

**Virtual Talk on Problem Solving by Utilising Generative AI (ChatGPT)**

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Generative AI, particularly exemplified by ChatGPT, has emerged as a powerful tool for problem-solving across various domains. Its ability to understand natural language, generate human-like responses, and provide creative solutions makes it a valuable asset in tackling complex problems. This report delves into the applications, benefits, challenges, and future prospects of utilising generative AI, with a focus on ChatGPT, for problem-solving purposes. Additionally, it emphasises the importance of effective prompting to enable ChatGPT to generate more relevant solutions. This virtual talk was held on 22nd February 2024 from 6 – 8 pm via IEM Penang Branch Zoom Platform. The speaker of this evening talk was Mr Tanasak Pheunghua from Thailand. He is an International TRIZ Association (MATRIZ) certified Level 4 TRIZ Specialist and Managing Director of The Inventor Development Co., Ltd. There were 41 participants attended the evening talk.

Mr Tanasak started the evening talk by introducing what generative AI is. Generative AI refers to artificial intelligence systems that can generate new content, such as text, images, or music that is similar to what humans might produce. ChatGPT, developed by OpenAI, is a leading example of such technology, capable of understanding and generating human-like text responses. This report aims to explore how leveraging generative AI, particularly ChatGPT, can enhance problem-solving processes through effective prompting techniques. This technology, when combined with Problem Solving and Inventive Problem-Solving techniques like TRIZ Tools, facilitates remarkable advancements across multiple areas:

1. Enhancing Information Search:

Through generative AI, the scope and depth of information searches are significantly improved, leading to an increase in data volume and a reduction in time required for searches. This technology utilises comprehensive research to access and understand complex system functionalities and structures, aligning with Problem Solving Tools used in Problem Analysis. These include Function Analysis, Component and Interaction Analysis, Root Cause Analysis, TRIMMING, and others.

2. Facilitating Idea Generation:

Generative AI effectively integrates with Idea Generation Tools, such as Brainstorming, the 40 Principles, MATHCHEM, TESE, and FOS, fostering the creation of innovative solutions for resolving conflicts or tackling critical issues. This collaboration promotes the development of unbiased and inventive ideas. Figure 1 below shows the empirical model of idea generation.

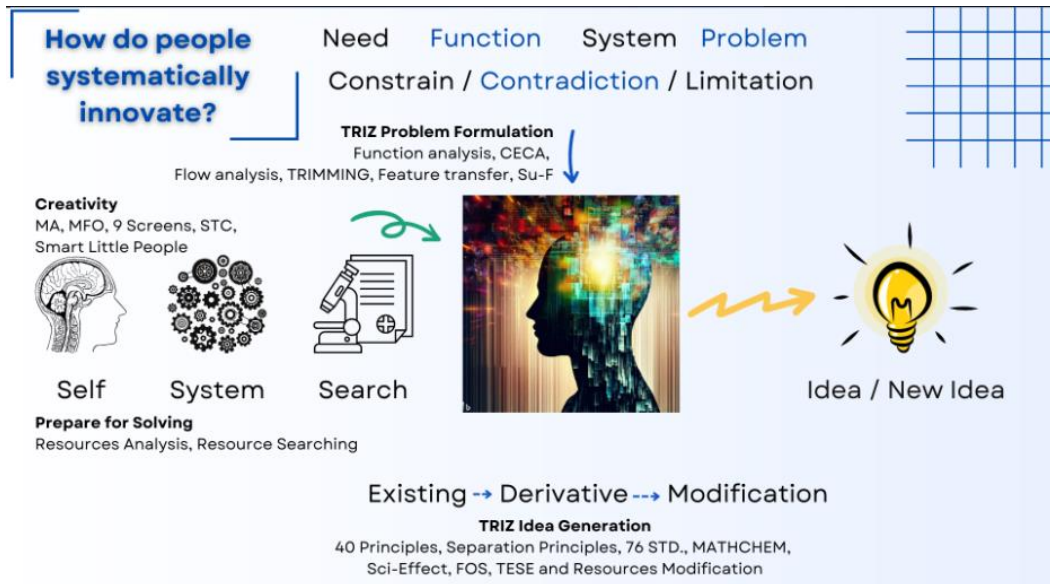


Figure 1. Empirical Model of Idea Generation

3. Evolving TRIZ Tools:

The advent of generative AI has transformed traditional TRIZ tools, making tools like Function Oriented Search (FOS) more accessible and easier to use. These tools, which previously presented challenges for human operators, are now enhanced by AI's capabilities.

4. Providing Expert Information:

In instances where specific expertise is lacking, generative AI can act as a valuable source of expert knowledge through the Role Prompting technique.

During the talk, participants have also had the opportunity to experience a few hands-on activities by trying the prompting in ChatGPT as well as Google Gemini. The example of the prompt and the output is as shown in Figure 2 below:

Think before prompt	
What does the user need? :	There is "Function" and User is looking for "System"
Prepare to Prompt :	Should provide detail of "Function" and Instruction to AI
Expect from AI :	Finding the systems

Prompt

Please explore the 5 novel solutions and 5 Low-cost solutions of technical system which able to perform "To capture and to move dust by airflow" in tabulated form, including 1. System 2. Detail. / In tabulated format.

Novel Solutions:

Solution	Details
1. Electrostatic Precipitator (ESP)	ESPs use electrostatic forces to capture dust particles from the air. The system charges particles, making them stick to collector plates or surfaces. It's efficient but may require more power.
2. Cyclone Dust Collector	A cyclone separator spins incoming air to create a vortex, which separates dust due to centrifugal force. This can be used as a pre-filter in industrial setups.
3. Sonic Agglomeration	This technique uses sound waves to induce dust particles to agglomerate, making them easier to capture by filters or collectors. It's energy-efficient but may require specialized equipment.
4. Electrostatic Dust-Free Air Ventilation (EDFAV)	An innovative approach using electrostatic fields within air vents to attract and capture dust. It maintains cleaner indoor air in homes and offices.
5. Robotic Air-Purifying Drones	Small autonomous drones equipped with air filtration systems can navigate indoor spaces, detecting and capturing dust. They can be programmed for periodic cleaning.

Low-Cost Solutions:

Solution	Details
1. DIY Air Filtration System	Create a simple air filtration system using a box fan and a high-efficiency particulate air (HEPA) filter. This is cost-effective for small spaces.
2. Natural Ventilation	Utilize cross-ventilation by strategically placing windows to allow natural airflow to remove dust from indoor spaces. No additional cost is incurred.
3. Fabric Dust Barriers	Hang breathable fabric barriers in work areas to trap dust. Shake them out periodically to release collected dust.
4. Wet Dust Suppression	Spraying water in dusty areas can weigh down dust particles, making them settle faster. This is low-cost but may require regular maintenance.
5. Magnetic Dust Sweepers	Attach magnets to a broom or mop to attract and capture metal dust particles, commonly found in workshops or industrial settings. It's inexpensive and easy to implement.

Figure 2. Example of Prompting and the Output from ChatGPT for the Solutions

After which Mr Tanasak guided the participants through a more comprehensive prompting technique to make ChatGPT to act as a consultant performing consultancy work by asking questions to the user and

waiting for the response from the user before proceeding to the next step via the problem review and definition process as outlined below:

Step 1: Initial Understanding what is the problem? - Describe the problem in as much detail as possible, focusing on what is happening, where, and to whom. Immediate Effects - What are the immediate consequences or effects of the problem? Who and what are directly impacted?

Step 2: Historical Context Previous Occurrences - Has this problem or something similar happened before? If so, provide details on when and in what context. Past Solutions - What solutions or attempts to address the problem have been made in the past? How successful were they?

Step 3: Specific Conditions and Constraints Environmental Conditions - Are there any environmental factors (physical, economic, cultural, etc.) that influence the problem? Stakeholders - Who are the key stakeholders involved or affected by the problem? This includes individuals, communities, organizations, etc. Constraints - What are the constraints or limitations faced in solving the problem? Consider resources, technology, regulations, etc.

Step 4: Impact Analysis Short-term Impact - What are the short-term implications of the problem if it remains unsolved? Long-term Impact - What might be the long-term consequences if the problem persists?

Step 5: Refining the Problem Definition Based on the information gathered, refine the problem statement. This refined statement should clearly articulate the nature of the problem, its scope, and the impacted entities. It should also highlight any critical conditions or constraints that must be considered in potential solutions."

Problem Review and Definition, lies in its structured approach to understanding complex problems. It assists by:

1. **Clarifying the Problem:** It helps in breaking down complex or vague issues into more understandable parts, making it easier to identify what exactly needs to be addressed.
2. **Comprehensive Assessment:** Through a series of targeted questions, it ensures that all aspects of the problem, including its history, impacts, and previously attempted solutions, are considered. This thorough examination helps in avoiding oversights and uncovers details that might not be immediately apparent.
3. **Refined Problem Definition:** By systematically exploring various facets of the issue, it aids in refining the problem statement. This refined definition is crucial for effective problem-solving as it ensures that efforts are directed towards the actual issue rather than symptoms or unrelated aspects.
4. **Foundation for Solutions:** With a clearer and more precise problem definition, devising solutions or further analysis becomes more straightforward and focused. It provides a solid base from which to explore potential solutions, research further, or seek expert advice.
5. **Efficiency in Problem-Solving:** By organizing thoughts and information about the problem, it saves time and resources that might otherwise be spent on addressing the wrong aspects of an issue.
6. **Enhanced Understanding:** The process encourages a deeper understanding of the problem, which is essential for anyone involved in solving it, ensuring that all stakeholders have a common, clear understanding of the issue at hand.

In conclusion, effective prompting plays a crucial role in harnessing the capabilities of generative AI systems like ChatGPT for problem-solving purposes. By providing clear, specific, and contextually relevant prompts, users can guide ChatGPT to generate more precise, customized, and innovative solutions tailored to their specific needs and objectives. As prompting techniques continue to evolve and improve,

coupled with advancements in generative AI technology, the potential for leveraging ChatGPT in problem-solving applications is poised to expand, driving innovation and facilitating new avenues for addressing complex challenges across diverse domains.