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METHODS OF ESTIMATING THE INTERDISCIPLINARY COMPETENCIES OF A DEVELOPER OF INTELLIGENT POWER LINES DESIGN SYSTEMS

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Today it is almost impossible to find a place with no electricity. We use home appliances, electronic devices and lamplight. We greatly depend on these facilities. But few people think of how much work needs to be done to provide even the most remote corners of the planet with electricity. It is not just about power engineering, creating power plants and transformers. The designing of power lines is no less significant aspect. This includes arrangement of power poles, designing of cable inserts and creating branches on the consumer [1, 2].

The designing of power lines is a complex task. Today this task could be significantly simplified if you use a computer-aided power lines design system. Such systems can perform a vast number of calculations necessary to create a power lines with respect to landscape, existing power lines placement, financial and time constraints.

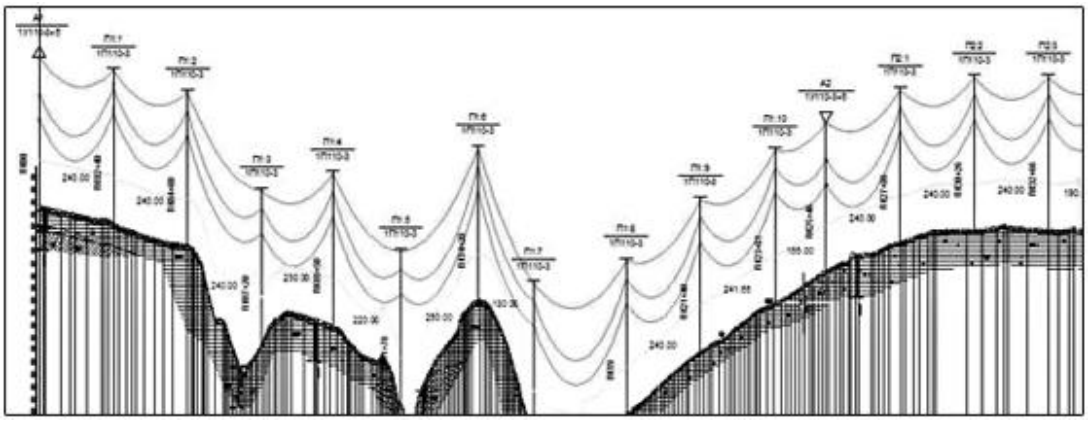

Fig. 1. The process of placing power poles in the power lines design system

Power lines design systems should be as reliable and resilient as possible. Any inaccuracy or error of such system could lead to the huge expenses. A huge responsibility lies on the developers of such systems. The question is how to find people who meet all the requirements to reliability and accuracy? Not less important thing to know is how to find out whether they can create such powerful and feature-rich systems, making sure that the developed power lines design system contains no critical shortcomings and bugs [3].

As many of us know, any kind of software is created by programmers or, more generally, developers. Slightly fewer people know or suggest that there some other developers, like interface designers, software designers, specialists in computer graphics and geometry, testers, quality assurance staff and so on. All these people should work cohesively and understand each other's roles and objectives.

Interesting to note that these roles are completely different and, as a result, require totally different skills and competencies. When people with different roles work as a team, they need to communicate with each other regularly. This, in turn, obliges them to find a common language. It is not that simple as it seems for people with completely different roles. Person should be able to use the terms of the other person's role and clearly understand which technologies, tools and limitation he has. That means a developer should not be limited only to his own subject area, he also needs to understand some aspects of the work of his colleagues with different roles. For instance, designer should clearly understand the limitations of developer's tools and frameworks while creating a graphical user interface for the software [4].

However, one can note that during the development process, for example, programmer should communicate a lot with many people of different roles. To do this he should be qualified enough to work with all these people and to use terms from different professional fields. This leads us to necessity of finding developers who has interdisciplinary competencies in different fields. For power lines design systems developer the most valuable fields are:

- mathematics;
- computer geometry;
- kinematics;
- electrical engineering;
- software development;
- geoinformatics;
- algorithmic.

Also, to communicate with other roles the developer has to know basics of the following fields:

- interfaces design;
- software design;
- software testing;
- quality assurance;
- system administration;
- network administration
- software licensing [5, 6].

As a result, lots of interdisciplinary competencies are required to develop a power lines design system. The question is how to estimate such competencies when you hire a new developer for such purposes?

The list of interdisciplinary competencies is too large to estimate the level of each of these competencies during the interview. But there are some other ways to estimate developer's competencies before hiring him [7].

The most primitive way is a verification task usage. Before hiring a new person one can give him a simple verification task. Such task should be similar to the real development task in some aspects and should verify programmer's competencies as well as team work and applied competencies. For instance, such task can be implemented as a simplified project based on the geometric and physics task. To estimate team work competencies the task verifier should play a project manager role. It is possible to include occasional communications with designer or product manager to estimate the applied competencies.

Another efficient way of interdisciplinary competencies estimation is certification. Many companies use internal human resources management systems. Employees can specify the competencies they have using such systems. Once in a certain period of time one can hold a certification to estimate the level of employee's competencies. These systems allow automating the recruitment process for power lines design system development as well as for any other purpose.

The most time-consuming way is competencies estimation during the interview and entering test. In this case the responsibility totally falls on the human resources manager. One can identify potential factors causing an overall effect with an Ishikawa diagram (cause-and-effect diagram).

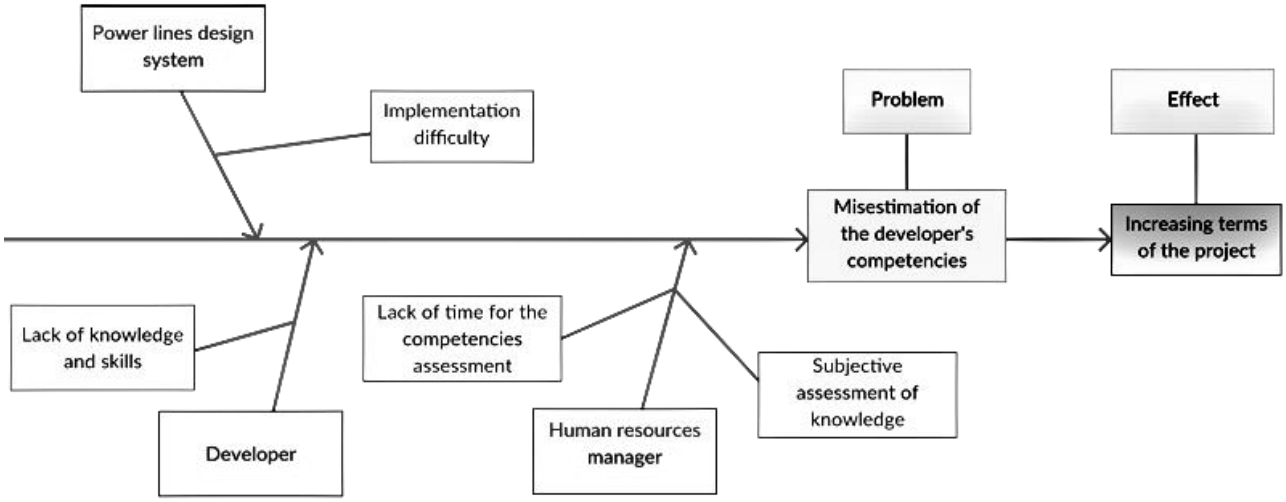

Fig. 2. The Ishikawa diagram showing that misestimating of developer's competencies

The main risk of such competencies estimation is caused by the sufficient amount of time that is required for accurate assessment. Human resources manager can use interview and any type of test, but such estimation is less efficient that a real development task. However test and interview preparations and verifications require much less time [8].

Another approach to the interdisciplinary competencies estimation is adaptive assessment. This technique involves the changing of assessment grade after success-

fully or unsuccessfully solved problem during the development process. Such approach is not that efficient for preliminary competencies estimation but it allows sufficient reducing of the negative effect of misestimating or even underestimation of employee's competencies level. But this method also requires additional time to assess the reasons and effects of success of failure and, as a result, the grade changing [9].

To sum up, any approach to interdisciplinary competencies estimation is based on a subjective assessment. Some of these assessments are supported by the results of the developer's completed tasks or by the feedback from project manager and teammates, but still these assessments are subjective. One can choose some of the mentioned approaches to competencies estimation and combine them to achieve the maximum efficiency.

It is very important to consider the significance of well-timed competencies estimation, especially for power lines design system developers. Neglecting the estimation leads to the huge time expenses, caused by numerous mistakes, bugs and misunderstandings. Power lines design system is a huge complex software product which requires a lot of interdisciplinary aspects for its development. All team mates should work as a single mechanism in which each part must be on its place and perform its function. Like a malfunctioning mechanism's part, an incompetent employee can cause damage to the whole mechanism.

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ЭТИЧЕСКАЯ СОСТАВЛЯЮЩАЯ ИНЖЕНЕРНОЙ ДЕЯТЕЛЬНОСТИ В КОНТЕКСТЕ ПРОБЛЕМЫ СОЗДАНИЯ НОВЫХ ТЕХНОЛОГИЙ

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В современном мире деятельность ученого детерминирована не только правовым законодательством, но и этическими нормами, что накладывает существенные ограничения на процесс научного исследования[1]. Данное ограничение возникло в результате ряда исторических событий, философское осмысление которых проходило в рамках этики как философского учения о морали. Результатом послужило создание ряда этических норм, большинство из которых в настоящее время прописаны во множестве уставов и кодексов, регламентирующих деятельность человека в рамках научного сообщества. При этом, необходимо констатировать, что даже в современном мире конечная цель научного исследования – истинное знание об окружающем мире. В связи с этим возникает вопрос: «Должна ли инженерная деятельность быть детерминирована этикой? И какими именно этическими нормами следует ее регулировать?».

Этика (греч. etika, от ethos – обычай, нрав, характер) – философская дисциплина, изучающая мораль, нравственность [2]. Как обозначение особой области исследования, термин «этика» впервые был употреблен древнегреческим философом Аристотелем (384–322 гг. до н.э.). Научная этика – в современной науке это совокупность официально опубликованных правил, нарушение которых ведёт к административному разбирательству [2]. То есть, для того, чтобы иметь возможность заниматься исследованиями, ученый должен следовать принципам научной этики. В настоящее время подавляющее число международных компаний, научные объединения и институты создают свои внутренние этические кодексы, отвечающие тем сферам, в которых они работают. Это обусловлено стремлением к улучшению взаимоотношений внутри компании и контроля вектора ее развития. Наиболее яркими и оказавшими наибольшее влияние на человечество являются такие документы, как Манифест Рассела-Эйнштейна, Нюрнбергский кодекс, а также такие объединения как Пагоушское движение и Общество Макса Планка.

Предпосылками к созданию перечисленных выше кодексов и движений послужили определенные исторические события. Например, создание атомной и водородной бомб способствовало развитию технологий и обогащению багажа знаний в данной области, что, несомненно, является положительным результа-