

# CHATGPT POTENTIAL TO SELECT TECHNOLOGY IN RAPID PROTOTYPING OF CYBER-PHYSICAL SYSTEM

## CHATGPT POTENCIĀLS IZVĒLĒTIES TEHNOĻĪJU KIBERFIZIKĀLĀS SISTĒMAS ĀTRAJAI PROTOTIPĒŠANAI

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**Abstract.** *It is a common task to select optimal technologies for a prototype implementation. If a prototype of a cyber-physical system is developed, it is required to select suitable components, devices and software development tools, which are compatible with each other. Traditionally, the market analysis is conducted reviewing components, searching for a trade-off combination which are optimal for the prototype implementation. That is a sufficiently time consuming process. Additionally, the market changes are relatively fast. Therefore, the search must be repeated periodically. We propose the hypothesis that ChatGPT can help in market analysis to select optimal components in the rapid prototyping tasks. To evaluate our hypothesis, each author tried to find an optimal solution considering his specialization or interest field. Based on the obtained experience, the Delphi method was applied to collect expert opinions to gain consensus, which is presented in this article.*

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**Keywords:** *ChatGPT, cyber-physical systems, decision-making, optimization, rapid prototyping.*

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### Introduction

A chatbot tool called ChatGPT was developed by OpenAI and released on November 30, 2022. The main objective of ChatGPT is to make it easier for people to access information and complete tasks by providing helpful and accurate responses to their questions and requests. It has received a lot of attention because of its potential to automate a variety of tasks and possibly have an impact on sectors like translation, customer service, and content creation (Haque, 2023).

Hassani and Silva (2023) completed analysis of the ChatGPT role in data science to automate various aspects of the workflows and to analyze unstructured data. They identified the following statistical capabilities of ChatGPT: language modeling, text classification, named entity recognition, machine translation, question answering and text generation. Additionally, they identified situations, when ChatGPT is not always correct: ambiguous or unclear questions, out-of-domain questions, biased or inaccurate training data, complex or technical language.

Sometimes starting a research into a new topic is hindered by not knowing correct keywords to input into a regular search engine. If an overview is needed of technique to solve a problem in a specific domain search engine can be used to compile the summary manually by going through search results one-by-one. ChatGPT can be used in both of these cases to get a concise summary that can be used as a starting point for further research into the topic. Exploring a suggested solution further by expanding on the query may help generating initial ideas on how to tackle the task at hand. For example, in the field of autonomous orchard management one might ask ChatGPT “What are some of the most common techniques to [problem to solve] using UAV?”. This results in a bullet point list of techniques and solutions that can be explored further. A reasonable next query would then be “If [name of the technique suggested in the last ChatGPT’s answer] approach is selected, what would be a

basic algorithm to implement it?”. The resulting algorithm is a step-by-step guide on how to implement it on a high level.

ChatGPT shows a potential to identify optimal technology for rapid prototyping by developing cyber-physical systems that necessitates consideration of numerous interconnected parameters. This is possible because ChatGPT can assist in market analysis and decision-making process, by aiding in selection of optimal components in the rapid prototyping tasks. To evaluate our hypothesis, each author tried to find an optimal solution considering his specialization or interest field. Based on the obtained experience, the Delphi method was applied to collect expert opinions to gain consensus, which is presented in this article.

**Aim of study:** to evaluate ChatGPT potential to select technology for rapid prototyping of a cyber-physical system.

**Objectives:** two tasks were set as objectives in attempt to evaluate potential of ChatGPT as tool to select technologies in rapid prototyping of cyber-physical systems:

- 1) Involve experts to analyze available technologies in market using ChatGPT;
- 2) Apply the Delphi method to get summary consensus on applicability of ChatGPT for this purpose.

During plenary discussion about the experience of each participant in this experiment several theses were put forward and discussed, evaluating their importance and impact on the raised issue. In the authors' experience this approach to exploring and refining queries provides satisfactory results. It is helpful if the person using ChatGPT is knowledgeable in the problem domain. This way any obviously incorrect answers can be discarded.

### **Materials and methods**

ChatGPT 3.5 May 12 (2023) version was used as it was the latest version available for usage. To evaluate and make decisions on usability of ChatGPT as a tool for rapid prototyping, experts were asked to take part in this test. Authors were selected as an expert group that will use ChatGPT. For the test group, a task that was set to search for available technologies in the market using ChatGPT. Technologies varied from software solutions for specific tasks to finding consumer ready devices for immediate deployment. After testing ChatGPT capabilities, each author provided a description of their experience. After that, a plenary discussion was set. During the plenary discussion, the authors came up with several theses about the potential of ChatGPT.

### **Results**

#### **Experience Results 1: Search for software solutions or IT tools for a specific task**

In most cases when a person defines a problem and finds a solution for said problem, the person needs tools to get to that solution. If a person is experienced in the problem domain, tools for reaching a solution may be known from previous experience. But in the case if the person has not prior experience in solving said problem, tools may not be obvious. There is a tremendous amount of possible software or tools for any problem, and some may be so obscure that a general user may not even have heard about them.

For example, the need for tools for image segment labeling has arisen. ChatGPT can greatly assist in searching and selecting the optimal tool for said task. By asking “Create a list of software or tools for [tasks to do].”. By using chain prompts that ChatGPT supports in borders of the same instance, said list may be refined by adding additional parameters or setting specific constraints. A good example is asking to add information if the tool is free to use and if it supports specific function: “Add information if [additional information] and [extra constraints]”.

Considering results received from ChatGPT based on 2 prompts used, a list of tools for image segmentation was created. Next step for the user would be checking tools one by one to

find the most suitable for the task at hand. Considering results, limitations of ChatGPT need to be taken into consideration, and not disregard tools that may not fully fulfill requirements set in prompts, as data ChatGPT uses are only till September 2021. As such, additions to tools from the list may be added and today they may fulfill tasks that they were not able to do in the past.

### **Experience Results 2: Search of agricultural UAV for spraying**

The most suitable template to get the list of UAVs for crop spraying available in the market was:

“Specific models of [device] for [task] in table with columns: model, [param1, param2, etc.]”

It was possible to get an average price, which was presented as one value or range. Considering the quantitative parameters like price or weight, the values were not precise, but close to the parameters of real models. Sometimes, the list contained fake models, their titles were generated based on the sources of services, redistributors, stocks, events and mentioned models published in some common article. The technologies like “RTK” and “SDK” were well recognized by ChatGPT and their support depicted in the table as “Yes” or “No”. Once in a while, ChatGPT provided UAVs, which were produced for cinematography, agricultural monitoring or cargo transportation. It was not possible to obtain an immediately useful list of market available UAVs. The process was repeated using the spiral model requesting the list of models and checking it out using Google search. The most stable information was about DJI models, it can be concluded that information mass is important. The most useful results were the lists of potential models, which could be reviewed on the Internet manually. However, the process was sufficiently time consuming.

### **Experience Results 3:**

The preferable use for response generation using ChatGPT would be asking it to list possible tools for the project. For example:

“[key project requirements], [specific issue]”

If the generated prompt does not fit the requirements, you should make another prompt stating the limitations of the project.

“[I have a project, where I would have [requirement], that would be [specific issue]. Can you recommend me [Specific output data, for example, programming tools]”

The only downside of using such a method is that inputting the same prompt in a different ChatGPT conversation will generate a different output. Which will exclude or include different options. The result will be similar if the question is repeated in the same conversation. Repeating the initial prompt in a different conversation can yield additional information.

Asking it to score the output tools can also be helpful if it is kept to using simple comparisons as “True” or “False”. If asked to score a model numerically or compare it to other models, it will have trouble, and the generated responses will be inaccurate. Prompts or table entries that are, for example, specifically referring to complexity should be asked to state if it is complex or simple because it can lead to possible confusion.

### **Experience Results 4: ChatGPT as a data analysis tool**

One of the areas where ChatGPT could shine is as a data analysis tool. For example, if a certain amount of data is provided with enough context it could potentially give insights and also even forecasts for the future. The desired prompt for it would be:

“[data], [specific thing to be analyzed]”

However, it could also be asked just to give general insights that it sees as notable. For example, it was given a dataset about software technologies and data associated with them

like cost, development time, ease of integration, scalability and performance. The response that ChatGPT gave was quite insightful, it ranked which technologies were the most cost-effective, which had the lowest development time and went through all the other parameters that were given and also gave an overall favorite it seemed as the best option. Even if the insights might be easy to calculate it still gives them for a dataset that does not necessarily contain a lot of useful data.

The biggest downside of ChatGPT as an analysis tool is that as much as it knows what it needs to find, it simply can not do it accurately. Specifically, the main place it struggles is at math calculations, it simply can not do it as it is not meant for it as it will just try to find a similar dataset that it was trained on to output the data from. However, there is potential for it in the future if these specific functions for calculations are added separately and are independent of the text based generation, but are given to the text based model to output.

### **Discussions**

During plenary discussion about the experience of each participant in this experiment several theses were put forward and discussed, evaluating their importance and impact on the raised issue.

One of the theses that were put forward emphasized the utility of ChatGPT in offering comprehensive and detailed insights when supplied with abundant information about a given product or topic. For instance, if a popular brand of agricultural drones is under discussion, the model is able to provide reliable and extensive information. In contrast, when dealing with less known brands, it tends to generate potentially unverified data. In response, it would be beneficial for future iterations of ChatGPT to have a substantial amount of information prepared in advance. This measure would equip the model to adequately respond to inquiries within the domain of the newly introduced tool or technology.

It corresponds to the one of other theses put forward that that the results generated by ChatGPT are influenced by the quantum of information available on the internet. Therefore, such results could potentially be manipulated by interested parties. For example, if a company were to heavily publicize a product's specific properties, the model might inadvertently disregard any critical test results that contradict the company's claims, thereby reinforcing the importance of ensuring the reliability and accuracy of the information the model is trained on.

There was a consensus that while ChatGPT can be used to gather general information about a wide range of subjects, it presently lacks the capability to make sound decisions from multiple options in more complex problems. As a result, the user is required to have a fundamental understanding of the domain that underpins the prompt.

In conclusion, our discussion underlined the potential of ChatGPT, while simultaneously drawing attention to areas requiring improvement to further enhance its applicability and reliability.

### **Conclusions**

Based on results of plenary discussion of participants, it was concluded that ChatGPT at its current state still has much to improve with its usability cases. As it stands, it can be used as a virtual assistant with requests of additional information about topics of interest or general information about said topic, but a person knowledgeable in the domain of topic in question is needed to filter AI's generated information from actual factual information. In conclusion, ChatGPT is only partially usable as help for selecting technologies and rapid prototyping for cyber-physical systems, as it can provide information needed for tasks, but only knowledgeable person will be able to use information provided and information may be dated, based on version of ChatGPT and time of requesting of information.

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### **Bibliography**

1. Haque, D. M. (2023). *A Brief Analysis of “ChatGPT” – A Revolutionary Tool Designed by OpenAI*. EAI.
2. Hassani, H., Silva, E. (2023). *The Role of ChatGPT in Data Science: How AI-Assisted Conversational Interfaces Are Revolutionizing the Field*. Retrieved from MDPI Open Access Journals: <https://doi.org/10.3390/bdcc7020062>