



Computer Aided Designing for Landscape Gardening

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ABSTRACT

The concept of computer aided designing for landscape gardening is comparatively new. It can be simply defined as design and drafting of a landscape garden with the aid of computer. Originally the technique was aiming at automating a number of tasks a designer is performing and in particular the modelling of the product. A variety of 2D and 3D based tools and approaches have been evaluated along with their advantages and disadvantages. The scope has been broadening to include and contrast interior designing tools in order to gain better domain knowledge. As the CAD software makes use of some of the best tools, the percentage of error that occurred because of manual designing is significantly reduced. When it comes to the amount of effort that was needed for the sake of designing the different models, it has been reduced significantly because the software automates most of the task. While, using the computer aided design software, it saves time and better and more efficient designs can be made in shorter time duration.

KEYWORDS

Computer, Design, Gardening, Tools

Introduction

The concept of Computer aided designing for landscape gardening is comparatively new. It can be simply defined as design and drafting of a landscape garden with the aid of computer. It can also be defined as use of information technology in garden designing. A CAD system consists of IT hardware (H/W), specialised software (S/W) (depending on the particular area of application) and peripherals, which in certain applications are quite specialised. The core of a CAD system is the software, which makes use of graphics for product representation; databases for storing the product model and drives the peripherals for product presentation. Its use does not change the nature of the design process, but, as the name states, it aids the product designer. The designer is the main actor in the process, in all phases from problem identification to the implementation phase. Computer aided designing is an important industrial art extensively used in industry and landscape architecture designing and many more. For landscape designs, it represents a practical solution for their imperative needs. Nowadays, CAD is using to create 2D or 3D computer models.

History

The beginnings of CAD can be traced to year 1957, when Dr. Patrick J. Hanratty developed PRONTO, the first commercial numerical-control programming system. In 1960, Ivan Sutherland MIT's Lincoln Laboratory created SKETCHPAD, which demonstrated the basic principles and feasibility of computer technical drawing. The first system were very expensive, the computer graphics technology was not so advanced at that time and using the system required specialised H/W and S/W which was provided mainly by the CAD vendors. The actual application of CAD/CAM in industry, academia and govern-

ment is only approximately 30 years old. Formal courses in CAD and Finite Element Analysis (FEA) were introduced in 1970's. The major application thrust of CAD came in 1980's, with the availability of PCs and workstations. Today, WINDOWS is the main operating system for CAD systems. The first applications were for 2D-Drafting and the systems were also capable of performing only 2D modelling. Even today 2D-drafting is still the main area of application (in terms of number of workplaces). Later, (mid-1980), following the progress in 3D modeling technology and the growth in the IT H/W, 3D modeling systems are becoming very popular. 3D modeling is at the beginning wire frame based. Each generation has become more powerful and more user-friendly.

Need of Computer aided designing in landscape

Originally the technique was aiming at automating a number of tasks a designer is performing and in particular the modelling of the product. Today, CAD systems are covering most of the activities in the design cycle, they are recording all product data, and they are used as a platform for collaboration between remotely placed design teams. CAD systems can shorten the design time of a product. Therefore the product can be introduced earlier in the market, providing many advantages to a landscaper. Traditional drafting is repetitious and can be inaccurate, while, CAD provide accurate and efficient drafting with repetitive option which is prime need for a landscaper. CAD systems have the ability to provide a digital prototype of the product at early stages of the design process, which can be used for testing and evaluation. Many specialists from various subject areas can share it, they can express their opinion for the product at early stages, in order to complete the design in less time and with the least mistakes.

**Components of CAD system**

There are two main components of CAD system, i.e., software and hardware.

**Hardware**

There are basically two types of devices that constitute CAD hardware, one is input devices and another are output devices. A brief description is given below in the following section.

**Input devices**

In computing, an input device is a peripheral (piece of computer hardware equipment) used to provide data and control signals to an information processing system, such as a computer or information appliance. These are the devices that we use for communicating with computer, and providing our input in the form of text and graphics. The text input is mainly provided through keyboard. For graphic input, there are several devices available and used according to the landscaping provision.

**Mouse:** The mouse is a small device used to point to a particular place on the screen and select in order to perform one or more actions. It can be used to select menu commands, size windows, start programs, etc. Joystick and trackballs are analogous to a mouse device, and operate on the same principle.

**Digitizers:** Digitizers are used to trace a sketch or other 2-D entities by moving a cursor over a flat surface (which contains the sketch). The position of the cursor provides a feedback to the computer connected with the device. There are electrical wires embedded in orthogonal directions that receive and pass signals between the device and the computer. The device is basically a free moving puck or pen shaped stylus, connected to a tablet.

**Light Pens:** Lockheed's CADAM software utilizes this device to carry out the graphic input. It is a pen shaped device used to select objects on a display screen. It is quite like the mouse (in its functionality) but uses a light pen to move the pointer and select any object on the screen by pointing to the object.

**Touch Sensitive Screens:** This device is embedded in the monitor screens, usually, in the form of an overlay. The screen senses the physical contact of the user. It allows the user to operate/make selections by simply touching the display screen.

**Other Graphic Input Devices:** In addition to the devices described above, some CAD software will accept input via Image Scanners, which can copy a drawing or schematic with a camera and light beam assembly and convert it into a pictorial database.

The devices just described are, in general, independent of the CAD package being used. All commercial CAD software packages contain the device drivers for the most commonly used input devices. The device drivers facilitate a smooth interaction between our input, the software, and the computer. An input device is evaluated on the basis of the following factors:

- Resolution
- Accuracy
- Repeatability
- Linearity

**Output Devices**

After creating a CAD model, we often need a hard copy, using an output device. Plotters and printers are used for this purpose. A plotter is often used to produce large size drawings and assemblies, whereas, a laser jet printer is adequate to provide a 3-D view of a model. Most CAD software requires a plotter for producing a shaded or a rendered view (Zuo, 2002).

**CAD Software**

Recently, much gardening-related application software has

been proposed with the development of information technology (Pavan and Naomi, 2012).

1. Software for the Windows OS which simulates group planting of a container garden and a hanging basket et cetera.
2. Software which can enjoy gardening as wallpaper of a desktop.
3. Software which can perform a gardening simulation with feeling of the game.

**A software which can enjoy the quiz on gardening**

However, such software is hard to support design, work and management required for gardening. Thus, we try to develop a digital gardening system to support people who want to enjoy gardening. In order to make a garden with a unified beauty, three minimum items are required as follows:

1. A plane view of the planning garden.
2. Knowledge about plants and vegetables for gardening.
3. A 3-D sketch helping to imagine the real garden.

Although garden designers and planners make a plane plan utilizing accurate and quantitative description when carrying out a design, it is difficult for gardening beginners to make a satisfying plan view. Moreover, the beginners have to gather up special knowledge of flowers, vegetables and plants from a book, internet, etc. In addition, garden designers and planners try to realize a concrete image by drawing a sketch after a plane view is completed. For the beginners, however, it is difficult to imagine the concrete image of the designed garden.

Some of the CAD softwares (<http://usa.autodesk.com/autocad/> features) used in landscaping are

1. AutoCAD
2. ArchiCAD
3. Advance Concrete
4. Advance Design
5. Advanced Steel
6. BRL-CAD
7. BricsCAD
8. Tekla
9. Revit
10. LANDCADD, etc

**Tools and Technologies**

A variety of 2D and 3D based tools and approaches have been evaluated along with their advantages and disadvantages. The scope has been broadening to include and contrast interior designing tools in order to gain better domain knowledge. These findings are presented in table below (Haixiao, 2013).

Tools	Advantages	Disadvantages
AutoCAD	3D view of the design. Cross-platform. Import 3D models. Design in 2D & 3D. 3D Navigation providing functionalities to view the environment in different angles and by adding multiple camera. Export 2D or 3D plan. Proper documentation and Community support.	High cost. No cost estimation. Requires high-end hardware requirements.
Floorplanner	Provides a 2D view to design. The design can be viewed in 3D. Freedom to navigate around the 3D environment. Library of 2D textures and 3D models. Can draw for scaling. Running on the web browser. User-friendly.	Cannot design in 3D. Cannot import symbols or 2D textures. Cannot import 3D models (COLLADA, 3DS, etc.). Cannot modify the 3D terrain/floor. Lack of cost estimation feature. Commercial version includes essential features such as 3D export and print to scale.

Garden Planner	Over 800 pre-designed elements. User-friendly. Environment transformation. Drag & drop elements. Elements scaling. Each element can be exported to an image. List of elements used with its dimensions.	Commercial application. No situation awareness mechanism. No 3D elements library. Lack of 3D environment. No virtual tour.
VR-CAD System	Flexibility to create 3D models.	The cost of hardware devices such as HMD and 3D mouse are expensive. Consumes more time. Requires more time to train. Difficulty of modeling.
Google SketchUp	Real-time rendering. 3D navigation – Providing functionalities to view the environment in different angles such as Air, Global and Local tours. Scale elements. Data exchange – The support of other file formats such as AutoCAD, 3dsmax and Revit building. Google warehouse – A warehouse that has a variety of 3D models. Environment transformation. 2D & 3D designing –A user can switch between 2D and 3D designing. Export 2D & 3D designs.	No Cost estimation– This is a very important feature that is needed in a landscaping software.

### Major steps in designing outdoor landscapes through CAD

The five steps of the design process include:

1. Conducting a site inventory and analysis
2. Determining your needs
3. Creating functional diagrams
4. Developing conceptual design plans
5. Drawing a final design plan.

The first three steps establish the aesthetic, functional, and horticultural requirements for the design. The last two steps then apply those requirements to the creation of the final landscape plan.

### Advantages of CAD in designing outdoor landscapes

1. Drawing errors can be corrected easily
2. Drawings can be sent and received elsewhere quickly via e-tools.
3. Drawing can be zoomed, copied and pasted for more detailed sections.
4. Reuse of designs
5. Can be stored in personal computer
6. Can work throughout the night so can produce product 24 hours of a day.
7. Design can be analyzed and optimized virtually using finite element analysis
8. Reducing timescales and mistakes.

### Disadvantages of CAD in designing outdoor landscapes (Desh Raj, 2015)

1. It can be very expensive
2. It can be hard to do and handling needs training
3. Sometimes can't do everything you want to because the tools are not available.
4. Sharing of drawings via computer hacking.

### Conclusion

In this era of multitasks and shrinking time, CAD comes as much needed help to landscape designers owing to its multi-faceted advantages. As the CAD software makes use of some of the best tools, the percentage of error that occurred because of manual designing is significantly reduced. When it

comes to the amount of effort that was needed for the sake of designing the different models, it has been reduced significantly because the software automates most of the task. While, using the computer aided design software, it saves time and better and more efficient designs can be made in shorter time duration. By using computer aided design software, it will be much easier to make any changes because errors can be fixed easily. There is absolutely no doubt about the fact that the kind of accuracy that CAD software will offer can never be achieved by opting for manual drawings. The CAD tools make it easier to save the files and store it in a way that one can use it time and again and send it without any unwanted hassles too.

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