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THE USE OF GEOGRAPHICAL INFORMATION SYSTEM AND UNMANNED AERIAL VEHICLE IN CANCER STUDIES

Tarık Türk

Department of Geomatics Engineering, Faculty of Engineering, Sivas Cumhuriyet University, 58140, Sivas, Turkey

Abstract

Since health is a geographical phenomenon and various factors attributing to the health diagnostics and planning are connected to geographical location, GIS is a significant tool for health studies. Geographical Information System (GIS) has been extensively used to research public health issues in recent years. Cancer is one of the most important health issues around the world.

In this study, the importance of a GIS-based decision support system is emphasized during taking necessary measures for cancer cases and revealing the relation between cancer case and geographical location. Data, one of the most important components of GIS, must be accurate and up to date. Providing accurate and up-to-date data in a short time, Unmanned Aerial Vehicle (UAV) is the most remarkable data collection method. In this process, how UAV contributes to GIS-based system is also discussed.

Keywords: *Cancer, GIS, Unmanned Aerial Vehicle*

1. Introduction

New diseases and epidemics spread through the world's population every year. Geographical Information System (GIS) enables a strong framework for our increasing ability to monitor these diseases and identify their causes [1, 2]. GIS is widely used by healthcare authorities, public health managers, policy makers, statisticians, regional and local health professionals to map disease rates, to understand the relationship between environmental risk factors and diseases, and to apply health services [3, 4], [5]. GIS covers a wide range of topics, such as the creation of disease maps, epidemiological studies, analysis and planning of health services, environmental health and assessment analysis, risk analysis, disease prevalence and clustering maps, research of health differentiation, and examination and resolution of many other health problems for the community [6]. In addition, it has great potential in the management of chronic diseases such as cancer and their clinical research and administrative health data [7]. Therefore, many researchers carry out health applications with the help of GIS [4, 6, 7, 8, 9, 10, 11, 12, 13].

Cancer epidemiology is a field of research and practice within the public health discipline that



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examines the prevalence of cancer cases in the community, tries to find out the causes of cancer. Cancer in Turkey and a large part of the world is known as one of the biggest health problems. It is known that environmental factors, unhealthy nutrition and smoking constitute more than half of the cancer diagnoses. Furthermore, cancer disease is a disease whose frequency varies with many causes. The most important problem in the control of cancer diseases is the accurate determination of cancer registry data. If accurate cancer registry data cannot be obtained, it is not possible to determine which type of cancer represents which characteristics, to make strategic planning, and above all to be realized in relation to realistic human resources [14]. Health is a geographical phenomenon and GIS provides a remarkable service since many factors affecting health diagnosis depend on geographical locations [5].

2. Geographical Information System (GIS)

GIS is an information system that includes all of the software, hardware and communication tools that perform the functions of collecting, storing, querying, analysing, documenting and presenting to the user the geographical and non-geographical data obtained through location-based observations. GIS consists of the following five main components.

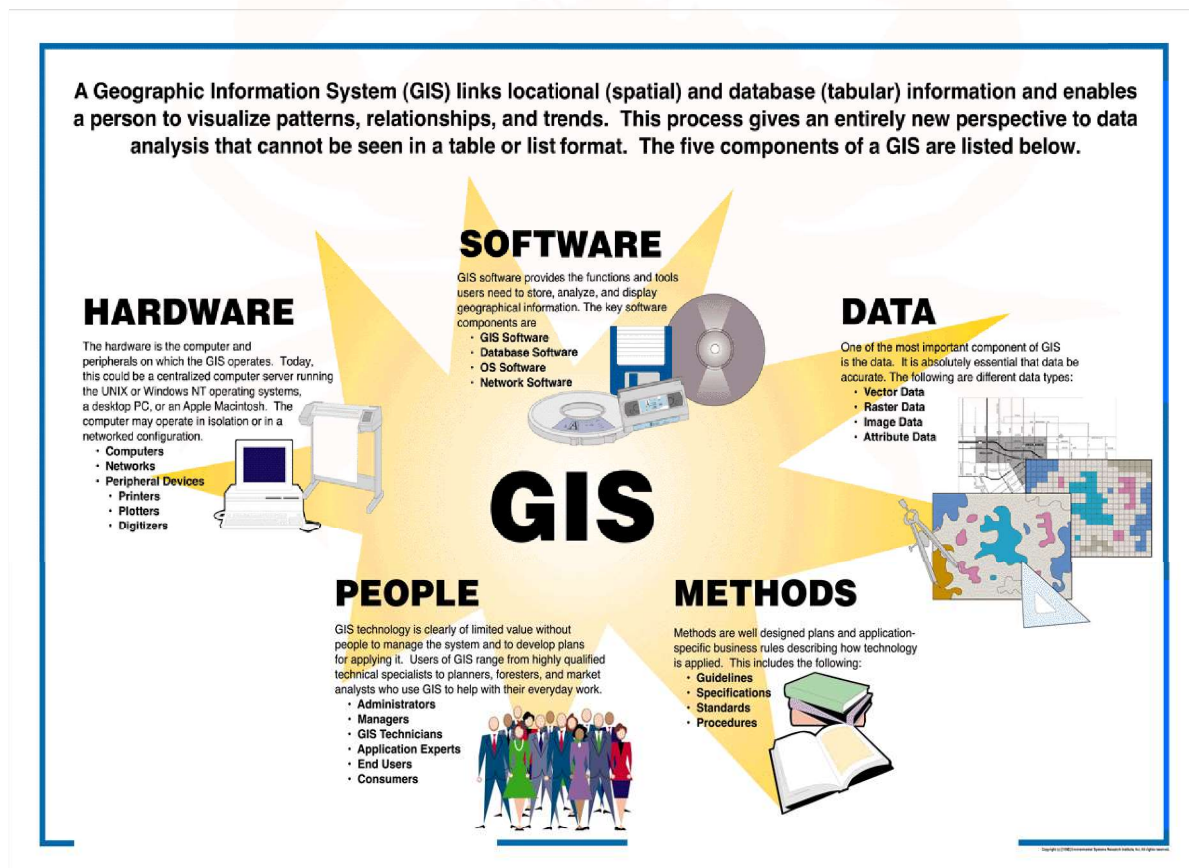


Figure 1. Components of GIS [15]



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One of the most important components of GIS is data. The data used in the GIS must be accurate and up to date. Queries and analyzes using incorrect and outdated data can mislead users by providing incorrect information. There are many different data collection methods for GIS such as Unmanned Aerial Vehicle (UAV), satellite images, laser scanning, aerial lidar, digitizing, Global Navigation Satellite System (GNSS), photogrammetry (Fig. 2). UAV, which produces accurate and up-to-date data quickly, is one of the most important data collection methods. In recent years, UAV has been effectively utilized in the production of digital maps, ortho-images and Digital Surface Models (DSMs), which are used as basic data in GIS.

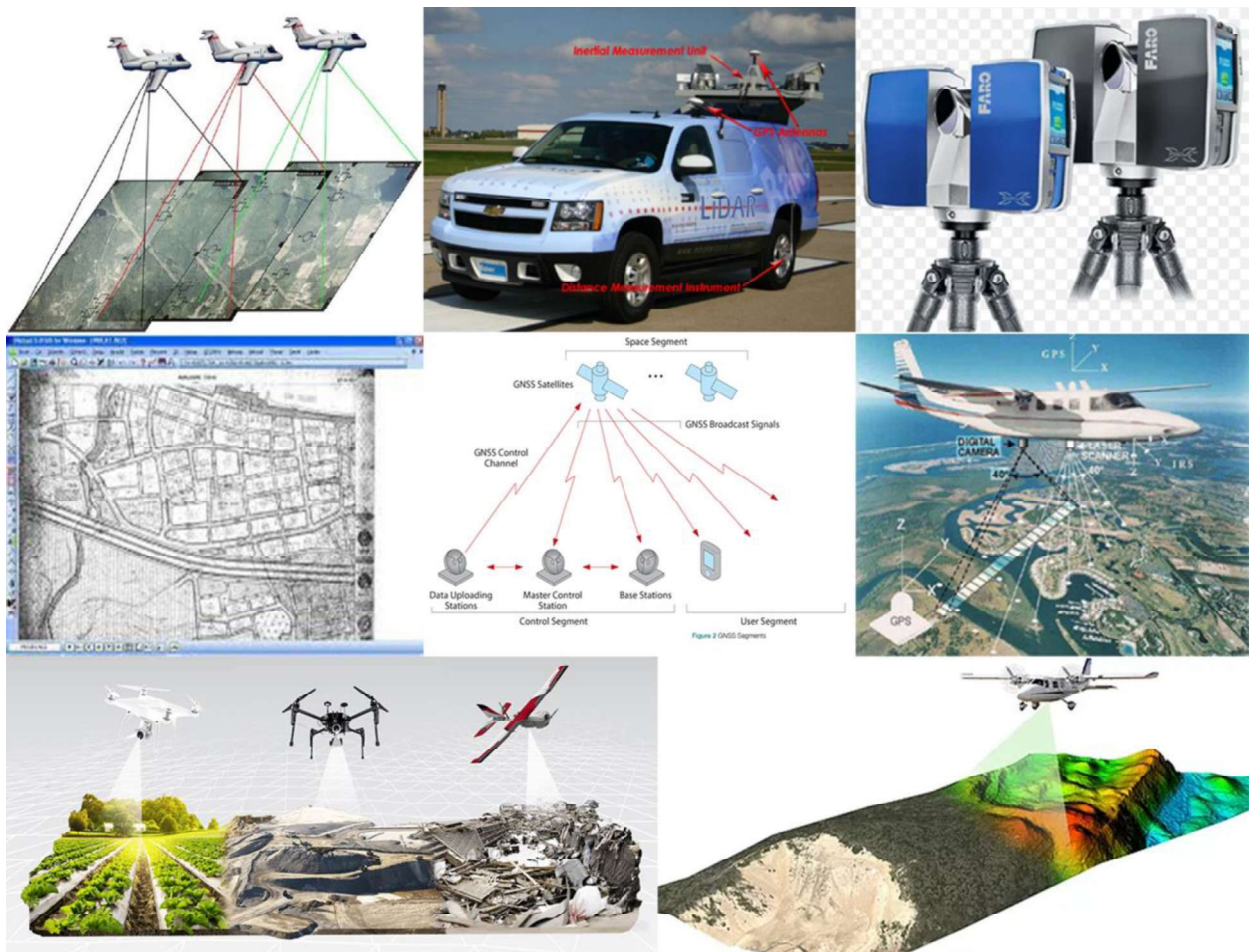


Figure 2. Data collection methods for GIS

3. Unmanned Aerial Vehicle (UAV)

UAV has been used successfully in many different fields such as forest fire, mainly military, archaeological surveys, agricultural applications, traffic control, radiation monitoring, natural disasters monitoring and urban areas. At the same time, UAV is an extremely important tool for fast and economical access to accurate and up-to-date data. Nowadays, photogrammetric UAVs can



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remain in the air for up to 3.5 hours and during this time they can acquire aerial images that can produce ortho-images of approximately 15 square kilometers. All of these features make the UAV a fast, accurate data acquisition and easy to use, professional land surveying and ortho-image production tool.



Figure 3. Data collection by UAV

When the literature is examined, there are various studies on public health with UAV. In the field of public health, UAVs have remarkable potential. One of their main applications has been to obtain real-time data and constantly update important risk-related information in hotspot areas [16]. The detailed ecological and environmental data collected can be used for assessing factors (e.g. movement and distribution of people, animals, and pathogen-carrying insects) influencing the transmission of infectious diseases [16, 17, 18]. UAVs have recently emerged as an efficient alternative for wildlife monitoring and ecological research [19, 20]. These systems enable the ability to monitor biological processes of large areas remotely and rapidly [21, 22, 23, 24].

4. Conclusion and discussion

When the epidemiological features of cancer are examined; cancer is associated with geographical distribution, gender, age, socioeconomic status and professional characteristics. As can be seen here, one of the most important features is the geographical distribution. The frequency of cancer may vary according to regions, countries and even different settlements of the same country. This is considered to be caused by genetic and environmental risk factors.

GIS makes a major contribution to the studies performed for taking under control cancer cases in any geographical location. Thematic maps produced by GIS are a visual interaction tool. Several maps can be produced for specific diseases and other health events. It is possible to produce cancer incidence rate maps, common cancer case maps, and other maps. Taking into account these



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maps, studies for the prevention of public health can be performed.

A detailed examination of the environmental risk factors that cause infectious diseases and cancer is extremely important for controlling these diseases. In this process, UAV is a remarkable data collection tool that provides accurate and up-to-date data for GIS in a short time. UAVs present a new opportunity to obtain high-resolution, georeferenced data in real time.

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