GPS Technology & Smart Phone Interoperability for Situational Analysis Support

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Abstract

Hands on training is the most effective way to learn Combining live video chat and GPS technology could soon enhance live fire training to equal the effectiveness of fully immersive motion simulators. These enhanced features would allow real time objective monitoring and instructor feedback. Managed Information Systems could then analyze the data collected for use in the After Action Review (AAR). Collecting data from the two devices then applying analytical processing real time with Oracles Express Analyzer would provide feedback on previously unseen maneuvering relationships.

Keywords: Training scenarios, Management, GPS technology, Smart Phones, Electronic Teaching Aids, Field Support Systems, Combat Maneuvering Scenarios, Management Training Systems, After Action Review, Situational Analysis Tools, Situation Awareness Improvement and Modeling & Simulation.

Description of the Configuration

Conducting training scenarios in live fully immersive fire range training with GPS tracking and Smart Phone technology may be the wave of the future. These live training scenarios require students to physically navigate through a terrain, interacting with electronic sensory cues. Training enhancement cues such as pop up targets and live explosive devices would offer increased training effectiveness if early threat identification and continuous instructor live chat feedback were available. The instructor would be able to answer immediate questions, relay the locations of live threats and the software would record student reaction times.

Government training typically requires a training management system. A well developed system provides a method for documenting and sharing projects, tracking the achievement of learning objectives, reinforcing the link between class work and real-world engineering concerns, and encouraging students to reflect on their own learning processes (Oblinger 2007). Full motion aircraft simulators such as L-3's Link Simulator, currently utilize this type of capability. (Oyler, 2007)) Providing instructor interaction to open terrain simulations would benefit from this similar configuration through the concept of adding live video chat and GPS reporting capabilities. The scenario based data could be relayed to a wrist worn device allowing for the student to chat with the instructor, allow the instructor to monitor and track situation awareness while the student maintains full range mobility.

Worthy of filling these two requirements are the Smartphone device and Oracle Maps. An additional application required behind the scenes would be software such as Oracle Express to gather and analyze the real time location coordinates & reaction data. The only aspect that is difficult, although not impossible to emulate real world events, is in having the threat marked with a GPS tracking device. The concept of adding a GPS tracking device to a known threat might create negative training if it were impossible to add GPS tracking to the real world threat. This might lead to social, ethical and broader organizational issues.

Do real world criminals or know terrorists automatically require embedded tracking devices? Does this database link to the FBI, CIA or local police records database? How much info are we allowed to share on criminal and known terrorists and with whom or when? Otherwise adding GPS tracking to simulation exercises of known threats in a mapped environment might be like shooting ducks in a cage.

Software Considerations

Live video chat such as the Skype application is an efficient way to relay live video chat data with 256 bit encryption. (Chugh, 2010) The capability for the video chat to time stamp student reaction times would allow an automated analysis to compare the data to expected reaction times. Oracle Express Analyzer features a collector tool to gather performance data by tracing function calls and collecting profiling data for applications written in the Java™ programming language, including clock-based profiling. (Oracle, 2010)

An added interactive application providing GPS coordinates of both the student and simulated threats would give the instructor more control over successful learning. Oracle Maps is tool used to track GPS location tracking events. The GPS coordinate could then be sent to an Oracle database for real time coordinate plotting. (Oracle Dashboard, 2011)

The application portal provides the whereabouts of users at the current time as well as a history of the identified marks location, key performance information like speed, bearing and altitude. (Oracle, 2012). The instructor student video chat and GPS location reporting data would be invaluable situational awareness improvement information if relayed to the student during training. The Smartphone would be a wrist worn device with GPS tracking, providing full range mobility during the training exercise.

Oracle Application Express has presentation graphics for charts to the instructor for real time data analysis. There is potential for the instructor to not only view student reaction times but also the location of upcoming threats. The data processing capability collects statistic on the number of rows, the number of empty data blocks, the number of blocks below the high water mark, the average data block free space, the average row length, and the number of chained rows in a table when the Oracle ANALYZE TABLE command is performed (Burleson, 2012) Using this data instructors and or the after action review team may identify previously unseen relationships in training maneuvers particularly when a new variable or multiple role players are involved.

During deployment instructors could chat with the student as they walk through the exercise to relay success and or potential cue for threats in the field. Identify and record timed events in the simulation. The data collected during the training exercise would also be invaluable review material used during the After Action Reviews, which is a requirement for most service based simulations.

The main reason these technologies are not yet integrated into live simulation training exercises is due to the lack of control over Information Assurance exchange. There would need to be an encrypted GPS capable of securing Information Assurance protected data, which is costly to implement. To add to the lack of maturity are current business practices.

Another reason this configuration is not in current use is due to business process models in place. Current live fire training facilities typically use 20th century technology, lacking the ability to record and analyze training data. Range capabilities typically only require the distance for anno to travel and terrain descriptions. (Stone, 2008) Additionally some training systems continue to monitor effectiveness with pen and paper role playing questionnaire spreadsheets. This requires the analyst to physically comb through the data collected for the After Action Review. Most current live fire facilities do not provide measurability of student reaction times nor situation awareness improvement.

Process Management – Information Technology Infrastructure Library

The second most significant aspect of this trisect configuration is the Data Warehouse required to organize collected data. If the Data Warehouse is not driven by a controlled process especially in a variety of diverse systems, intrasystem problems may arise such as:

- homonyms--Different columns with the same name.
- Synonyms--The same column with different names.
- Unit incompatibilities--Inches versus centimeters, dollars versus yen, and so on. (Burleson, 2012)

Maintaining the integrity of established business rules that span operational systems may be identified with process identified with Information Technology Infrastructure Library toolbox. The principles are based on the service design, transition and operation including failures and service disruptions. The question an industrial engineer might ask are:

- What unexpected impact to day-to-day business operations avoided?
- What cycle time for change reduced significantly?
- What changes may be achieved faster and cheaper, driving additional value. (Kneller, 2012)

These tools allow in the Industrial Engineer to maintain a consistent set of analysis criterion for a baseline and evaluating process.

Integrated Project Management

Orchestrating the project management end of the warehouse has its equal if not greater challenges which cover the front end to back end planning. Implementation of plans are organized in the Infrastructure Library which include implementing established, systems engineering models. These models identify interest from the multiple disciplines, (development, operations, and support) allowing collaboration with common goals needed to maximize utilization of resources. (Bardoloi 2012):

One main question that will pull the different services or even one service unit 's organizational together is how to get all requirements in alignment when everyone has their own vested interest. This process may continually updated by asking basic Industrial Engineering question such as:

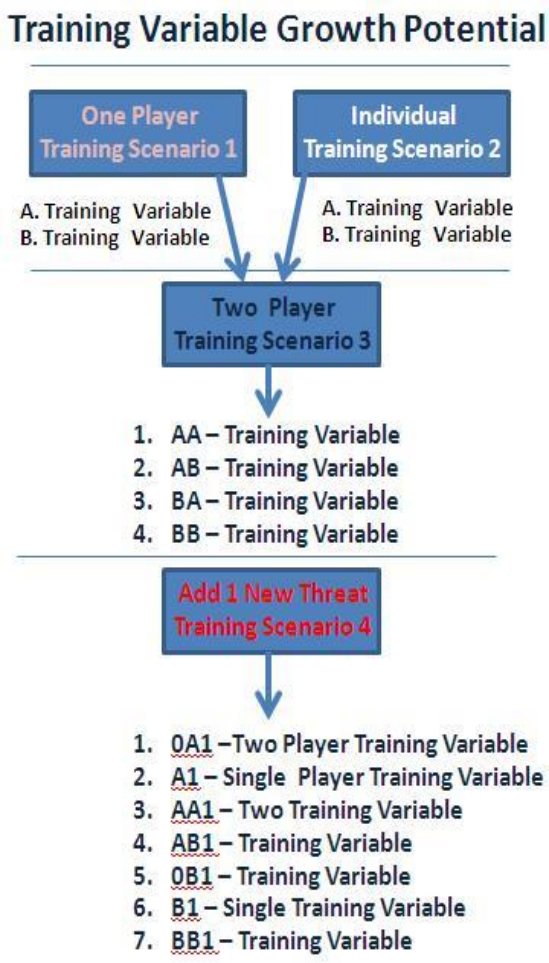
- 1) what are the course and class requirements for each of the service locations?
- 2) what criterion constitute passing a class or course for each government service?
- 3) What are the different services processes for the student to transition to the next level of training?

Organizing data allows us to identify what requirements are consistent between the services and to establish baseline metric. Question should be embedded in the data analyzer such as : Why is it taking one control group longer to identify a threat or reload the weapon that other control groups? We will be able to analyze this data within on e unit and between the various military base location results.

This organization will also allow us to identify relationship based search engines. System queries either automated or user initiated may retrieve results from single and multiple player scenarios and single to multiple threat impact results. The same data will be used during the verification stage to analyze training requirements against the budget milestones, address programs risk and provide feedback on previously unseen objectives, partnering or software related relationships.

Objectives must be managed in a quantitative configuration management system with non overlapping sections previously identified by all stakeholders. This dimensional model might include a list of qualified scenarios expected results per base requirements and the subcategories would include a hierarchy of qualified students who were allowed to be assigned to the scenarios. Using dimensional systems allows endless subcategories to be assigned to the established dimensional categories. . There should also be a process for foreign keys as unplanned objectives arise.

The Architectural design must allow for the expanding probability of results to include variable control since the system is not indented to analyze just one set of data. The following diagram illustrates how exponentially the systems capability grows by adding multiple players and or multiple threats. Adding just one threat doubles the objective results. This allows planning for unseen variables. Using this sampling method it is obvious that as the student population grows the amount of data to be measured increases.



Project management should practice a benchmarked timeline where analysis provides a review and approved process to update the system. Different interpretations of process maturity and an infrastructure systems will arise during the life of the IT environment being managed. A mature process definition establishes guidelines for decision making support typically by Integrated Product Teams, establishes who documents processes, changes and identifies how the

information is properly controlled. Another option for IPT structure is to use the IEEE Std 1220-1994 on Systems Engineering. This standard proposes the use of a Systems Breakdown Structure (SBS), defined as "a hierarchy of elements and related life-cycle processes used to assign development teams, conduct technical reviews, and to partition out the assigned work and associated resource allocations to each of the tasks necessary to accomplish the objectives of the project. (DoD, 1998)

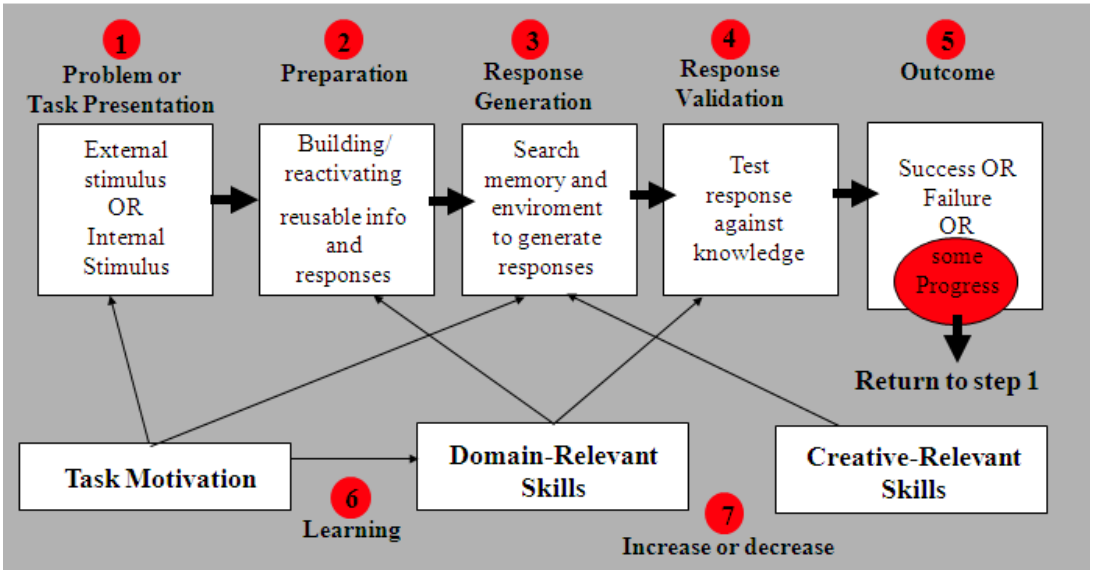
Each Integrated Product Team focuses on different aspects of the data requiring the industrial engineer to label and categorize those requirements and their interaction the system. In an ideal arrangement this Smartphone and GPS embedded technology would start with a mature business process model that has the scope of Six Sigma scope for identifying deficiencies in the system. The six sigma tools are to ;

- Define differences in desired outcomes and results
- Measure how data is gathered and analyzed
- Analyzing the preliminary ideas
- Improving root relationship designs and finally
- Controlling how new design are implemented (Crown, 2004)

During an analysis phase it is important to identify and document if new process is implemented correctly and resolving what created the gap in the first place. One question might be to ask "Has the systems or student performance changed or have the standards changed?" The breakdown in those processes will show that management is aware of what's done, who is working what, if the requirements are being met and what future work is proposed. Management would be required to establish and monitor administrative disciplines to ensure the efficiency of the system is not lost to increasing administrative duties.

Project Planning for Continuous Improvement

Project Tracking for the system capabilities must be based on a continuous evaluation of the collected data. Here we are able to determine if the combination of applications continuously meets the needs of training compared to the original



intended use. Following the principles of maturity usability the previous illustration shows the need to determine is task are dominant oriented concepts building on the expected outcomes. (Law, 2012). Learning may result in identifying relevant and creative skills et results.

If the system engineering processes established in the requirement management phase are implemented then risks such as not knowing what tasks have been completed over time can be avoided. It is especially important as the system matures, to integrate previously collected data into an upgraded system, Determining if objectives met in the past continue to meet requirements in updated systems may be regulated. A continuous improvement process would allow for evaluating service based requirements according to the required training /usage data an ongoing system changes.

Finally the architecture should be designed with an open ended capability for interoperability in case the proprietary software changes considerably or has difficulty integrating with the three application over the lifecycle.

Organization & Business Challenges

The challenge is any system are to verify if improvements have been made and is the system meeting its goals. This may be address with the action points we established early in the configuration management process. A few key question to consider would be have the categories for training or software changed and are the result reflecting what the objectives intended to prove?

- Who are the organizations managing the dimensions
- Have the requirements for training elements changed
- Has the security system been maintained overtime ensuring student information is private and secure. During configuration changes where interoperability is an issue there may be compromises to the system.
- Is the database ontology consistently suitable for a training management system as the system matures.

Process Management Improvement

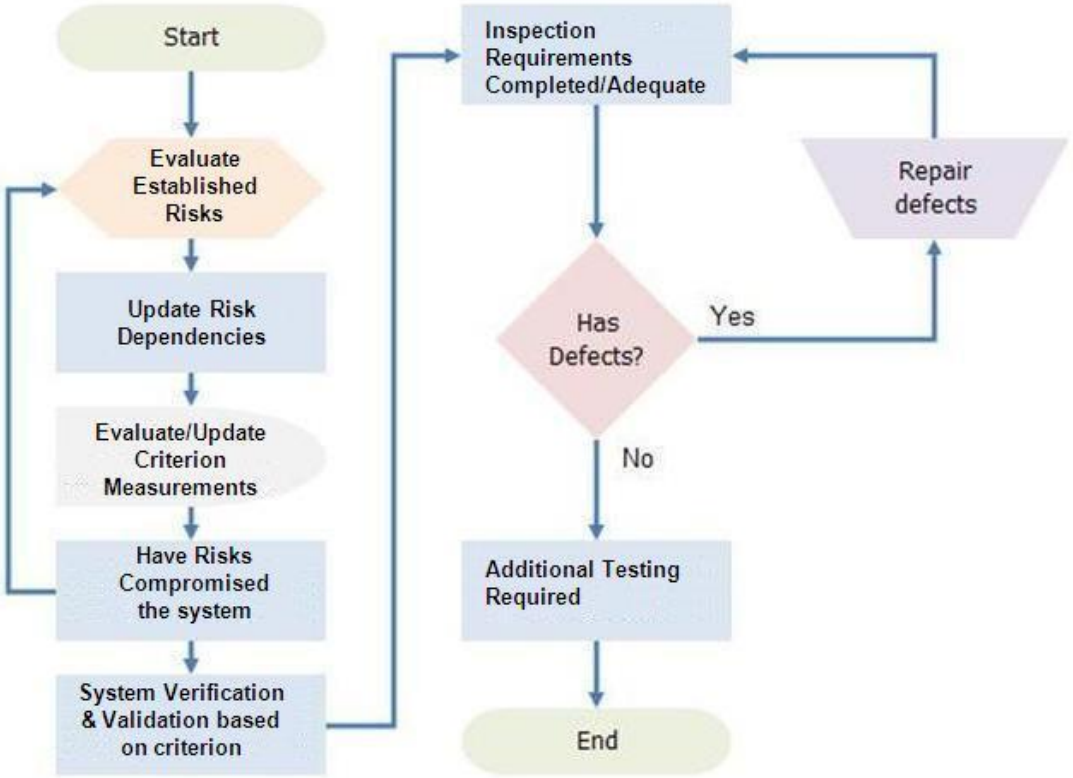
As the system matures process management should follow a CMMS (Capability Maturity Model Integration) to identify benchmarks required to advance. Otherwise, the system may be dissected to the point of no use by politically vested interests of the different Integrated Product Teams. Management, shareholders and engineering should agree to stands for configuration management and policies regulating the system as the system matures. Research shows that a systems organized by CMMI Level 1 processes, typically suffer from poor project management with difficulty quantifying development progress, inconsistent estimates and inconsistent results between projects or people. (Meek 2010). Poor configuration management and the inability to quantify development of the system may be alleviated by advancing to a level 2 organization.

Configuration management is defined as the control of configuration items (VIs, configuration files, test plans, requirements, process guidelines, etc.) from design through retirement. Signs of poor configuration management are previously fixed bugs returning, overwriting software changes, inability to know which version belongs in a baseline, inconsistencies between two "identical" stands, and the inability to duplicate or modify software years in the future. Software applications which can manage the problems are plentiful including Labview/Vista. (Meek, 2010). Creating a working environment where test and evaluation according to system engineering process is an invaluable too to advance to a system that has proven Level 2 capabilities which are tested and most important, repeatable. (Meek , 2010)

Risk Management

Planning vulnerabilities in a distributed network for the services requires inviting representatives in from the government teams to discuss and review the practices and strategies. Operational strategies do include the verification and validation of not only the training but also the intended system usage. A weighted median, depending on the assignment of values and risk assessment questions we could determine if the system was at risk and in what areas.

Scores above and below the media could be extracted from a systems engineering driven questionnaire based on an Entity Relationship diagram. The process flow diagram illustrated in the Risk Management section, provides the flexibility allowing individual criterion to be



compared against the system throughout the lifecycle. If each category is evaluated by answering the step by step questions and determined to continually meet the established requirements then a high score would be added to the evaluation results chart and the risk assessment would be complete. Keep in mind the current customer requirements are traced back to the original contract and not based on customer or staff desire-ments. If one of the risk step questions analyzes the capability no longer is meets a Risk Mitigation goals then the industrial engineers would return to the section on evaluation the established risks. For example if one of the goals was to improve student performance by 50% then the lifecycle of system interoperability should continue to allow the student to achieve those results.

Any approved risk objective could be process through the above process flow diagram. The Risk Matrix should be guided by an Entity Program relationship model. An entity type is a set of artifacts with the same structure and independent existence within the enterprise. Examples of an entity type would be Employees or Products. (Gornik 2011) The Entity Relationship diagram would most likely link a cost schedule profits table to maintain consistency with the systems engineering plan and funding for the program . Training element from software, hardware and training objective could be supported through an ER to determine the effectiveness and supportability of the training program. . Analyzing these databases would allow the business to offer additional training features to their customers. Identifying the student population potential for not passing or moving on to additional training will drive the scope of this training system . Management: This is where the verification and validation section become important.

Verification Finale

Quantitative Project Management ends with verifying the Capability Based Assessment. This entrance criteria from the development and acquisition analysis portion allows to verify and determine if a new capability would be useful to the existing system. Analysis of survey results clearly indicate that the greatest challenges in successfully executing Performance criteria starts early in the work breakdown structure process. Understanding customer requirements early in the acquisition process and building those requirements into performance based expectation models, managing the risks associated with those requirements, remains a central theme in contracts. Talk to stakeholders who will use the data to
understand their wants and needs. A narrow goal will help you to relentlessly simplify the survey. (Vovici, 2012)

This information verified might include expected training results, the variable presented, the time relationship tasks to completed objective, and graded results will serve as performance metrics. The attributes may be grouped into relationships and validated against the timed intervals in the systems intended use. The expected benefits of the proposed Smartphone and GPS capabilities may be managed through the validation process

The proposed live fire system supplemented with the ability to track student location and reaction times would be a practical application anywhere in a live environment. Receiving real time answers to immediate questions with the operator being able to address the situation you are entering while identifying know danger zones might save lives. Although, the system

might be best left to the trianing so this does not expidite a Big Brother universe. If this were combined a live the instructor and or multiplayer players all working synchronized through a voice activated smart phones, training requirement could be closely monitored, the scenarios could be stopped and evaluated and learning would be enhanced as it is in a full motion simulator. This type of integration allows for the After Action review to predict behavioral interaction and performance characteristics.

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