior management to make strategic decisions regarding the flow of the project, re-adjustment of manpower. This report will guide project managers to revise estimation or reestimate the project if requires. This report will further contribute in calculating effort variance in a project module wise.

![Figure 7: Summarized Project Effort Report](image)
5. TEST OF HYPOTHESIS TO MEASURE THE EFFECTIVENESS OF SYSTEM

Need of Test of Hypothesis is to statistically quantify the certainty of an observation or experiment. We conducted the hypothesis testing on effort variance data calculated manually or through Effort tracking system.

Statistical analysis is performed on data using Normality test, F Test and T Test to ascertain the results of the observation and tests performed on data.

1. Normality Test: Normality test also called as Gaussian test, determines whether the data set follow normal distribution or not. Since various statistical tests (e.g. t-test) require that the data is normally distributed therefore violation of this assumption is verified first. When the p-value of the probability plot is greater than 0.05 then it is concluded that data set is normal.

2. Test for equal variances (F test): F-Test is performed on normally distributed data to test for two groups of data sets have equal standard deviation with specified confidence level. If the p-value is greater than 0.05 then there is no enough evidence to state that the groups have unequal variances. Thus, the next step is to perform the t-test.

3. Test for equal means (t test): 2 Sample t-tests is performed with data set retrieved for two groups of process size to test for equal means. This test compares the average difference between the two groups and when the p value is greater than 0.05 then there is no evidence of a difference in mean resulting in keeping both the groups of data sets in the same bucket.

Step 1: Efforts invested by employees and calculated using manual method is denoted using B-1 and efforts calculated by the Effort Tracking System is denoted using B-2.

As per the normality graph with 95% of the Confidence Interval P value is coming 0.073 which is >0.05 therefore we can conclude that B1 data is following normal distribution. Similarly, the normality graph with 95% of the Confidence Interval p-value is coming 0.447 which is >0.05 therefore we can conclude that B2 data is following normal distribution.

Step 2: Test for Equal Variances: Tests for Equal Variances for B1 and B2 is performed on data sets to determine whether both have same standard deviation with specified confidence level or not.
Therefore, as per the results of Test for Equal Variances with 95% of the Confidence Interval p-value is coming 0.011 which is <0.05 therefore we can conclude that B-1 and B-2 variances are unequal.

Step 3: Test for Equal Means: B-1, B-2

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<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean</td>
<td>StDev</td>
<td>SE</td>
</tr>
<tr>
<td>B-1</td>
<td>21</td>
<td>19.86</td>
<td>5.72</td>
<td>1.2</td>
</tr>
<tr>
<td>B-2</td>
<td>37</td>
<td>40.59</td>
<td>9.90</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>Difference = mu (B-1) - mu (B-2)</td>
<td>Estimate for difference: -20.74</td>
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<tr>
<td></td>
<td>95% CI for difference: (-24.85, -16.63)</td>
<td>T-Test of difference = 0 (vs not =): T-Value = -10.11</td>
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<tr>
<td></td>
<td>P-Value = 0.000 DF = 55</td>
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As per the results of Test for Equal Means with 95% of the Confidence Interval p-value is coming 0.000 which is <0.05 so it can be concluded B-1 does not show the real picture of efforts put in by the employees and B-2 means are unequal thereby holding the assumption true.

The hypothesis testing outcome clearly shows that there is difference in effort variance data calculated manually or using effort tracking system.

6. BENEFITS OF EFFORT TRACKING SYSTEM

Some benefits of using effort tracking system are:

1. Effort Tracking System aids in measuring the effectiveness of project health and progress.
2. It measures the efficiency of team and individuals in a project involved.
3. It determines the lessons learnt based on the involvement and efforts spent in a software project.
4. The health and progress status helps the senior management to make critical project decisions.

7. CONCLUSION

Effort Tracking System results into a clear picture of the involvement of organizational workforce on various projects and the individual efforts absorbed by these projects. Effort tracking in a project contributes to highlights the lessons learnt during project implementation which can be used to measure the effectiveness of the overall project progress. Implementation of automated tool helps in turning the stable process to mature capable process.

8. REFERENCES


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