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Modeling reliability measurement of interface on information system: Towards the forensic of rules

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Abstract. Today almost all machines depend on the software. As a software and hardware system depends also on the rules that are the procedures for its use. If the procedure or program can be reliably characterized by involving the concept of graph, logic, and probability, then regulatory strength can also be measured accordingly. Therefore, this paper initiates an enumeration model to measure the reliability of interfaces based on the case of information systems supported by the rules of use by the relevant agencies. An enumeration model is obtained based on software reliability calculation.

1. Introduction

Talking about the current machine, it cannot be separated from the software or the system that controls it [1]. Thus, an information system as the implementation of rules that apply in the management become an integral part of the rule [2]. If the information system is built on the principles of software engineering, then the information system can be measured its reliability in carrying out its duties, and this is also used as a measure of the strength of the rule. This is as a basis for its possible forensic form of applicable regulations [3].

The measurement of reliability of a program that represents the information system can be summarized by involving the principle of software reliability [4], by involving a probability calculation of the ongoing process flow by involving a flowchart or not [5]. The approach to the reliability model is based on the ease of enumeration [6]. This paper aims to reveal an enumeration model based on a single case, i.e. Kabupaten Road Management (KRM) system [7], in order to obtain a model to reveal the force of the applicable rules of something related.

2. Review and Motivation

An information system is built to support decision making quickly and precisely [8]. Such a system is built on the agreement and rules set that have been determined both by stakeholders and system designers [9]. The system is built from various technologies according to that provision [10]. The technology of translating those provisions into the system involves programming. In programming the size of the failure for a given time proportionately is the number of errors left and each error contributes equally to the size for the i-failure occurs is λ_i, and is declared with

$$\lambda_i = \pi_0(N_0 - (i-1)) \tag{1}$$

with where π_i is the correct failure size per error and N_i is the number of correct errors introduced early in the software [11].

On the different side of the software engineering, the program is composed of modules that are created procedurally and will take a specific place dynamically in memory if the program is executed. Each program or module can be describe as an execution with a flowchart, which is indirectly a process with a starting point and ending at a single point of destination [12]. Thus, the x_i event occurs on the edge $e_i \in E$ from a graph $G = (V, E)$ and $\bar{x_i}$ components circumstance that e_i fails, with which V is the set of vertices and E is the set of edges. The probability of operation p_i from edge e_i is probability x_i, and failure is represented by $q_i = 1 - p_i$, so for operational circumstance with the limited edges $e_1, e_2, \ldots, e_5$ [13]. Likewise, the process that takes place in the use of a system as a description of procedures that apply to reality.

3. An Adaptive Approach

The interface model can be represented by a node, and the data stream process is expressed as an edge, whereby the whole process can be represented by a flowchart [14]. The interface operation in the system is viewed as a flowchart as well, but in this section it can be judged based on the need for a large number of data inputs [13, 9].

By recognizing interface operations that flow data, by it also recognize of necessity in the data processing system. This operation is expressed by the flow from the source node s to the destination node t [15]. Operation is to record data or information from a human source to the destination database with the opportunity of false or true is balanced. Therefore, the probability graph G and the nodes s, t which are expressed as the reliability of two terminals, or so-called connections, are written $Hub_2(G)$, or $An_2(G)$ [13].

The second operation in the data flow is the dissemination of appropriate information. The reliability of all terminals, $Hub_2(G)$, against the probability that there is a path from s to every other node, or is the probability that the directed graph contains at least one spanning-tree that is rooted in s. Thus a path operation will simultaneously involve the pairwise connection of the k nodes as the stated terminal, $2 \leq k \leq n$ [16]. The k-terminal reliability, $Hub_k(G)$, is the probability that for the destination node, the graph contains a path between each pair of k nodes, or expressed as the connect-s, T for the directed graph G, with which s is the source node and T is the set $k-1$ destination nodes. In addition, other measurements may still be possible. However, the general mechanism is to state that reliability issues exist in the existing order. For any probabilistic graph $T = (V, E)$, it expresses a state from G to a subset, defined as all arcs in S operate and all arc $E - S$ fails. A path operation is defined by defining the set of operations, by which $OP(G)$ is the set of circumstances deemed to operate, or expressed in the $FA(G) = -OP(G)$ as failure set. $OP(G)$ is sometimes referred to as a stochastic binary system, with which its members in a set of paths [17].

If the provision has established a system, and the system can be measured its reliability, then the provision can be measured ability.

4. Enumeration Model

Let a matter of discussion about a case of using the KRM (Kabupaten Road Management) system, whose use is based on provision, with a size of file is 1.4MB. The system is run in semi-manual, whereby data validation between one admin with another admin is done by sending data by courier. Surely at this time, this system is no longer feasible to use because not accordance with the information technology development. However, if the interfaces of this system still

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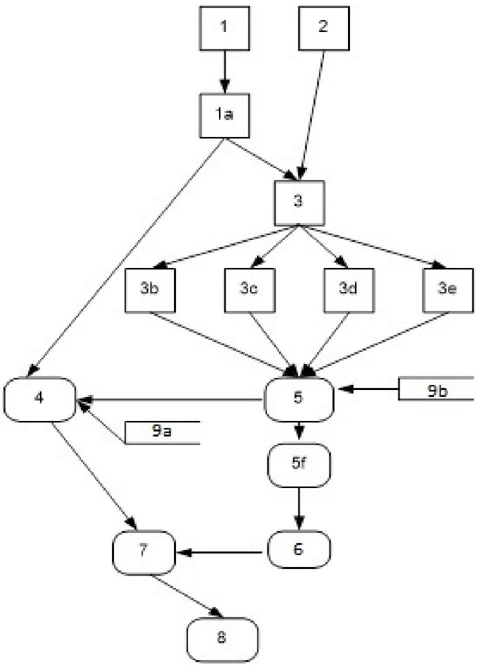

Figure 1. Data flow of the planning interface in KRM

keep the applicable rules of course the procedures in it can be transferred to another system. KRM has the following cycles: project approval, project preparation, project implementation, and project completion. This measurement model focuses on the planning module, which has the following interfaces: (a) Road Network Mastering Instructions (K1), (b) Bridge Inventory Log (K10), (c) Roads Analysis Form (A1), (d) Proposed Maintenance Form (P), (e) Large Work Study Form (P2), (f) Proposed Selected Weighing Work Form (P3), (g) Proposed Plan Form, (h) Definitive Plan Form, and (i) Maintenance Cost Table [7].

The sequence of data entries (numbers: $1, 2, \ldots, 9$) and the data analysis activities are carried out on/through whole interface of the planning part (a,b,...,f) see Fig. 1. According to the model, circumstance enumeration requires the production of all operating circumstances and determines a probability for each. The reliability of the terminal $Hub_{s,t}$ is obtained by summing all the 2^m probabilities of circumstance of G, which is sufficiently efficient in solving the problems inherent in measuring the reliability of the role of a provision directly [17]. Enumerate the perfect circumstance with G from the connect-s, t as Fig. 2, each edge corresponding to the number of activities: $e1 = 1$, $e2 = 2$, $e3 = 1a$ and so on, which can be tabulated as Table 1.

Furthermore, the minimum of the set of paths is called min-path, and it becomes a tree with root s with all arcs pointed from the root, $X = \{s\}$ is the set of nodes in the spanning-tree $T \subseteq E$, while $C \subseteq E$ is the set of edges which is left as a candidate for inclusion in the spanning-tree, up to $C = E$ [13]. Next, suppose min-path from G is registered. Suppose that the event that all edges are within min-path operates, and suppose $Pr[]$ denotes the probability of an event. Then reliability is none other than the probability that one or more events $\{E_i\}$ occur, with which $\{E_i\}$ is a jointed event, and therefore cannot simply summarize its probability. So in particular

$$Pr[E_1 \vee E_2] = Pr[E_1] + Pr[E_2] - Pr[E_1 \wedge E_2] \tag{2}$$

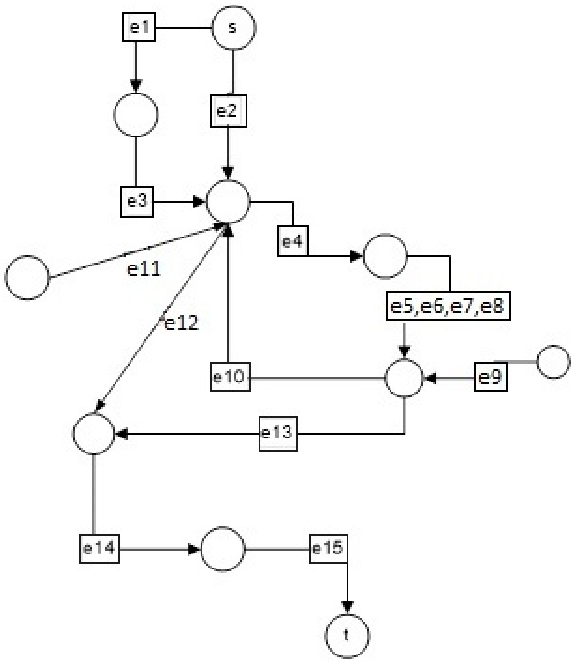

Figure 2. Connect-s, t graph of the planning interface in KRM

Table 1.[4] Enumerate perfect circumstance

Code Number	Sequence of Edges
1	$e_1e_3\overline{e}_2$
2,3,4,5	$e_1e_3e_4(e_5, e_6, e_7, e_8)\overline{e}_9$
6,7,8,9	$e_1e_3e_4(e_5, e_6, e_7, e_8)\overline{e}_{10}\overline{e_2}$
10,11,12,13	$e_1e_3e_4(e_5, e_6, e_7, e_8)\overline{e}_{11}$
14,15,16,17	$e_1e_3e_4(e_5, e_6, e_7, e_8)e_{10}e_{12}e_{14}e_{15}$
...	and so on

whereas

$$An(G) = Pr[E_1 \vee E_2 \vee \ldots \vee E_n], \tag{3}$$

and then based on the concept of Eq. (1) we have

$$An(G) = \sum_{j=1}^{k}(-1)^{j+1} \sum_{I \subseteq \{1,\ldots,k\}, |I|=j} Pr[E_i] \tag{4}$$

with E_i being the event for all paths P_i with $i \in I$ operating. Therefore, interfaces with each other can be disclosed are not interdependent based on how the system works. Suppose $\overline{E}_i$ indicating the complement of events, the declared events, and generally written $D_i = \overline{E}_1 \cap \overline{E}_2 \cap \ldots \cap \overline{E}_n$ [17], and therefore we have

$$An(G) = \sum_{i=1}^{h} Pr[D_i] \tag{5}$$

The calculation of values for interface performance can be performed using Eq. (5) by substituting each interface probability value for error in data entry or process or by using edge based on Table 1. For example for interface 1 there is the data entry consists of 9 items, the probability of failure is 1/9 and the probability of success is 8/9, for interface number 1a there is a data entry is 20 items, the probability of failure is 1/20, and so on. So system reliability indicating regulatory toughness, the both can be measured at once.

5. Conclusion

The enumeration model of interface reliability of an information system using graph, logic, and probability concepts showed a good or not application interface. Using the case of the planning section interface of KRM system can be considered good because the failure factor is considered small according to the perfect enumeration that has been performed on each interface units in accordance with the data flow requirements in this system. It also illustrates that regulations set up to enforce KRM system are also considered good.

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