Model Based Estimation and Tracking Method for Agile Software Project

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ABSTRACT

In this paper, the authors propose a software cost estimation model for agile software development project which can help estimate concrete development costs for the desired features of a product and tracks the project progress dynamically. In general, cost estimation methods for agile developments used a story point. Because it is relative value, the estimation results tend to be easily fluctuated by the small variation of the base story point. To estimate the effort of a project development, the authors use function points in addition to the story point. The function points are determined based on the desired features of the project. The authors adopt the Kalman filter algorithm for tracking project progress. The daily variation of the function point is observed and inputted to the Kalman Filter for providing concrete estimation and velocity. The authors then validate the better performance of our model by comparing with traditional methods through a case study.

Keywords: Agile Planning, Agile Software Development, Cost Estimation, Daily-Base Estimation, Dynamic Estimation, Function Point, Kalman Filter, Model Based Estimation

1. INTRODUCTION

Estimation and planning are critical to the success of any software development project of any size and consequences (Corte, 1986). Especially agile software development project has been the subject of much criticism. Its critics point to the contention that it is difficult to estimate effort related to projects accurately, because at the early phase of a project there is uncertainty about the project scope. Moreover, there are inherently many requirements changes associated with agile software development which increase the risk of scope creep. Thus it is necessary to provide a mechanism of dynamically estimating software cost for agile developments. Most agile project estimation models use a story point as a primary input parameter (Cohn, 2006). The velocity is measured in terms of iteration to track the project progress. However, these factors are highly uncertain because story points lead to relative and subjective values and because the velocity based on iteration cannot track the variations in the daily progress of the project.

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This paper proposed a dynamic software cost estimation model for agile developments. It can help estimate concrete development costs for the desired features of a product and can track the progress of a project dynamically. The proposed model uses function points and daily-based velocity. The function point provides an objective estimation of the story regardless of the relation to other stories. The daily-based velocity can help track the variation in the daily progress and to reflect to the schedule.

As a tracking algorithm, we adopt a Kalman filter. To be tracked by a Kalman filter algorithm (Welch & Bishop, 2001), each day of the project is modeled by the state space as a representation of the history of the function points. The state space model is used by Kalman filter to estimate the future value. The changes in the requirements and the daily progress are inserted into the Kalman filter for the dynamic estimation. This can also be transformed to cost metrics such as the number of persons per month or the number of lines of code. These metrics can be used to estimate a more reasonable project schedule.

2. AGILE SOFTWARE PROJECT

A. Agile Planning

Plans help us know if a project is on track at to deliver the functionality that user need and expect. Planning is also a critical task to lead for the success of any software development project. Especially in agile software developments, it is necessary to iteratively estimate effort and refine the plan. Agile planning activities (Figure 1) for large-scale development should rely on multiple levels (Smits, 2011).

However, most agile teams achieve a progressive elaboration by planning only the three innermost levels of agile planning: Release, Iteration, and Day. At the beginning of an agile project, a project team sets the scope of the system and the desired features which has a story (Cohn, 2006). In an agile project, story points are measured to estimate the volume of the product for each story and velocity is the amount of story point and measured to estimate the working capability of a team.

B. Story Point

In terms of cost metrics for an agile project, story points are widely used. These are a metric that represents the size of task or features. At the beginning of an agile project, a project team sets the scope of the system and the desired features. For a project team that develops a web site for a travel business, for example, with 50 desired features, each feature has a user story, such as “cancellation information is displayed on the site and is emailed to the user.” In an agile project, the story points are measured to estimate the size of the work for