MASTER OF SCIENCE
IN
SOFTWARE ENGINEERING

VHDL MODELING AND SIMULATION FOR A DIGITAL TARGET IMAGING ARCHITECTURE FOR MULTIPLE LARGE TARGETS GENERATION

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The subject of this thesis is to model and verify the correctness of the architecture of the Digital Image Synthesizer (DIS). The DIS, a system-on-a-chip, is especially useful as a counter-targeting repeater. It synthesizes the characteristic echo signature of a pre-selected target. The VHDL description of the DIS architecture was exported from Tanner S-Edit, modified, and simulated. Different software oriented verification approaches were researched and a White-box approach to functional verification was adopted. An algorithm based on the hardware functionality was developed to compare expected and simulated results. Initially, the architecture of one Range Bin Modulator was exported. Modifications to the VHDL source code included modeling of the behavior of the N-FET and P-FET transistors as well as Ground and Vdd (the voltages connected to the drains of the FETs). It also included renaming of entities to comply with VHDL naming conventions. Simulation results were compared to manual calculations and Matlab programs to verify the architecture. The procedure was repeated for the architecture of an Eight-Range Bin Modulator with equally successful results. VHDL was then used to create a super class of a 32-Range Bin Modulator. Test vectors developed in Matlab were used to yet again verify correct functionality.

KEYWORDS: Digital Image Synthesizer, Counter-Targeting Repeater, Range Bin Modulator, VHDL, White-box, Matlab

ANALYSIS AND DESIGN OF AN IMPROVED SENSOR FORMULA FOR THE TACTICAL REMOTE SENSOR SYSTEM (TRSS)

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This thesis examines the current Sensor Formula and target classification capabilities of the Tactical Remote Sensor System (TRSS). It serves as the basis for a new and improved algorithm using object oriented programming techniques. It incorporates the software engineering principals of modularity and class inheritance in order to create a more robust and adaptable target classification capability. This thesis is focused on improving the sensor processing and target classification of both the remote sensors currently in use in the United States Marine Corps and those in development. Finally the thesis gives recommendations on how the formula structure can be further improved through the implementation of weather and terrain data stores which are updated on a near-real-time basis.

KEYWORDS: Sensors, Target Classification, Sensor Formula, Sensor Algorithm, TRSS, Tactical Remote Sensor System, RSMS, Remote Sensor Management System

PROPOSAL TO DEVELOP ENHANCEMENTS AND EXTENSIONS OF FORMAL MODELS FOR RISK ASSESSMENT IN SOFTWARE PROJECTS

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Over the past 40 years limited progress has been made to help practitioners estimate the risk and the required effort necessary to deliver software solutions. Recent developments improve this outlook. Researchers from the Naval Postgraduate School developed a formal model for risk assessment used to estimate software project risk. This model is based on easily obtainable software metrics quantifiable early in the software development process. The risk assessment model was developed on data collected from a series of experiments conducted on the Vite'Project simulation. This unique approach provided a starting point towards a proven formal model for risk assessment, one that can be applied early in the software development lifecycle. Software risk estimation has previously enjoyed minimal success in this manner. This research provides definitive evidence that software risk assessment can be conducted early in software development using quantifiable metrics and simple techniques. Extensions are made possible based on calibrations against post-mortem projects. These enhancements result from many threads of research; extension of input metrics, increased simulations, simulations calibrated on actual projects, and model development. The research proposes an improved risk assessment model, one that has been validated against thousands of post-mortem projects, with applicability on any software development activity.

KEYWORDS: Risk Assessment, Formal Models, Software Estimation Models, Software Metrics, Project Management, Monte Carlo Simulation

U.S. MARINE SPECIFIC SOFTWARE INTEROPERABILITY REQUIREMENTS OF THE AFATDS AND IOS SOFTWARE SUITES

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The Marine Corps has several Tactical Combat Systems at the Infantry Division level and below. The Information-Operations Server Version 1 (IOS v. 1) is a command and control (C2) system with a client-server architecture that when networked offers the Common Operational Picture (COP). The client is called Command and Control Personal Computer (C2PC). IOS was designed primarily to support maneuver, and has its roots in the Navy's Joint Maritime Command Information System (JMCIS). C2PC has been fielded to all Battalion and Squadron level and higher units in the Marine Corps, while IOS resides in Regimental and higher units.

The Advanced Field Artillery Tactical Data System (AFATDS), originally designed by the Army, is the Marine fire support C2 System of Record. Current AFATDS software is tightly coupled to a particular hardware platform. AFATDS is currently being fielded to all units in the Fleet Marine forces.

There are several problems with having two stand-alone C2 systems inside the same Combat Operations Center (COC). Among the most pressing problems is the inability for fires to support maneuver without tedious and dangerous manual conversion of data between systems. This thesis explores the software requirements for tactical systems integration of AFATDS and IOS.

KEYWORDS: Command and Control, Tactical C2 Systems, AFATDS, IOS, Intelligence-Operations Server, Interoperability