APPLICATION OF AI TECHNOLOGIES TO OPTIMIZE PROJECT ESTIMATION PROCESSES IN IT COMPANIES

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Abstract. This paper presents the results of the development and application of the system FlexEstimate AI, aimed at optimizing the evaluation processes of projects in the field of information technology. The system uses machine learning algorithms to automate data collection and analysis, which can significantly speed up and improve the accuracy of initial project estimates.

1. Introduction.

The modern information technology market is characterized by high competition and rapid development, which requires companies to be able to quickly respond to changes and effectively manage resources. One of the critical aspects of IT project management is the ability to estimate projects accurately and promptly. Traditional estimating methods, including manual data collection, requirements analysis and multi-level reviews, although providing the necessary accuracy, are often prohibitive in terms of both time and resources [1-2].

Delays in estimating projects can result in lost potential business as clients often demand quick decisions. In addition, inaccuracies in estimates can lead to under- or over-allocation of resources, which reduces the overall effectiveness of project management and increases project execution costs.

In response to these challenges, artificial intelligence technologies have begun to be actively implemented in the IT industry, especially machine learning methods to automate and improve project evaluation processes. These technologies can quickly process large amounts of data, identify patterns, and draw preliminary conclusions that can then be used to estimate cost, time, and other critical project parameters [1-2].

System FlexEstimate AI, which is the subject of this article, represents one innovative approach to solving the problem of quickly and accurately estimating of the new and existing projects. Designed to integrate existing assessment methodologies with machine learning algorithms, the system can significantly speed up the assessment process, increasing accuracy and reducing the likelihood of human error. The further text of the article will discuss the theoretical foundations, methodology of the system, as well as an analysis of the results obtained and the possibilities for further development and integration of Flex Estimate AI in IT sales and project management processes.

2. Theoretical basis.

At the heart of the FlexEstimate AI system is based on the principles of machine learning and statistical analysis, which allow you to efficiently process and analyze large volumes of data necessary for accurate project estimation. To understand the operation of the system, it is important to consider key theoretical

aspects, which include methods of regression, classification, clustering and natural language processing (NLP) [3-5].

2.1 Regression methods. Regression models in machine learning are used to predict continuous variables. In the context of project evaluation, regression can help predict, for example, task durations or resource costs based on historical data on similar projects. This allows you to automate and refine initial estimates, minimizing the risks of underestimating or overestimating projects.

2.2 Classification methods and data mining. Classification algorithms are used to predict categorical variables. In ' flex Estimate AI', classification can be used to determine the type of project based on given characteristics or to categorize tasks based on complexity, which affects the calculation of time and costs. These models allow the system to quickly adapt to various project conditions and provide the user with a detailed analysis of possible resource needs.

2.3 Clustering methods. Clustering is used to group objects with similar characteristics. In the context of project evaluation, this can be used to identify and group similar tasks or project phases, simplifying the planning and resource accounting process. This technology promotes a deeper understanding of the project structure and its requirements.

2.4 Natural Language Processing (NLP). NLP allows the system to analyze text data such as project descriptions or technical specifications. Using NLP, FlexEstimate AI automatically extracts key information from documentation, which may include design requirements, intended functionality, and other critical parameters. This significantly speeds up the process of collecting data for assessment and reduces the likelihood of errors associated with manual data entry.

Combination of these methods in Flex Estimate AI allows you to create a powerful estimation system that not only automates and speeds up the project estimation process, but also increases its accuracy and reliability. Such application of advanced technologies in information technology opens up new opportunities for project management, making them more adaptive and effective in changing market conditions.

3. Methodology.

Flex Estimate AI integrates several key components for project estimation, using algorithms and artificial intelligence techniques to automate and optimize the process. In this section, we will consider in detail the main stages of the system’s operation, starting from data preprocessing to issuing the final evaluation results [3].

3.1 Data preprocessing module. One of the first stages of the system's operation is preprocessing of input data. This process includes cleaning data from possible errors and anomalies, normalizing it and structuring it. In the context of FlexEstimate AI, this may involve filtering and standardizing project information that may come from various sources such as emails, documents or even verbal descriptions converted to text using NLP.

3.2 Analytics module. After data preprocessing, the next step is analytical processing. Here, data is analyzed using various statistical methods and machine learning algorithms. In FlexEstimateAI uses both supervised and non-supervised machine learning methods:

– regression models are used to predict costs and time based on previous projects;

– classification algorithms help identify project types and their corresponding requirements;

– clustering algorithms are used to group similar tasks, making them easier to process and evaluate later.

3.3 User Interface. User Interface in FlexEstimate AI is designed to make interacting with the system as easy as possible. Users can enter data about new projects through convenient input forms, including drag-and-drop capabilities for documents and integrated tools for recording verbal descriptions. The interface also includes visual analytics dashboards that provide aggregated data on current scores and historical trends. Figure 1 shows one of the elements of the system interface – with an option already assessed for the project according to the request.

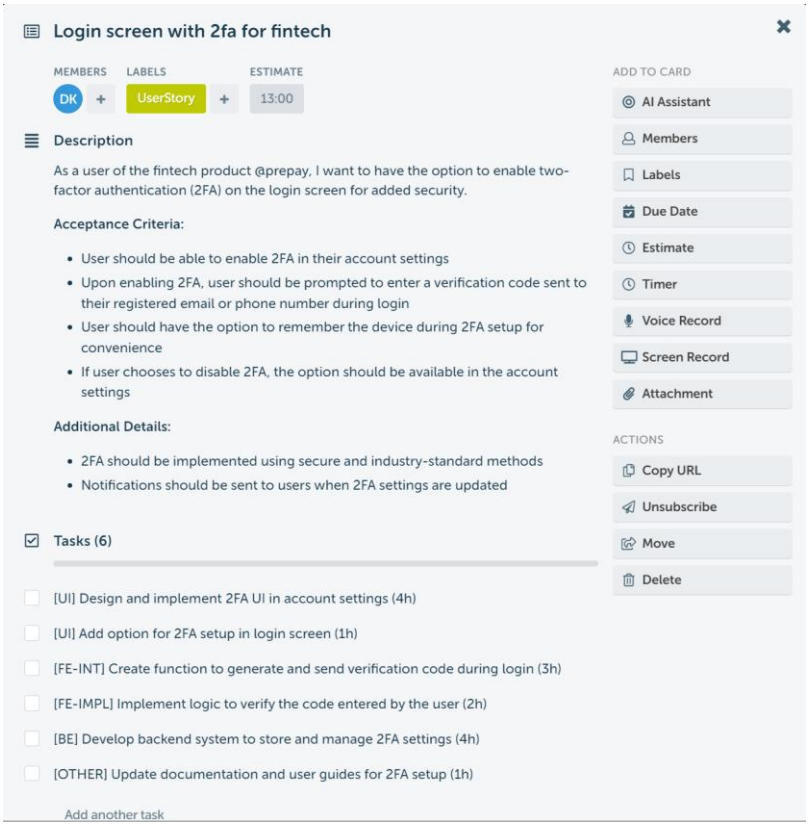


Figure 1 – Result of work of estimation module

The system generated a description of the task in deliverables format, and also made a detailed assessment and divided it into subtasks intended for various specialists – UI\UX, Backend and Frontend developers, and also took into account the time for QA and project management.

3.4 Document generation module. The final stage of the system is the generation and management of the project documentation. FlexEstimateAI automatically generates necessary documents such as proposals and detailed estimates. These documents are generated from templates that can be customized to meet the specific requirements of the client or project. Document generation includes not only textual content, but also comprehensive budget tables, graphs and charts, providing complete transparency and understanding of estimates.

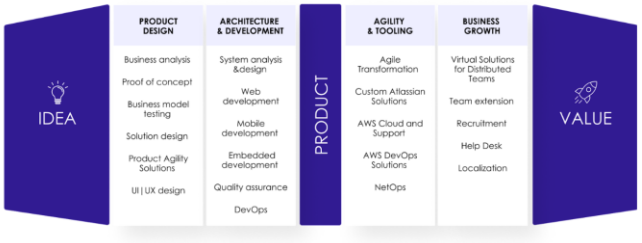
Figure 2 shows an example of a commercial proposal for a client generated using the FlexEstimateAI, as well as detailed calculations for both options that are used in this project (feature list), and on the necessary resources that are needed to implement the project within deadlines.

Executive summary

flti creating solutions for real life

Work process.

We cover full-cycle Agile custom software development



How much will it cost, how have we calculated this?

The total cost of your project will be approximately **€87 000**

SEE THE COST ESTIMATE

Feature	Total Hours min	max
Discovery Phase	20	24
UI/UX	55	75
API (Backend)	822	
Web App	1400.5	
PM & Testing	703	
Total Hours	2925.5	
Estimate 30 EUR/h	87 765	

Feature	API (Backend) min	API (Backend) max	Web App min	Web App max	PM & Testing	TOTAL min	TOTAL max
Dashboard Ticket - Documents	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Dashboard ticket - related activities	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Dashboard ticket - connected tickets	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Dashboard Ticket – Open ToDo's	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Dashboard Ticket Notes	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Activity list dashboard (Filter/Sort: Customer code, Customer name, Order type, ZIP, place, Activity status, Type of activity)	8.00	12.00	20.00	24.00	**10.00**	**38.00**	**46.00**
Dashboard activity / creation / change	8.00	10.00	8.00	10.00	**5.00**	**21.00**	**25.00**
Dashboard activity - contact person	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Dashboard Activity - User	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Dashboard Activity - Areas	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Dashboard Activity - Documents	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Activity Dashboard – Related Activities	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Activity Dashboard – Related Tickets	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Activity Dashboard – Open ToDo's	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Dashboard Activity - Notes	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Dashboard ToDo List	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Dashboard ToDo - New/Edit	3.00	5.00	6.00	8.00	**3.00**	**12.00**	**16.00**
Dashboard ToDo area	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Dashboard ToDo - Users	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Dashboard ToDo - Documents	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
ToDo contact person	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Dashboard ToDo – Notes	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Dashboard overview of activities	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Dashboard Activities - Related activities	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Dashboard Activities - Related Tickets	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Dashboard Activities - Open ToDo's	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Dashboard reports / evaluations (Export to Excel, Expression)	14.00	16.00	14.00	16.00	**9.00**	**37.00**	**41.00**
General masks for performing functions	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Function selection person	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Job selection function	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Function selection project	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Function selection user	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
Function selection area	5.00	7.00	8.00	10.00	**5.00**	**18.00**	**22.00**
New document / document upload function	5.00	7.00	10.00	12.00	**5.00**	**20.00**	**24.00**
Document display function	2.00	3.00	4.00	8.00	**3.00**	**9.00**	**14.00**
Total Hours	681.00	963.00	1,228.00	1,573.00	703.00	2,612.00	3,239.00
Average Total Hours	822		1400.5		703	2925.5	

Team	#	Rate $/h	~h	Sprint 0				Sprint 1				Sprint 2				Sprint 3				Sprint 4				Sprint 5				Sprint 6				Sprint 7				Sprint 8				MVP
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
Backend Developer	0	$30.00	1360			40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	
Frontend Developer	0	$30.00	1360			40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	
ReactNative Developer	0	$30.00	1360			40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40	
BA	0	$30.00	160	20	40	40	40	20																																
QA	0	$30.00	840			20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	40	40	40	40	40	40	
PM	0	$30.00	720	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	
UI/Ux designer	0	$30.00	150	20	30	40	40	20																																
DevOps	0	$30.00	70		10	10	10																													10	10	10	10	
Total:	**0**	**$176,100**	**6020**																																					

Figure 2 – Prepared commercial offer and additional data on the project

Methodology of FlexEstimateAI provides an integrated approach to project assessment, from data collection and preprocessing to the preparation of final documents for clients. The use of advanced artificial intelligence technologies can not only speed up the assessment process, but also significantly increase its accuracy and efficiency.

4. Practical significance.

Application of the FlexEstimate AI in the context of information technology project management represents a significant improvement over traditional estimating methods. This improvement covers several key aspects that are important for IT companies seeking efficiency and competitiveness.

4.1 Speeding up the assessment process. One of the main advantages of FlexEstimate AI is a significant reduction in the time required to estimate projects. The system automates many aspects of data collection and analysis, allowing for faster assessments. On average, the time spent on initial project assessment is reduced by 70%. This allows companies to respond faster to customer requests and speed up the process of launching projects.

4.2 Improving the accuracy of estimates. FlexEstimate AI uses extensive data on previous projects to train algorithms, allowing it to make more accurate predictions about project costs and timelines. This reduces the likelihood of unexpected costs and delays that could negatively impact project completion and client satisfaction. It is estimated that the accuracy of preliminary estimates reaches 60-70%, and continues to improve as the system accumulates experience and develops artificial intelligence technologies.

4.3 Resource optimization. Automate the estimating process with Flex Estimate AI allows you to allocate resources more efficiently. The system helps determine which projects are the most profitable and which require additional resources. This allows for more strategic planning and use of both human and material resources of the company.

4.4 Transparency and documentation. FlexEstimateAI automatically generates all necessary documents related to project estimation, which improves the transparency of the process and simplifies interaction with clients. Every aspect of the assessment is supported by detailed calculations and analytics, which helps build customer confidence and improve the overall perception of the company as a reliable partner.

4.5 Cost reduction. Finally, using of FlexEstimate AI results in lower overall operating costs. Fewer hours spent estimating and fewer errors in estimates result in savings in both time and money. This makes processes more cost-effective, freeing up resources for other critical tasks.

Using the system Flex Estimate AI can provide companies a powerful tool to improve their efficiency. The system not only speeds up and simplifies estimating processes, but also improves their quality, which ultimately leads to better project planning, increased profits and improved customer satisfaction.

5. Technologies and tools.

Flex Estimate AI has been developed using a number of modern technologies and tools, which ensures its high performance, scalability and adaptability to the various requirements of information technology projects. Let us consider in detail the main technologies and tools used in the system.

Programming languages.

1. Python: Used for backend development due to its powerful support for machine learning libraries such as TensorFlow, scikit-learn, and Numpy. Python is also popular for data science and mathematical calculations, making it an ideal choice for the algorithmic part of FlexEstimate AI.

2. JavaScript: Used for front-end development. When combined with frameworks such as React, JavaScript allows you to create interactive user interfaces that can dynamically display complex data and analytics.

Frameworks and libraries.

1. TensorFlow and Scikit-learn: These libraries provide tools for creating and training machine learning models. TensorFlow is especially useful for developing complex neural networks, while scikit-learn offers convenient tools for more traditional machine learning tasks such as classification and regression.

2. React: Used for user interface development. React allows you to create scalable and fast web applications, which is important for interactive systems such as Flex Estimate AI'.

Database.

PostgreSQL: The choice of this database management system is due to its powerful capabilities and reliability. PostgreSQL is ideal for tasks that require complex queries and data integrity, which is critical for project evaluation systems.

Cloud platforms.

AWS (Amazon Web Services): AWS cloud services are used to host the application and data. This provides flexibility in scaling the system depending on user needs and reliability of data storage. Additionally, AWS provides additional services such as Amazon S3 for file storage and Amazon EC2 for computing.

Auxiliary tools.

1. Docker: Used to containerize applications, making it easier to deploy and version control in a variety of environments, from development to production.

2. Git: A version control system for managing a project's source code, which is standard practice in modern software development.

Using these advanced technologies and tools allows Flex Estimate AI effectively analyzes data, ensures high system speed and provides the user with a convenient interface for interacting with complex data. This makes the system not only technologically advanced, but also convenient and accessible to a wide range of users in the field of IT project management.

6. Conclusion.

Application of the system FlexEstimateAI represents a significant step forward in information technology project management. This system not only simplifies and

speeds up the project evaluation process, but also increases its accuracy and reliability thanks to the integration of modern technologies and artificial intelligence techniques.

Flex Estimate AI changes the approach to project estimation, shifting the focus from time-consuming and error-prone manual methods to automated and data-driven processes. This can significantly reduce the time required to evaluate a project and increase the transparency and validity of proposed solutions.

The system allows you to allocate resources more efficiently, plan budgets and deadlines more accurately, which contributes to more successful implementation of projects. It also minimizes the risks associated with potential budget and schedule overruns by accurately predicting data-driven estimates.

Flex Estimate AI provides high-quality proposals for clients, including detailed documentation and accurate estimates. This builds customer trust and increases satisfaction through transparency and predictability of results.

Development and implementation of systems such as presented in this paper, is making a lasting impact on the information technology industry by raising project management standards and promoting best practices and innovative solutions. This also opens the door for further research and development in the application of artificial intelligence in project management.

FlexEstimateAI can be further improved by introducing new algorithms and technologies, as well as expanding its functionality for integration with other project management systems and corporate tools. It is also possible to create industry-specific versions of the system, adapted to the specific requirements of various market segments.

Flex Estimate AI demonstrates how artificial intelligence technologies can transform key aspects of project management, making it more efficient and adaptable to the ever-changing technology landscape. This system is an example of a successful combination of innovation and practical utility, providing IT companies with a powerful tool to increase their competitiveness and achieve business success. All this mentioned above fits into the concept of proactive enterprise management [6], of which this system can become a part for effective sales and project management.

References

1. Stetsyuk, P.A., & Korsakov, D.O. (2019). Methodical features of the analysis of alternative investment projects. Economics . Management. Business, 4(30), 14-21. https://journals.dut.edu.ua/index.php/emb/article/view/2333.

2. Polozova, T.V., Gureeva, K.A., & Mar'enko, O.M. (2023). Methods for assessing the effectiveness of investment projects. Current strategies of economic development: science, innovation and business awareness. (p. 69-71). https://eces.nure.ua/nauka/mizhnarodna-naukovo-praktichna-konferencija-suchasni-strategii-ekonomichnogo-rozvitku-nauka-innovacii-ta-biznes-osvita.

3. Kovtunenko, Yu.V. (2019). The use of artificial intelligence in an enterprise management system: problems and advantages. Economic Journal of Odessa Polytechnic University, 2(8). 93-99. https://economics.opu.ua/ejopu/2019/No2/93.pdf. DOI: 10.5281/zenodo.4171114.

4. Bagan, T.G. (2021). Methods of machine learning in the design of automated heating systems. Kiev: KPI im. Igor Sikorsky. https://ela.kpi.ua/handle/123456789/45676

5. Litvin, V.V., Nikolsky, Yu.V., & Pasichnik, V.V. (2021). Methods and techniques for data engineering and knowledge. Lviv: Magnolia 2006. https://mybook.biz.ua/ua/bazi-danih/metodi-ta-zasobi-injenerii-danih-ta-znan/.

6. Kostaryev, D.B., Tevyashev, A.D., Sizova, N.D., & Tkachenko, V.P. (2024). Analysis of the problem of forecasting in proactive enterprise management. – Intelligent Sustainable Systems. Selected Papers of WorldS4 2023, (1), 539-549. ISBN 978-981-99-8031-4 (eBook). https://doi.org/10.1007/978-981-99-8031-4.