3D SOLID CAD APPLICATION ON ANDROID HANDHELD DEVICES FOR FASTER AND MOBILE DESIGN SOLUTION

By

Mohamed Ahmed Metwalli ElSharawy

A Thesis Submitted to the
Faculty of Engineering at Cairo University
In Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
In
Mechanical Design and Production Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Under the Supervision of

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Title of Thesis:

3D Solid CAD Application on Android Handheld Devices for Faster and Enhanced Design

Key Words:
3D – Solid – CAD – Computer Aided Design– Android – Apps

Summary:

Handheld mobile applications (apps) are growing massively in both function and mobility. This is due to the increasing variety of mobile operating systems (Android, iOS, RIM, Windows ...etc.), technological advancement in the handheld computing power and the fact that these apps are mobile and can be used literally everywhere. With the growing need, one has to have more live-design tools offering on the spot solutions that meet more of the instant (Rapid Prototyping) technologies growing e.g. 3D Printing, Real-Time Construction/Maintenance...etc.

Scientific communities cannot be disengaged from the above stated facts there had to be a research about what are the available offered engineering solid computer-aided-design apps that can offer the same level of details and design capabilities as the ones offered on personal computers. Android OS offers what is needed in terms of popularity across different platforms, manufacturers, users and developers; in addition to being an open-source coded OS. In this thesis two sections are covered. First is the analysis for the Android platform and answering the following questions: What are available 2D/3D modeling apps on Google-Play (Android Market)? Can these apps be used in true design applications? What are these apps offering i.e. solid or surface modeling? What is the difference between both? What is missing in the market and how to close the engineering-need gap available? In the second section a solid 3D CAD app that is designed and programmed (from the point-of-view of this work) that offers

the needed CAD app capabilities, tools and options in order to serve the higher purpose of having a real-time tool to design with on the fly. The app name is chosen to be (3Droid). It is a 3D solid modeling CAD application that functions on all Android handheld devices; which enables full 3D solid modeling with just the fingertips of the user enabling a real-time design solution.

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Dedication

I wish to dedicate this thesis to my loveable parents, caring wife and joyful daughter.

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Nomenclature

SYMBOLS

P: Geometric Point
L: Geometric Line / Length
x: X-Axis Coordinate Value
y: Y-Axis Coordinate Value
z: Z-Axis Coordinate Value
S: Geometric Planar Surface
r: Circle Radius
α,β : Circle Center Coordinates
θ: Angle
A, B, C: Constants
t: Incremental Value

ABBREVITIONS

CAD:	Computer Aided Design
APP:	Application; common term for software that runs on a mobile device
3Droid:	Solid CAD app developed through this thesis
SDK:	Software development kit
ADT:	Android Development Tools
AVD:	Android Virtual Device
JDK/E:	Java Development Kit/Environment
OS:	Operating System
RP:	Rapid Prototyping
OSS:	Open-source software
PC:	Personal Computer
CNC:	Computer Numerical Control
STL:	Stereo-Lithography; 3D CAD file format
OBJ:	Object; 3D CAD file format
DXF:	Drawing Exchange Format; 3D CAD file format
IDE:	Integrated development environment
OOP:	Object Oriented Programming
SDK:	Software Development Kit
API:	Application Programming Interface
GLUT:	OpenGL Utility Toolkit
GLU:	OpenGL Utility Library
GPU:	Graphics Processing Unit
EGL:	is an API that manages the interface between Khronos renderers (OpenGL-ES, OpenGL or OpenVG) and the native platform windowing system

Piecewise function: Any function that is defined by a multiple of other sub-functions