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A case study of technological innovation practice by using Algorithm of Inventive Problem Solving (ARIZ) in IT sector

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ABSTRACT

This paper deals with the practical approach of the software development in mobile communication industry by using the systematic innovation tools. Converged IP (Internet Protocol) Messaging (CPM) has been the new reusable building blocks to create the variety of interpersonal, interactive and multimedia communication services that run on top of an IP Multimedia Service networks. Even though, full IMS has been discussed more than 10 years, it is hard be deployed because of huge amount of the financial investments. It is also same burden for CPM service because the current CPM service requires additional full IMS infrastructure. ARIZ (Algorithm of Inventive Problem Solving) is applied for developing the new mobile enablers. ARIZ is one of powerful tools in *Theory of Inventive Problem Solving* that has been designed by a Russian scientist. The paper provides the full deployment of ARIZ-85C for applications in mobile industry. Enhanced CPM client is the alternative client that is implemented to avoid complexities of network systems. This case research also demonstrates a technological innovation by applying ARIZ in the IT industry sector.

1. Introduction

Mobile industry is one of major industry in the world and everyone in the world is using mobile phones or tablets as daily basis. There are many messaging based services based on mobile phones (mostly smartphones and tablets). Even old messaging services such SMS (Short Message Services), MMS (Multi Media Services) are still popularly used all around world because messaging services are revenue generating services by operators (i.e., mobile carriers). Converged IP Messaging (CPM) is new reusable building blocks to create the variety of interpersonal, interactive and multimedia communication services that run on top of IMS (IP Multimedia Subsystem) networks (Open Mobile Alliance, 2010a,b,c) and it is considered as a next generation service framework. IP Multimedia Subsystem (IMS) is an architectural framework for delivering Internet Protocol (IP) multimedia services (Camarillo & García-Martín, 2004) in mobile networks like UMTS (Universal Mobile Telecommunications System) and GPRS (General packet radio service) and EDGE (Enhanced Data Rates for GSM Evolution). IMS has been introduced since 1990s but actual deployments are difficult because of requiring huge financial investment and network complexity. The CPM enabler needs to provide the functionality that CPM users communicate seamlessly with other users. A CPM client could be developed as third party applications on smartphones and these applications also should interact with other CPM users as participants.

In this paper, the new technology strategy to expand CPM based services is proposed and the innovative method to generate the new ideas (i.e., TRIZ) is applied to solve the complicated problem regarding CPM service deployment. TRIZ (Teoriya Resheniya Izobretatelskikh Zadatch), that is also called TIPS (Theory of Inventive Problem Solving), is a model-based technique for generating innovative solutions for problem solving (Altshuller, 1996) and it has been developed by the Russian scientist, Genrich Altshuller who have learnt how to invent new things (Terninko, Zusman, & Zlotin, 1998). After his first approach, TRIZ has been evolved as a science of innovation and many companies have adopted TRIZ to solve complex technical problems. A systematic technique of TRIZ is applied for enhancing the CPM standards in OMA (Open Mobile Alliance, 2010a,b,c). This research shows another practical TRIZ approach for the high-tech sector. This paper demonstrate the adaptation of the innovative problem solving process (and tools) for high-tech industry case. Even though, TRIZ has been applied in various engineering and management cases (Regazzoni & Russo, 2009), it is rare to be found in software development area. The paper also demonstrates how to use the algorithmic TRIZ techniques especially in mobile industry. A tractable example in mobile industry gives the guideline for someone who wants to apply TRIZ technique into other high-tech sectors such as Information Technology (IT) and Biotech (BT).

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2. Overview of Algorithm for Inventive Problem Solving (ARIZ)

The acronym of TRIZ (TIPS) and ARIZ (Algorithm for Inventive Problem Solving) come from Russian words. TIRZ is the model based technique to generate innovative ideas and solution for engineering problems. It is one of most practical tools in the systematic innovation (Terninko et al., 1998) and ARIZ, which is a primary part of TRIZ (Altshuller, 1996; Petrov, 2009), is the set of sequential tasks to analyze problem situations and to provide effective solutions by using TRIZ tools (Bukhman, 2012). ARIZ mostly contains 9 parts and 85 step-by-step procedures to solve complicated invention problems (Bukhman, 2012; Marconi, 1998; Yoon, 2008). The name of ARIZ was introduced in 1965 and it had been updated since then and notified the version based on years such as ARIZ-76, ARIZ-77, ARIZ-82 and ARIZ-85C (85B in Russian which meant third revision within year 1985) which was the last modification of ARIZ (Bukhman, 2012). ARIZ has mainly three functions: First, ARIZ is the flow of the questions to find the TRIZ tools which could collaborate to find the best possible solution of the problem. Basically, it provides the indication of which tools to be applied after the problem analysis (i.e., problem identification) step. Second, ARIZ is the analytic algorithm that helps to generate the out-of-box thinking types of solutions. Third, ARIZ is designed to avoid a psychological inertia that usually interrupts to generate a new idea (Bukhman, 2012). ARIZ-85C contains 9 parts (Part 1–9) but Part 1–4 are mainly applied even for complicated engineering problems (Fig. 1).

ARIZ is not only a sequential process but also a recursive process until users get right solutions. The candidate solutions might be generated at the end of each part. Alternatively, ARIZ users might move on to the next part even they could not find any solution. ARIZ-85C Part 7 is the evaluation session for candidate solutions from Part 1 to Part 4 but it could be replaced to other evaluation procedures such as the balance score card and Pugh matrix. In addition, some companies have their own project evaluation systems regardless the projects are based on TRIZ or not. Part 5 and Part 6 in ARIZ-85C could be skipped because these parts are almost same as Part 1–3 in terms of a applied process and tools. Forty (40) Inventive Principles, Separation Principles (for Physical Contradiction), Scientific Effects are applied during Part 5 and Part 6 which are same tools to be applied in Part 1–3. Each part of ARIZ-85C has the following sequences (Altshuller, 1989):

Part 1: Initial Solution Analysis:

1.1. Formulate the mini-problem;
1.2. Define the conflicting elements;
1.3. Describe graphic models for technical contradictions;
1.4. Select a graphic model for further analysis;
1.5. Intensify the conflict;
1.6. Describe the problem model;
1.7. Apply the inventive standards;

Part 2: Existing Resource Analysis:

2.1. Define the Operational Zone (OZ);
2.2. Define the Operational Time (OT);
2.3. Define the Substance-Field resources (SFR);

Part 3: Determination of Ideal Final Result (IFR) and Physical Contradictions (PC):

3.1. Formulate IFR-1;
3.2. Intensify the definition of IFR-1;
3.3. Identify the Physical contradiction for the Macro-level;
3.4. Identify the Physical contradiction for the Micro-level;
3.5. Formulate IFR-2;
3.6. Apply the Inventive Standards to resolve the Physical contradiction;

Part 4: Utilization and Application:

4.1. Simulation with little creatures;
4.2. Take a step back from the IFR;
4.3. Using a combination of substance resources;
4.4. Using voids;
4.5. Using derived resources;
4.6. Using an electrical field;
4.7. Using a field and field-sensitive substance;

This research considers up to ARIZ-85C Part 4 (Part 1–4) because the procedures in ARIZ-85C Part 1–4 are enough to get the candidate solutions of CPM service developments. The evaluation based on the patent search (Part 7) is out of scope because a research evaluation procedure has been followed by other system. This paper has been written based on the research development project of technology adaptation for mobile services (Kim, 2011). The following sessions could be considered as a study case of ARIZ implementation for software implementations in high-tech industry because of the full deployment of ARIZ-85C up to Part 4 (4.1).

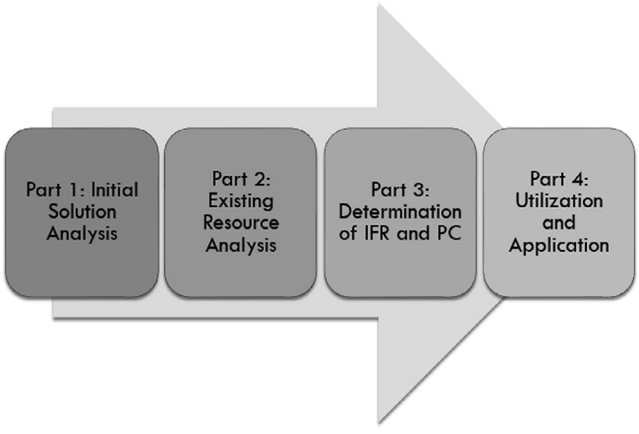

Fig. 1. Workflow of ARIZ-85C.

3. Problem identification

The current problem must be identified more clearly before applying ARIZ-85C. There is a certain procedure to identify core problems on ARIZ-77 but it has been removed somehow after 1980s. Even though problem clarification part has been removed on ARIZ-85C, it is still required to identify core problems before starting to solve the inventive problems via ARIZ. RCA (Root Cause Analysis) is one of commonly used TRIZ tools to identify core problems (*Root Causes*) effectively (Terninko et al., 1998). It is also widely used for the cause-effect analysis in Lean and Six-sigma. RCA is applied to find the core problems of the research. The initial problem which is the starting point of RCA is "*CPM service is not adapting well in the current mobile industry.*" Developing an enhanced Converged IP Messaging client is the target of the project by using the innovative method for problem solving. Unlike usual CPM clients in the standards (Open Mobile Alliance, 2010a,b,c), an enhanced client should be supported not only on IMS networks but also on legacy networks to diffuse a new technology more effectively. In other words, a CPM client should also support messaging services on existing data networks. Otherwise, CPM service could not be launched until IMS networks are fully deployed. So, the