Designing features for next generation technology products – Role of TRIZ tools.

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1. Abstract

The process of designing technology products has to undergo changes in today's high tech industry because of many external fluctuations, complexity of a global market and increased uncertainty. Changing customer requirements, fluctuating market trends and market segments, integrating several technologies, and linking with multiple industries to create a bigger consumer spectrum has made the traditional way of conceiving product features difficult.

This paper is a case study of a **process** to identify innovative features using TRIZ techniques narrating through the feature designing for a telematics and fleet management product. Technology advancements in telecommunication, wireless, and electronics industries are changing the way the automotive industry satisfies its customers. Customer requirements of security, comfort, and resource optimization are forcing the product companies in this segment to design unique features catering to multiple user needs in more than one market.

The specific TRIZ techniques used in this case study includes;
- System Operator, (9-Windows) designing the features looking from a multi super-system level perspective comprising various technologies and markets.
- Defining the actors (different users of the product), and looking at the ideal final results of each actor's needs for defining features
- Law of technology evolution has helped understanding the technology growth in each area and to foresee the future market and consumer needs.
- TRIZ contradiction and inventive principles in the implementation stage.

1.1 Background & Introduction

Product development is becoming more important even for service organizations across the world. The companies, especially from the low cost destination like India and China are playing an important role in realizing product faster. Technology companies, including start-ups, move portions of design and development to service companies across the globe. The expectation from these organizations is now to provide the services for identifying the suitable market segment, creating new features and in every phase in the product conceptualization.

Following are some characteristics of a technology service company to understand the background of this case study.

- o Breadth of knowledge in several technologies and domains, but depth of technical knowledge and expertise limited in few domains.
- o Offering services to multiple customers in different technical streams
- o Quality and time to deliver is the key factor for sustaining business
- o Globally dispersed team and customers result in possible communication problems

The present approach adopted by service companies for product realization revolves around the technical knowledge and expertise of individuals using traditional product requirement design tools and processes. This involves discussion, research, and heavy interactions with the industry experts for identifying the product requirements and market.

This author undertook a project applying TRIZ techniques to overcome many challenges mentioned in this paper for a customer assignment.

The following briefs the technical background and scope of this project.

- o A product using telematics technology - GPS, GSM, CDMA, WiFi
- o Remote vehicle diagnostics using OBD interface, vehicle body electronics
- o The current market targeted to fleet management companies.
- o Identification of new market and customer requirements
- o Passive security management feature for passenger and goods
- o A semi-universal product, catering to multiple market and user needs
- o Low cost, customizable variants ready to be integrated with future technologies

2. Challenges

2.1 Multiple technologies and Market

The product companies in the telematics/fleet management and related space offer innovative products catering to specific set customer needs. Many of them are for location tracking, infotainment, security, theft and espionage prevention and parking assistance. A plethora of new technologies, like satellite navigation, telecommunications (GSRM, WCDMA, WiFi, WiMax), weather forecasting systems, intelligent traffic management and remote diagnostics, impact the product features customers expect in the future. Also the convergence of technology is bringing integrated features, thereby saving cost and increasing usability. As the customer requirements are changing fast along with technology, defining next generation features for a product in this space required understanding emerging technologies and the knowledge about the present market opportunities.

2.2 Limited time and knowledge about the domain

The second and important challenge from a service organization perspective was limited time and knowledge about the domain. Understanding current and emerging technologies, existing market players, trends in consumer and technologies and then realizing the new features would consume more time if attempted in a typical product requirement design framework.

2.3 Cost reduction

Cost reduction is an important phase of product design. Apart from deriving new and innovative features, the implementation of them without increasing the cost is an important aspect in a product life cycle. The causes of cost are many; hardware, components, tools, service, and support from third party vendors. The bigger challenge is to reduce the cost of hardware and components that constitute the product as this is the deciding factor in producing large volumes of the product. The other common requirement of present day product design is keeping multiple functionality. Adding more functionality means adding hardware and software complexities. By scaling up and yet keeping the cost low enough to meet the market target leads to contradictions and dealing with these contradictions in traditional product development process is difficult.

2.4 Product Architecture: Reconfigurability and Modularity

The present trend is to have various flavors of the same product so that it can be sold to satisfy slightly varying customers needs while retaining the same architecture. This brings the challenges of modular architecture that fits all variant customer needs in the telematics/fleet management market. The cost being an important consideration, designing multiple products for variant customer base is not possible.

3. Approach

TRIZ offers several inherent techniques for structured creativity and innovation. We identified the following TRIZ systematic innovation techniques as most suitable and created a process flow to work towards overcoming the challenges mentioned above.

  a. System Operator (9-Windows)
  b. Ideal Final Result and Laws of technology system evolution [Ref 2]
  c. Contradiction Matrix

Although this specific case study is based on the implementation for a telematics/fleet management product requirement design, we felt the process outlined in this paper can be generalized and applied to any product requirement design in a service organization.

3.1 System Operator (9-Windows)

The concept of System Operator helps one to think in time and space in a very simple and concise manner. The 9-Windows technique helped us to identify several elements associated with user needs, current market, technology, user constraints, and also to identify various resources available around the system. The 9-Windows was applied here in two phases, each by identifying an *actor* associated with the product and determining the need and perspective.

The following *actors* were identified based on the expected product usage and the market in which the customer wanted to sell their product.

A. Vehicle – There are different automotive market segments which use telematic products. From a preliminary background search on the web for the existing products and companies, combined with information on our client's target market, the following most important vehicle categories were identified.

> **Trucks & Trailers** – The need for monitoring the fleets on the ground by the fleet management company has pushed the telematic product sales in the recent past. This segment requires capabilities ranging from GPS based navigation system to advanced onboard remote diagnostics. Another requirement is security monitoring of the goods being carried. Sensors based products are available for monitoring the goods from the start to end of the journey.

> **Rental Cars** – Many rental cars are already equipped with GPS navigation systems, infotainment systems and several other services associated with it for passenger comfort and security. Recently the remote customer assistance service like OnStar ™ is becoming a trend in the rental car segment.

B. Drivers – One of the important user categories in this area is drivers. Most of the features in the telematics based products are indirectly targeted to assist the drivers of the vehicle. Features like navigation, weather data, vehicle health notification, traffic assistance, fuel consumption information, and location tracking have been developed to assist the drivers. In each vehicle categorization, the requirements change accordingly.

C. Fleet Management Company – We can not ignore the fleet management company that the vehicle belongs to, as an actor. Managing thousands of vehicles on the road is a challenging task, and this market potential has driven the creation of a large number of products to satisfy this customer base.

3.1.1 System Operator – Phase 1

In the System Operator phase, each actor was considered as part of the present system (Fig 1) and we started analyzing the elements and functions associated with the vehicles, fleet management company and drivers in each space.

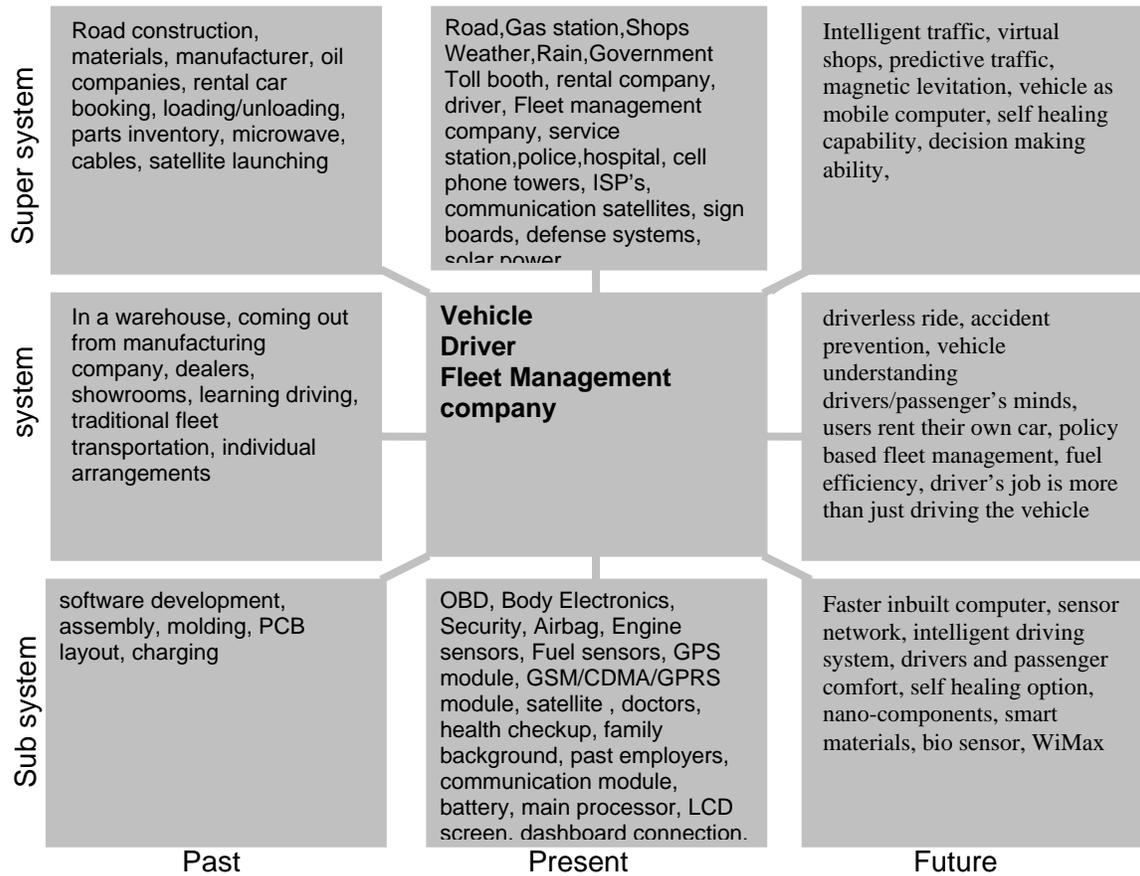|	Past	Present	Future
Super system	Road construction, materials, manufacturer, oil companies, rental car booking, loading/unloading, parts inventory, microwave, cables, satellite launching	Road, Gas station, Shops Weather, Rain, Government Toll booth, rental company, driver, Fleet management company, service station, police, hospital, cell phone towers, ISP's, communication satellites, sign boards, defense systems, solar power	Intelligent traffic, virtual shops, predictive traffic, magnetic levitation, vehicle as mobile computer, self healing capability, decision making ability,
system	In a warehouse, coming out from manufacturing company, dealers, showrooms, learning driving, traditional fleet transportation, individual arrangements	**Vehicle Driver Fleet Management company**	driverless ride, accident prevention, vehicle understanding drivers/passenger's minds, users rent their own car, policy based fleet management, fuel efficiency, driver's job is more than just driving the vehicle
Sub system	software development, assembly, molding, PCB layout, charging	OBD, Body Electronics, Security, Airbag, Engine sensors, Fuel sensors, GPS module, GSM/CDMA/GPRS module, satellite , doctors, health checkup, family background, past employers, communication module, battery, main processor, LCD screen, dashboard connection,	Faster inbuilt computer, sensor network, intelligent driving system, drivers and passenger comfort, self healing option, nano-components, smart materials, bio sensor, WiMax

Fig 1

At the sub-system/present level we looked at the components and technology; at the super-system/present, we see the environment that the vehicle belongs to, such as service centers, roads, weather, gas stations, government, people, and so on. For the drivers, the sub-system/present was considered as the driver's health, expertise in general, family background, track record; at the super-system level, we could sense that medical history, habits, past employers, criminal record, etc., might play some role in creating new features for the product. Although the past of each actor was looked upon through System Operator, the current and future needs were considered for further brainstorming to create new features.

Also considering the system/present as need of drivers, vehicles and fleet management companies, we looked at the past and present to understand how the system has evolved in time. Analyzing these details through 6 thinking hat ™ discussion process gave new ideas related to future requirements.

For a fleet management company, the sub-system/present emerged as the vehicle, driver, parking space, etc.; present-system level comprises competitors, technologies, and products currently available. At the super-system, government rules and regulations, back

office operations, customers, security of the goods being carried, quality of service, return on investment, etc., were given importance.

This step of System Operator usage revealed several potential resources available at the super-system that is associated directly or indirectly with the vehicles, drivers, and the fleet management company and the evolution of needs in each user category. Eventually this brought a good visibility to us for the features that could be derived for the product.

3.1.2 System Operator - Phase 2

Before starting the second phase of System Operator, we analyzed the data collected from the web search about the existing market players, products available, and few of the features offered to the customer. Having said that the area of telematics is big and wide, we narrowed the search to selected markets and the associated technology. Each helped us to identify the technology being used therein, features that most of the products offer currently. During the 9-Windows representation, we placed some of the features of existing solutions in the system present and started looking at the constraints from each actor's (vehicle, driver, and fleet management company) viewpoint. (Fig 2)

In this phase we wanted to identify better features than the current players offer in the market.

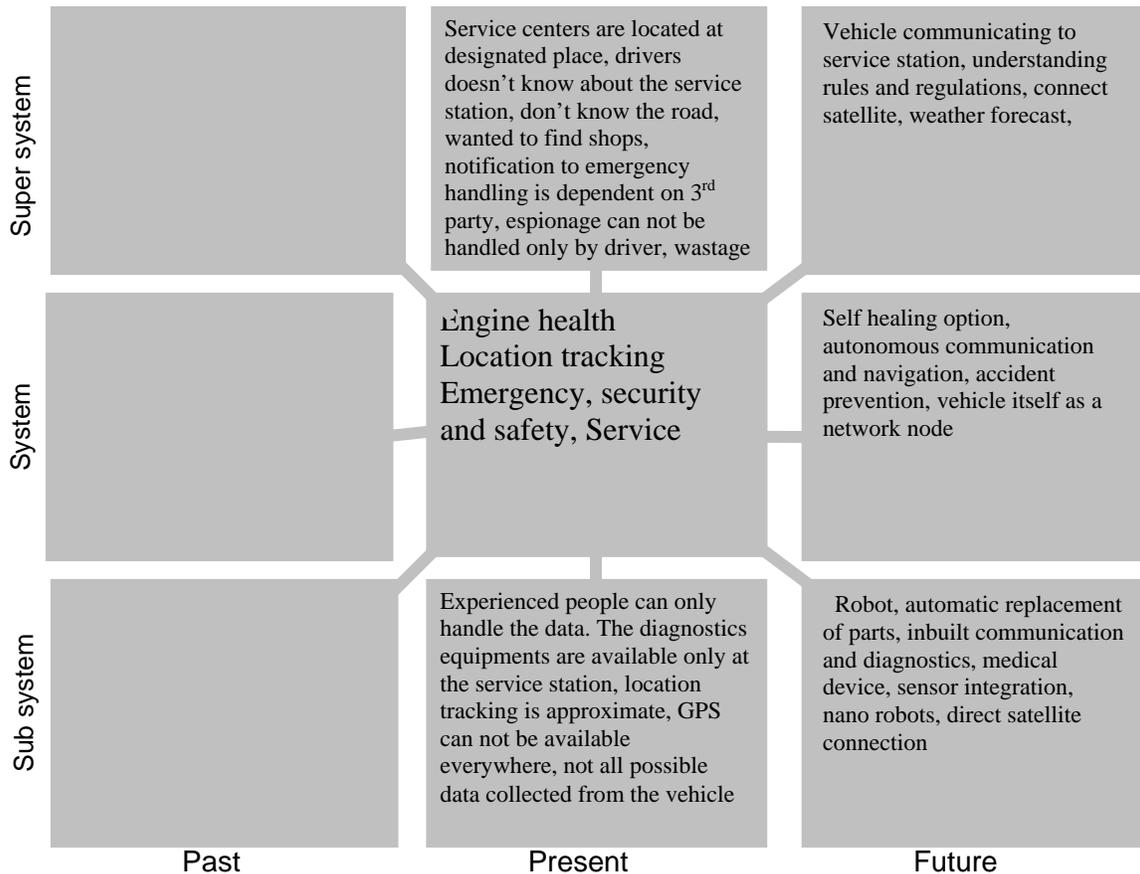|	Past	Present	Future
Super system		Service centers are located at designated place, drivers doesn't know about the service station, don't know the road, wanted to find shops, notification to emergency handling is dependent on 3rd party, espionage can not be handled only by driver, wastage	Vehicle communicating to service station, understanding rules and regulations, connect satellite, weather forecast,
System		Engine health, Location tracking, Emergency, security and safety, Service	Self healing option, autonomous communication and navigation, accident prevention, vehicle itself as a network node
Sub system		Experienced people can only handle the data. The diagnostics equipments are available only at the service station, location tracking is approximate, GPS can not be available everywhere, not all possible data collected from the vehicle	Robot, automatic replacement of parts, inbuilt communication and diagnostics, medical device, sensor integration, nano robots, direct satellite connection

Fig 2

From the application of System Operator in each perspective, a bigger knowledge base was created for the products; - the current constraints and unused resources available around the system in telematics and related areas were noted. A mindmap was created to represent them visually [Fig 3]
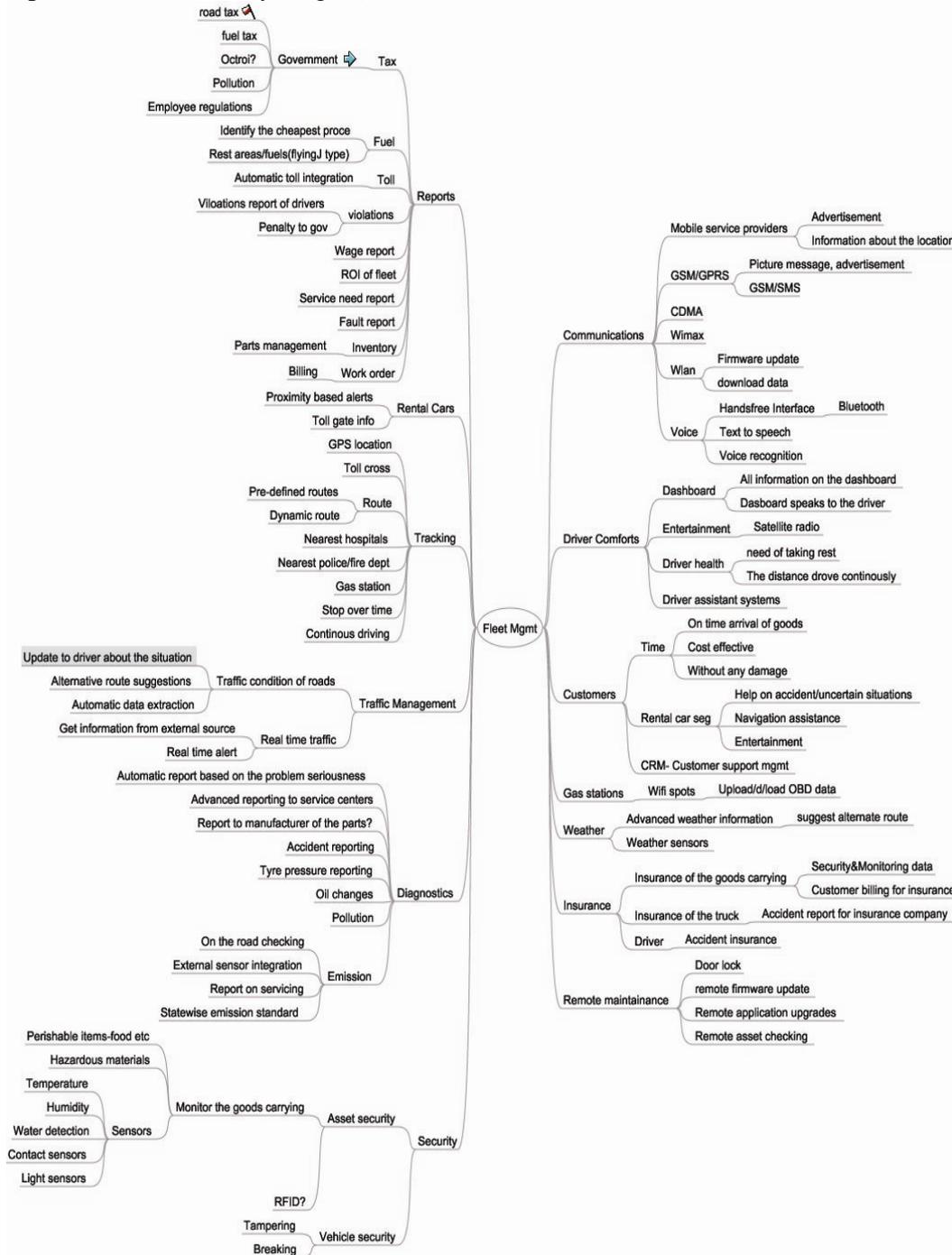

Fig 3

System Operator gave us a *sub-system level and super-system level* view and revealed the potential in designing new features by using the untapped resources around the system. The following section illustrates the approach to design new features.

3.1.3 Extracting Resources

Some of the available resources were found unused or used ineffectively in the present system;

- o Sub-system resource: Communication channel (GSM/GPRS/CDMA) - This communication channel is used only to transmit data to the central location on a need basis.
- o Super-system resource: The service provider – Along with the above sub-system resource of GSM/GPRS/CDMA, the service providers offering the communication service also has not been used effectively.
- o Stop-over – Gas stations, restaurants, hotels – The need of fuel refill and refreshment takes a driver to these locations. These resources are used for the immediate need, and may serve other purpose by utilizing them effectively.
- o Driver's data – The medical history of the driver is used in the initial phase of employment. However this can be reused to provide better working conditions to the driver.
- o Service stations – The service stations are associated with a vehicle only when it reaches there.
- o Driver – A driver can do more than just driving.

3.1.4 Constraints

Some of the constraints were identified from the driver's perspective

- o When driving through an unfamiliar place, a driver lacks information on shopping centers, available offers, good deals, etc. Specific to rental car drivers
- o Waiting time increases for immediate service needs
- o Diagnostic equipments are available only at the service station
- o Service centers do not have corresponding parts for repairing

At the end of the System Operator exercise new features were derived by associating the constraints, the sub-system elements, super-system elements (present and future) and the unused resources. The following describes one of the features derived.

Proximity based advertisement. As the car equipped with the device travels through a shopping locality, the driver gets picture messages on the LCD screen with information on shops 200 meters ahead, the special discounts offered, and the directions to get there. The existing service provider of the mobile communication will be used to transmit this data, and the product installed in the vehicle will display this. The proximity of the shop is located through the GPS coordinates controlled by the central server.

3.2 Ideal Final Result (IFR)

According to TRIZ, ideal system is a system that does not exist yet. However, increasing degree of ideality of technological system is visible since last decade from the emergent of technologies. New products, systems and methods being developed for the market clearly show the increasing ideality of its functions at a great extent. We felt the need for IFR as an important technique to derive unique and innovative features for the future needs of the customers in this product.

The IFR was applied by looking at the existing data captured from the web about similar leading telematic based products available in the market. As in a typical S-curve, existing product features can further travel to the ideality thus achieving more functions without extra cost or harming anything. In order to get the maximum benefit from applying IFR, we found that the best approach is to consider each actor defined earlier and create one feature combining for all that could be the ideal final feature for them.

The following template describes this approach in detail.

Need	Helping driver/passenger immediately if an accident occurs	
What is the final aim?	Driver	Get immediate help if an accident occurs
	Vehicle	Collect the data about the accident, who is responsible and damage
	Fleet management company	Know where the accident occurred, extent of damage and provide fixes.

Need	Helping driver/passenger immediately if an accident occurs	
What is the ideal final result outcome?	Driver	Real time information about the accident goes to the respective people who will bring help
	Vehicle	Send the collected data of the accident and damage to somebody to tell them about repairs needed
	Fleet management company	Automatically inform the parties who will bring help to the passenger and vehicle

Need	Helping driver/passenger immediately if an accident occurs	

What stops us from achieving this IFR?	Driver	He might be badly hurt and/or unconscious
	Vehicle	Only collects the engine health data, fuel related data. Don't know when the accident happened, and other collected data (engine health etc)may not be due to the accident
	Fleet management company	Don't know the details of hospitals, mechanics, police etc. in the area.

Need	Helping driver/passenger immediately if an accident occurs	
How could we eliminate the above obstacle from the system?	Driver	"Take out" the responsibility of informing the parties from the driver and have somebody else to do that.
	Vehicle	Have "somebody" inform the vehicle about the accident and then the vehicle collects other data such as engine health etc to send across
	Fleet management company	Have a detailed repository of the police stations, hospitals, mechanics of all locations that the vehicle may pass through

Need	Helping driver/passenger immediately if an accident occurs	
What are the resources available?	Driver	Vehicle itself, the existing communication technology used in the telematics and fleet management products (such as GSM, GPRS, WiFi, CDMA), police station, medical services, ambulance, people, timer, clock
	Vehicle	The data of airbag deployment and crash sensor data through OBD
	Fleet management company	GPS data received from the vehicle to identify the location, contact details of hospitals, police, fire station, and service technicians in the area where the accident occurs

Current products available in the market provide several features associated with safety and security for trucks/trailers, rental car customers, theft, loss of valuables etc. Looking at this requirement through the IFR framework and thinking through the law of technological system evolution guided us creating a feature that could further mature the functionality.

We found the following resources available to implement the safety and security features.

- o At the sub-system level, there are crash sensors and air bag deployment status available through OBD control. The product has GPS for location tracking and GSM/CDMA/GPRS as the communication channel inbuilt.
- o At the super-system level we looked at the roads the vehicle passes through. The service stations, police stations, and hospitals in the vicinity, telecom providers, communication towers and satellites were considered as other resources.

Considering the safety and security of the passenger as the requirement while he is on road, we figured a new and automated way of intimating the police and hospital without a third party involvement. Here, the product that goes into the vehicle can sense the deployment of airbag or activation of crash sensor, and this data along with the location data can be sent to a central server. A database is available in the data center with GPS coordination and the police stations/hospitals/fire stations around that place. Once a crash sensor or airbag data is received by this central server, the system identifies the police station/hospital and also the nearest service center through a policy created by the fleet manager/administrator.

Inline with the same requirements for asset tracking for trucks and trailers, another feature involving the sensor network was derived. An external sensor network (any type of digital or analogue sensor for temperature, chemical leak detection, glass breaking sensor, proximity sensor, etc.) will talk to the product installed on the truck and pass the information to the respective authority in case of a breach.

3.3 Laws of technological system evolution

The following known laws of technological system evolution were also looked at to ensure that the ideal final features are inline with the trends. [Ref. 2]

- a) Law of increasing degree of ideality
- b) Law of transition to higher-level system
- c) Law of increasing the dynamism (flexibility)

3.3.1 Law of increasing degree of ideality. This primary law of system evolution explains the increasing degree of ideality in a technological system. The degree of ideality is related to the benefit-to-cost ratio. [Ref 3] Considering the telematics and fleet management system, the law of increasing ideality is clearly visible in the current products available in the market. Many functions like location tracking, communication, data transfer has become less complicated and convergent with multiple technology spectrum has forced creating new features to the customers available at low cost. A typical GPS tracking system in a car integrated with digital entertainment and satellite radio is a good example of increasing degree of ideality in this spectrum. We found that this underlying law of increasing degree of ideality can be applied on each actor's needs (user needs) for creating new unique features across the product. Listed below are some of the thought processes applied to forecast the future.

- o Location tracking may no longer be a "nice to have" system for a vehicle. Emergence of technologies like Wi-Max could bring down the cost of location tracking on a mobile phone.
- o A personal device may replace many of the user actions related to location tracking, personal entertainment, navigation, early warning systems, weather forecast etc more convenient and pre-programmed.
- o A vehicle will become a mobile networking node with more computer power integrated to it, dynamically updating the configuration depending on the road condition, terrain and weather all without bothering the drivers and provide more comfort and security to the driver.

3.3.2 Law of transition to higher-level system

This law explains the evolution of technological systems as the increasing complexity of a product/feature and multi-functionality. It was interesting to study the mono-bi-poly trend in the technology related to this system and to try to figure out what else can move along in this line. This law was used at the sub-system level, to identify whether any of the existing hardware and components can traverse further to higher level systems and achieve more functionality. The following sections of a telematics/fleet management product were looked at:

- o Processor designed for single function achieves multiple features.
- o Using internal bus to transfer data
- o Using the processing power to process data collected onboard instead of sending to the remote location for processing

3.3.3 Law of increasing the dynamism (flexibility)

The product trends show us the typical process of technology system evolution is based on the dynamization of various components, functionalities, etc. Moving from a rigid mode to a flexible mode, a technology system can perform more functionality and can also adapt to the changing parameters and environment with ease. In this case study, the following area was looked at through this law of technology system evolution:

- o External product integration – Plug n play devices can interact with vehicle to increase the functionalities.
- o Vehicle satisfies other need of driver, passenger – Bring news, forecast, financial market statistics, virtual office.
- o Vehicle communicates to the government; update the rules & regulations, report violations of driver and security threat.
- o Medical devices integrated in the vehicle check driver's, passenger's health condition report the doctor, hospitals.

3.4 Contradictions

3.4.1 Cost Reduction

The contradiction is visible here as "**We should implement maximum features derived**" Vs "**The cost of product should not increase drastically**". Incorporating maximum features will increase the need of high speed processing power, battery life, communication bandwidth, data storage capacity, and other cost involved in manufacturing them, developing software, and testing. The final result of compromising one of them impacts the market opportunity for the product. Mapping this specific contradiction to TRIZ business contradiction, [Ref 1] we got the following parameters.

What Needs to be improved?	What is getting worse?
Implement new features derived	Cost and effort will increase
Parameter 1 - R&D spec/Capability/Means **Parameter 6 - Production spec/quality/means**	**Parameter 2 - R&D Cost** **Parameter 7 – Production Cost**

The TRIZ business contradiction matrix suggested the following TRIZ principles.

What Needs to be improved?	What is getting worse?	Suggested TRIZ principles
Parameter 1 - R&D spec/Capability/Means	**Parameter 2 - R&D Cost**	Takingout(#2),Asymmetry(#4), Dynamization(#15),Enriched Atmosphere (#38)
Parameter 1 - R&D spec/Capability/Means	**Parameter 7 – Production Cost**	Relative change (#37), Parameter Change (# 35),Prior Action (#10), Local Quality(#3), Universality(#6)
Parameter 6 – Production Spec/Quality/Means	**Parameter 2 - R&D Cost**	Merging (#5),Taking Out(#2), Cheap disposable (#27), Segmentation (#1)
Parameter 6 – Production Spec/Quality/Means	**Parameter 7 – Production Cost**	Dynamization (#15), Self Service (#25) Local Quality (#3), Prior Action (#10), Merging (#5), Counter Balance (#8)

From the above suggested TRIZ principle, we identified the following principles relevant.

Principle 10 – Taking Out.

a. Separate an interfering part or property from a system or object, or single out the only necessary part (or property)

Principle 10 – Prior Action

a. Introduce a useful action into an object or system (either fully or partially) before it is needed.

The current hardware architecture for the implementation was based on two processors. One that takes care of the data processing, communication to the central server and other one that interacts with the vehicle OBD interface.

Applying **Taking Out,** principle # 13, to reduce the cost resulted in removing the processor required for vehicle interface, but uses another system to achieve that function. With this approach we were able to come up with a multiprocessor architecture and introduced a low cost processor that takes care of the vehicle interface functionality. Adding this component saved the BOM cost of $14 compared to other architectures which were thought of.

Principle # 10 – **Prior action** gave us an insight into pre-configured modules at the central server units. The concepts of policy based alarm systems, pre-configured database of location based service center, hospitals, and police stations were derived.

3.4.2 Reconfigurability and Modularity

During the process of new feature development, we identified multiple customer segment associated with a single product. Here, the challenges involved is not developing multiple versions of the products, but catering to different customer base revealed the following contradiction from the TRIZ technical contradiction table. [Ref. 2]

What Needs to be improved?	What is getting worse?
Adaptability, flexibility, usability and configurability	Ease of manufacturing
The extent to which a system/object is able to respond to external changes. Also, relates to a system capable of being used in multiple ways or under a variety of circumstances. Flexibility of operation, use and customizability"	"Issues related to manufacture, fabrication and assembly issues associated with an object or system"

The contradiction table suggested the principle 1 (segmentation), 13 (Other way around), 31 (porous material). We found the following principles relevant.

Principle # 1 – Segmentation

a. Divide a system into separate part of section
b. Make a system easy to put together and take apart
c. Increase the amount of segmentation

Principle # 13 – The other way around

a. Use an opposite action(s) used to solve the problem
b. Make movable objects fixed, and fixed objects movable
c. Turn the system, object or process upside down

Single product Vs multiple customers segment and different cost – The important aspects of this contradiction had to resolve the issues related to not having all features for all customers and the same product should be sold at different cost. The product should be sold to independent car owner, fleet management company and rental car companies. In each segment, not all functionality of the product would be used by the customer, and the cost is an important factor deciding the customer purchasing the product depends on what features it is offering to them.

Principle # 1, with this principle we came up with an approach to implement two PCB boards, one circuit board with the main components (Processor,) and other board (Communication board) which is configurable for various market needs. This helps not only to meet the market needs but also to maintain / configure the product with change in the technology of the communication, for example if we need to add WiMAX, it is easier to redesign only this board and keeping the other. This reduces the design time as well as upgrading the products in the field.

Principle #13, "The other way round", helped us configuring the product for various user displays. Keeping the existing architecture it is possible to use different kind of display from simple LEDs, low cost alphanumeric display to a high end touch panel display.

5. Output

The objective of this project was to create a process that can be re-used in product development using TRIZ techniques in the similar scenario. The time and knowledge factor being a concern in the service company, how TRIZ techniques like 9- Windows and IFR can help for a structured thinking and ideation process in technology product development cycle became a key motivation to conduct this exercise. Another important objective was to force thinking not just new ideas and feature, but how to implement them without increasing the cost and effort.

The following table lists each techniques and the respective usage of them in this context.

Techniques	Usage	How it helped
System Operator (9-	Looking at the big picture of	Get rid of Ad-hoc thinking

Windows)	market, customers and products. 2. Understanding the consumers and technology trends in the relevant area. 3. Identifying possible resources, directly and indirectly associated with the products and users, inside the product and out side. 4. Identifying the constraints in current product offerings – Present and future at the system and super system level. 5. Deriving new features by looking at the resource availability and associating them together.	by defining a boundary that was stretchable. Able to easily identify the emerging technology by looking at future Identified several available resources not being utilized fully in the system to use with the super system elements and developing new feature. Forced divergent thinking within the scope of the system
Ideal Final Result (IFR)	1. Deriving common feature for identified user segment. 2. Exploiting the existing resource to make the feature implementable.	Convergent thinking process based on what is required and how it can be implemented Easy questionnaire helped engineers not exposed to TRIZ thinking "ideality"
Contradictions	1. Implementation of the new features without increasing cost 2. Reducing the complexity 3. Increasing modularity and configurability.	TRIZ principles helped a forced thinking for hardware design and architecture. Applying the principles in sub system, system and super system to reduce the cost of hardware, modularity, configuration
Laws of technological evolution	1. Effective brainstorming by adding the law of technological evolution in the scope of the project. 2. Forced association of elements identified from System Operator to validate the future trend.	Ability to dive into the technical domain associated with the product. Out of the box ideas that can be implemented in the future.

Fig 5

6. Conclusion

This case study showcases one of the processes of using TRIZ systematic innovation tools and techniques in designing technology product from a product development service company perspective. Although there are several case studies and possible implementation of TRIZ techniques in product design, this case study focuses on the processes followed in order to achieve the final outcome from recent phenomena of globally dispersed product development strategies.

TRIZ, looking beyond innovative problem solving approach offers wonderful techniques in structuring the out of the box thinking. 9-Windows, Ideal Final Result, technology evolution all emerge here as useful techniques to apply in different context of the problem domain.

The result of this project also revealed the need of other suitable techniques in the product development process in conjunction with 9-Windows

9-Windows can help extracting resources and elements associated with the system-present. However, it required effective brainstorming to create association between the elements and resources. Can there be a technique which could help this from TRIZ angle?

Reference

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2. [2003 – D. Mann – Hands on Systematic Innovation – Technical – IFR Press]
3. [2006 –Fey & Rivin, Innovation On Demand – Cambridge Press]
4. [2006 – On the Soft Side of TRIZ – Jack Hipple – Altshuller Institute of TRIZ studies]

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