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# Digital Earth

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***Abstract— Digital earth is a virtual representation of the earth, manifested as a multi-layer information facility. It is a multi-faceted computing system for education and research. As a global initiative, digital earth's goal is to improve social conditions, protect the immersive environment, and make sense of vast amounts of geo-referenced information about our planet. This paper provides a brief introduction to digital earth.***

***Keywords— digital earth, digital world, virtual earth***

## I. INTRODUCTION

Mankind lives only on the planet earth. Protecting earth's resources and environment is a common responsibility for all of mankind. But the planet earth is changing rapidly due to some forces such as globalization, the shifting economy, and the technological revolution brought about by the Internet, smart phones, social media, cloud, big data, and Internet of things [1]. It is imperative for mankind to make full use of these developments to understand and manage the earth so as to better protect our common home.

Digital earth (DE) refers to the integrated application of digital technologies to monitor, map, model, and manage the earth's environments. The digital earth vision was first proposed by former US Vice President Al Gore in 1998 during his speech before the California Science Center in Los Angeles. Al Gore described a digital future where school children all over the world could interact with a computer-generated three-dimensional virtual globe and have to access vast amounts of scientific and cultural information to help them understand the earth. The concept of a digital earth is a digital replica of the whole planet. In DE all information is referenced to positions on the earth's surface. The DE will require storing quadrillions of bytes of information [2].

The digital earth (www.digitalearth.gov) is part of other advanced technologies including: earth observation, geo-information systems, global positioning systems, computer communication networks, virtual reality, and grid computation. It should address challenges facing human society such as natural resource depletion, food and water insecurity, energy shortages, environmental degradation, population explosion, and global climate change [3].

One of the goals of DE is making global spatial information ubiquitously available as an essential part of democracy. Another goal is to create a virtual representation of the planet that will enable one to explore vast amount of information about the earth.

## II. REQUIRED TECHNOLOGIES

The technologies that would be needed to build a digital earth are either available right now or under development. These would include the Internet, computational science, mass storage, satellite systems, broadband networks, object-level metadata, information technology, data infrastructures, viewshed analysis, visualization, and earth observation. Earth observation technology is vital because it provides a global and continuous data coverage for the earth surface.

Technology is advancing rapidly and making possible what might have been inconceivable some years ago. Technologies such as Global Positioning Systems (GPS) and radio-frequency identification (RFID) will enable recording where anything is located, at all times [4].

## III. APPLICATIONS

Implementing the vision of DE will require a major effort in international collaboration as well as further advances in science and technology. The global nature of digital earth offers potential mainly for environmental applications such as global climate change, environmental protection, disaster management, natural resource conservation, sustainable economic development, and coping mechanisms in case of disasters [5].

DE must support a wide range of georeferencing schemes and projections.

Hundreds of digital earth cities have been created by governments and universities. Progress towards digital earth has been made over the last decade. For example, virtual globe geo-browsers such as NASA World Wind, Google Earth and Microsoft's Bing Maps for different applications have been made.

The Alexandria Digital Earth Prototype (ADEPT) is a follow-up to the previously funded Alexandria Digital Library Project (ADL). Its goal is to create an open infrastructure that allows anyone around the globe to publish or to

 

search for data. Another project is Global Learning and Observations to Benefit the Environment (GLOBE). This is an educational program that links students, teachers, and the scientific research community [6]. The potential applications will be limited only by our imagination.

## IV. CHALLENGES

Digital earth offers opportunities to better address societal global challenges. These opportunities raise some concerns such as cybercrime, unwanted profiling, spam, and security breach. A DE is built on ethical principles, which should yield benefits to all members of society [7].

Digital earth encapsulates many different concepts which have led to some ambiguity on the nature of the DE vision and created an unclear research focus. Sharing data across industry and across the globe is difficult. Some fundamental problems araise such as data rights and ownership. The mechanism for integrating geographic information into the DE is still quite limited. With an open Internet environment, the DE platform needs to ensure data security [8].

## V. CONCLUSION

Digital earth has evolved to keep pace with rapid developments in other technologies such earth-sensing, cloud computing, grid computing, crowd-sourcing, and big data. There has been an extensive international support for implementing the Gore digital earth vision. The idea has become an international collaborative program instead of just being one country's initiative. It is being promoted by scientific, educational institutions, industry, governments, and international communities. The International Journal of Digital Earth was launched in 2008 as a peer-reviewed research journal devoted to digital earth. It is an official publication of the International Society for Digital Earth (www.digitalearth-isde.org).

Although digital earth is inclusive in nature, it is becoming one of the global challenging disciplines in science and technology. This discipline includes geoinformatics, spatial sciences, and geographic information systems (GIS).

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