Chapter two

Theoretical Background

2.1 Description of the Current System

2.1.1 Project Insight

The history of the Sudanese Army goes back to the Kingdom of Kush 732 B.C. The name of Kush was attributed to Kush Bin Ham. All the time the soldiers of the kings served for defense and other military services. After the coronation of Kashta as the first King from the Kushite Dynasty and the successor of Alara, he Egyptianized Nubia and conquered with his soldiers Upper Egypt. This king founded the 25th Kushite dynasty of ancient Egypt.

What is known today as the people's armed forces begins before 1955. At that time the Sudan Defense Forces were created by a number of Sudanese soldiers under the order of the British army. After the independence of Sudan 1956 the Sudanese Army (people's armed forces) was configured with all its teams beginning with the infantry division and the navy, then the air force and other sections.

The Sudanese army is considered nowadays as a powerful army. Its strength does not come from the technical side, but from its unique creed combat and its rich experience, as the army has remained in combat position since the Second World War. Until this day, the responsible institution for the Sudanese army is the Ministry of Defense.

2.1.2 The Existing Systems and its Problems

The current system is a manual system, used for creating strategic plans and depending on the predictable human behavior. Sometimes mistakes might happen, because of oblivion, and more important, the current system is not able to explain the plans in the appropriate way. This leads to simulation failures because of missing information and weak explanations.

2.2 Tools and Techniques

2.2.1 Design Tools

A) Autodesk 3ds Max:
The 3D Studio Max is a 3D computer graphics software used in making 3D animations, models, and images. It was developed and produced by Autodesk Media and Entertainment. It has modeling capabilities, a flexible plug-in architecture and can be used on the Microsoft Windows platform. It is frequently used by video game developers, TV commercial studios and architectural visualization studios. It is also used for movie effects and movie pre-visualization.

In addition to its modeling and animation tools, the latest version of 3ds Max also features Shaders (such as ambient occlusion and subsurface scattering), dynamic simulation, particle systems, radiosity, normal map creation and rendering, global illumination, a customizable user interface, and its own scripting language.

B) Autodesk Maya:
Commonly shortened to Maya is a 3D computer graphics software that runs on Windows, Mac OS and Linux, originally developed by Alias Systems Corporation (formerly Aliased by Wavefront) and currently owned and developed by Autodesk, Inc. It is used to create interactive 3D applications, including video games, animated film, TV series, or visual effects. The product is named after the Sanskrit word Maya (मायाmāyā), the Hindu concept of illusion.

C) Motion Builder:
This is a professional 3D character animation software. It is used for virtual production, motion capture, and traditional key-frame animation. Motion Builder is produced by Autodesk. It was originally named Film box when it was first created by the Canadian company Kaydara – later acquired by Autodesk and renamed to Motion Builder.

It is primarily used in film, game, television production, as well as other multimedia projects. Motion Builder is widely used, for example in mainstream products, like Assassin's Creed, Kill zone 2, and Avatar.

At SIGGRAPH 2012 Autodesk started a partnership with Weta Digital and Light storm Entertainment to collaborate and to develop the next generation of the technology behind James Cameron's "Avatar" movie.

D) Autodesk Soft-image or simply Soft-image (XSI):
It is a high performance 3D computer graphics application, owned by Autodesk, for producing 3D computer graphics, 3D modeling, and computer animation. Formerly Soft-image (XSI), the software is predominantly used in the film, video game, and advertising industries, for creating computer generated characters, objects, and environments.

Released in 2000 as the successor to Softimage|3D, Soft-image|XSI was developed by Softimage, Co., then a subsidiary of Avid Technology. On Oct. 23, 2008, Autodesk acquired from Avid the Softimage brand and the 3D animation assets for approximately $35 million, thereby ending Softimage Co. as a distinct entity. In February 2009, Soft-image|XSI was rebranded Autodesk Softimage.

A free version of the software, called Softimage Mod Tool, was developed for the game modeling community to create games using the Microsoft XNA toolset for PC and Xbox 360, or to create mods for games using Valve Software's Source engine, Epic Games' Unreal Engine and others. It was discontinued with the release of Softimage 2014.

E) Z Brush:
This is a digital sculpting tool that combines 3D/2.5D modeling, texturing and painting. It uses a proprietary "pixel" technology (see below) which stores lighting, color, material, and depth information for all objects on the screen. The main difference between ZBrush and more traditional modeling packages is that it is more akin to sculpting.

ZBrush is used as a digital sculpting tool to create high-resolution models (up to ten million polygons) for use in movies, games, and animations. It is used by

companies ranging from ILM to Electronic Arts. ZBrush uses dynamic levels of resolution to allow sculptors to make global or local changes to their models.

ZBrush is most known for being able to sculpt medium to high frequency details that were traditionally painted in bump maps. The resulting mesh details can then be exported as normal maps to be used on a low poly version of that same model. They can also be exported as a displacement map, although in that case the lower poly version generally requires more resolution. Or, once completed, the 3D model can be projected to the background, becoming a 2.5D image (upon which further effects can be applied). Work can then begin on another 3D model which can be used in the same scene. This feature lets users work with extremely complicated scenes without heavy processor overhead.

ZBrush was created by the company Pixelogic Inc, founded by OferAlon (also known by the alias "Pixelator") and Jack Rimokh. The software was presented in 1999 at SIGGRAPH. The demo version 1.55 was released in 2002, and the version 3.1 was released in 2007. ZBrush 4 for Windows and Mac systems was announced on April 21, 2009 for an August release, but was later postponed. Version 3.5 was made available in September the same year, and includes some of the newer features initially intended for ZBrush 4.

Through GoZ ("Go ZBrush"), available in Version 4, ZBrush offers integration with Autodesk Maya, Autodesk 3ds Max, Cinema4D NewTek's LightWave3D Smith Micro's Poser pro, Daz 3d's Daz Studio and Modo.

F) CINEMA 4D:
This is a 3D modeling, animation and rendering application developed by MAXON Computer GmbH of Friedrichsdorf, Germany. It is capable of procedural and polygonal/subd modeling, animating, lighting, texturing, rendering, and common features found in 3d modeling applications.

G) modo:
Is a polygon and subdivision surface modeling, sculpting, 3D painting, animation and rendering package developed by Luxology, LLC. The program incorporates

features such as n-gons and edge weighting, and runs on Microsoft Windows, Linux and Mac OS X platforms.

2.2.2   Programming and Developing Tools

A) C++ (pronounced "see plus plus"):
This is a statically typed, free-form, multi-paradigm, compiled, and general-purpose programming language. It is regarded as an intermediate-level language, as it comprises both high-level and low-level language features. Developed by BjarneStroustrup starting in 1979 at Bell Labs, C++ was originally named C with Classes, adding object oriented features, such as classes, and other enhancements to the C programming language. The language was renamed C++ in 1983, as a pun involving the increment operator.

C++ is one of the most popular programming languages and is implemented on a wide variety of hardware and operating system platforms. As an efficient compiler to native code, its application domains include systems software, application software, device drivers, embedded software, high-performance server and client applications, and entertainment software such as video games. Several groups provide both free and proprietary C++ compiler software, including the GNU Project, LLVM, Microsoft, Intel and Embarcadero Technologies. C++ has greatly influenced many other popular programming languages, most notably C# and Java. Other successful languages such as Objective-C use a very different syntax and approach to adding classes to C.

C++ is also used for hardware design, where the design is initially described in C++, then analyzed, architecturally constrained, and scheduled to create a register-transfer level hardware description language via high-level synthesis.

The language began as enhancements to C, first adding classes, then virtual functions, operator overloading, multiple inheritance, templates and exception handling, among other features. After years of development, the C++ programming language standard was ratified in 1998 as ISO/IEC 14882:1998.

The standard was amended by the 2003 technical corrigendum, ISO/IEC 14882:2003. The current standard extending C++ with new features was ratified and published by ISO in September 2011 as ISO/IEC 14882:2011 (informally known as C++11).

B) C# (pronounced see sharp):
This is a multi-paradigm programming language encompassing strong typing, imperative, declarative, functional, procedural, generic, object-oriented (class-based), and component-oriented programming disciplines.

It was developed by Microsoft within its .NET initiative and later approved as a standard by (ECMA-334) and ISO (ISO/IEC 23270:2006). C# is one of the programming languages designed for the Common Language Infrastructure.

C# is intended to be a simple, modern, general-purpose, object-oriented programming language [6]. Its development team is led by Anders Hejlsberg. The most recent version is C# 5.0, which was released on August 15, 2012.

C) OpenGL (Open Graphics Library):
This is a cross-language, multi-platform API for rendering 2D and 3D computer graphics. The API is typically used to interact with a GPU, to achieve hardware-accelerated rendering. OpenGL was developed by Silicon Graphics Inc. (SGI) from 1991 and released in January 1992 and is widely used in CAD, virtual reality, scientific visualization, information visualization, flight simulation, and video games. OpenGL is managed by the non-profit technology consortium Khronos Group.

D) Microsoft DirectX:
This is a collection of application programming interfaces (APIs) for handling tasks related to multimedia, especially game programming and video, on Microsoft platforms. Originally, the names of these APIs all began with Direct, such as Direct3D, DirectDraw, DirectMusic, DirectPlay, DirectSound, and so forth.

The name DirectX was coined as shorthand term for all of these APIs (the X is standing in for the particular API names) and soon became the name of the collection. When Microsoft later set out to develop a gaming console, the X was

used as the basis of the name Xbox to indicate that the console was based on DirectX technology. The X initial has been carried forward in the naming of APIs designed for the Xbox such as X Input and the Cross-platform Audio Creation Tool (XACT), while the DirectX pattern has been continued for Windows APIs such as Direct2D and Direct Write.

Direct3D (the 3D graphics API within DirectX) is widely used in the development of video games for Microsoft Windows, Microsoft Xbox, Microsoft Xbox 360 and some Sega Dreamcast games. Direct3D is also used by other software applications for visualization and graphics tasks such as CAD/CAM engineering. As Direct3D is the most widely publicized component of DirectX, it is common to see the names "DirectX" and "Direct3D" used interchangeably.

The DirectX Software Development Kit (SDK) consists of runtime libraries in redistributable binary form, along with accompanying documentation and headers for use in coding. Originally, the runtimes were only installed by games or explicitly by the user. Windows 95 did not launch with DirectX, but DirectX was included with Windows 95 OEM Service Release 2. Windows 98 and Windows NT 4.0 both shipped with DirectX, as has every version of Windows released since. The SDK is available as a free download. While the runtimes are proprietary, closed-source software, source code is provided for most of the SDK samples. Starting with the release of Windows 8 Developer Preview, DirectX SDK has been integrated into Windows SDK.

Direct3D 9Ex, Direct3D 10, and Direct3D 11 are only available for Windows Vista and newer because each of these new versions was built to depend upon the new Windows Display Driver Model that was introduced for Windows Vista. The new Vista/WDDM graphics architecture includes a new video memory manager supporting virtualization of graphics hardware for various applications and services like the Desktop Window Manager.

E) Microsoft XNA:
This is a set of tools with a managed runtime environment provided by Microsoft, that facilitates video game development and management. XNA is based on the .NET Framework, with versions that run on Windows, Windows Phone and the

Xbox. In many respects, XNA can be thought of as a .NET analog to Microsoft's better known game development system, DirectX, but it is aimed at developers primarily interested in writing lightweight games that run on a variety of Microsoft platforms. XNA is the basic platform for Xbox Live Indie Games.

The XNA toolset was announced March 24, 2004, at the Game Developers Conference in San Jose, California. A first Community Technology Preview of XNA Build was released on March 14, 2006. XNA Game Studio 2.0 was released in December 2007, followed by XNA Game Studio 3.0 on October 30, 2008. XNA Game Studio 4.0 was released on September 16, 2010 along with the Windows Phone Development Tools. According to an email sent on 31 January 2013, XNA is no longer actively being developed, and it is not supported under the new "Metro interface" layers of Windows 8 nor on the Windows RT platform.

F) Unity (also called Unity3D):

This is a cross-platform game engine with a built-in IDE developed by Unity Technologies. It is used to develop video games for web plug-ins, desktop platforms, consoles and mobile devices, and is utilized by over one million developers. Unity is primarily used to create mobile and web games, but can also deploy games to consoles or the PC. The game engine was developed in C/C++, and is able to support code written in C#, JavaScript or Boo. It grew from an OS X supported game development tool in 2005 to a multi-platform game engine.

The latest update, Unity 4.1, was released March 2013. It currently supports development for IOS, Android, Windows, Blackberry 10, OS X, Linux, web browsers, Flash, PlayStation 3, Xbox 360, and Wii-U. The game engine is downloadable from their website in two different versions: Unity and Unity Pro.

G) The Unreal Engine:

This is a game engine developed by Epic Games, first illustrated in the 1998 first-person shooter game Unreal. Although primarily developed for first-person shooters, it has been successfully used in a variety of other genres, including stealth, MMORPGs and other RPGs. With its code written in C++, the Unreal Engine features a high degree of portability and is a tool used by many game developers today.

The current release is Unreal Engine 3, designed for Microsoft's DirectX 9 (for Windows and Xbox 360), DirectX 10 (for Windows Vista) and DirectX 11 (for Windows 7 and later), OpenGL for OS X, Linux, PlayStation 3, Wii U, IOS, Android, Stage 3D for Adobe Flash Player 11 and JavaScript/WebGL for HTML5.

2.2.3 Analysis Tool

A) Unified Modeling Language (UML):
This is a standardized (ISO/IEC 19501:2005), general-purpose modeling language in the field of software engineering. The Unified Modeling Language includes a set of graphic notation techniques to create visual models of object-oriented software-intensive systems.

The Unified Modeling Language was developed by Grady Booch, Ivar Jacobson and James Rumbaugh at Rational Software in the 1990s. It was adopted by the Object Management Group (OMG) in 1997, and has been managed by this organization ever since. In 2000 the Unified Modeling Language was accepted by the International Organization for Standardization (ISO) as industry standard for modeling software-intensive systems. The current version of the UML is 2.4.1 published by the OMG in August 2011.

Unified Modeling Language (UML) combines techniques from data modeling (entity relationship diagrams), business modeling (work flows), object modeling, and component modeling. It can be used with all processes, throughout the software development life cycle, and across different implementation technologies.

The Unified Modeling Language (UML) offers a standard way to visualize a system's architectural blueprints, including elements such as:

- activities
- actors
- business processes
- database schemas
- (logical) components

- programming language statements
- Reusable software components.

UML has synthesized the notations of the Booch method, the Object-modeling technique (OMT) and Object-oriented software engineering (OOSE) by fusing them into a single, common and widely usable modeling language. UML aims to be a standard modeling language which can model concurrent and distributed systems.

UML models may be automatically transformed to other representations (e.g. Java) by means of QVT-like transformation languages. UML is extensible, with two mechanisms for customization: profiles and stereotypes.

2.3 Software Development Methods Used

A) Design tools:
- Autodesk Maya.
- Autodesk 3d Max.

B) Programming and developing tools:
- C#(C Sharp).
- Unity (also called Unity3D).

C) Analysis tool:
- Unified Modeling Language (UML).