Chapter One

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Chapter One

Introduction

1-1 Background

Laser scanning is an emerging data acquisition technology that has remarkably broadened its application field and has been a serious competitor to other surveying techniques. Due to rapid technological development, the increased accuracy of global positioning systems and improving demands to even more accurate digital surface models, airborne laser scanning showed significant development in the 1990s. Somewhat later terrestrial laser scanning became a reasonable alternative method in many kinds of applications that previously by ground based surveying or close-range photogrammetry. [1]

Along with the penetration of laser scanning, significant paradigm change can be observed in geodesy, e.g. direct orientation instead of indirect orientation, surface detection instead of point measurements, complex 3D model product instead of simple coordinates etc. Laser scanning nicely demonstrates how these new paradigms work in practice. In the last years, due to the sensor fusion techniques, navigation solutions including inertial measurements and the improving demand for urban modeling, mobile laser scanning is gaining more and more momentum, as it can be seen even in the sensor manufacturers' product lists. [1]

All the technologies above based on the same principle: the scanner emits a laser beam through the ground/object, and computes the distance by measuring the traveling time or the phase difference of the laser beam. The emission rate of the cutting edge sensors is in the 100-200 kHz range. The direction of the beam is determined by different types of rotating or oscillating mirrors that enable the scanning of the area of interest. In case of airborne and mobile laser scanning, the position of the sensor is given by high accuracy GNSS and INS. [1]

As in many sources, laser scanning here is often referred as LiDAR (Light Detection And Ranging). ALM (Airborne Laser Mapping) or ALS (Airborne Laser Scanning) abbreviations are also widely used for airborne laser scanning, whilst term "terrestrial laser scanning" is used for ground-based laser scanning. [1]

1-2ProblemStatement

In 2017 ,Palestine Polytechnic University had laser scanner TX5 with characteristic :High accuracy, High resolution, High speed, Intuitive control via the built in touchscreen display, High mobility due to its small size, light weight, and the integrated quick charge battery, Photorealistic 3D color scans due to the integrated color camera, Integrated dual axis compensator to automatically level the captured scan data and Integrated compass and altimeter to give the scans an orientation and a height information. This project is aimed as training for use in the most proper and practical application.

1-3 Objectives

The project aims to:

1- The evaluate TX5 Laser Scanner at Palestine Polytechnic University for the data processing possibilities and evaluation of accuracy and limitation.

2- Apply scans of small and large objects from interior and exterior.

3- The different scans will be gathered to form the surface of the objects, 3D models will construct and finished.

4- Will include the expected accuracy and limitations of the scanner.

1-4 Literature Review

Y.M. Mogahed and M. Selim (2016) have done a study named Ability of Terrestrial Laser Scanner Trimble TX5 in Cracks Monitoring at Different Ambient Conditions: These approaches are indoor and outdoor system calibration, with the intention to specifically identify the accuracy of the Trimble TX5 scanner with different resolutions in detecting the various widths of small cracks from 1 mm to 9 mm. This calibration has been processed using the 3D Laser Scanning Trimble TX5,The calibration of data has been useful in order to identify and analyze over time, accuracy and it also gives us some elements about the validity of the technique for this kind of applications.[2]

Mr Brenton Light (2014) has done a study named Terrestrial Laser scanning for Building Information Model (BIM) Development and Application: This project aims to analyze the advantages and disadvantages of a TLS over conventional surveying techniques, it will aim to assess the accuracies of each method and then develop workflows to extract geometric and structural information from laser scanning point cloud data, and test these applications in building information modeling.[2]

Yelda Turkan, Simon Laflamme and Liangyu Tan (2016) have done a study named Terrestrial Laser Scanning-Based Bridge Structural Condition Assessment: This research project proposed to measure the performance of TLS for the automatic detection of cracks for bridge structural condition assessment. Laser scanning is an advanced imaging technology that is used to rapidly measure the three-dimensional (3D) coordinates of densely scanned points within a scene.[2]

1-5 Methodology

The project is to be achieved using the following steps:

1-Working on the device in different conditions.
2-Different objects are scanned from interior and exterior.

3-The object are scanned from different station.

4-The different scans are gathered to form the surface of the objects, 3D models are constructed and finished.

5-An evaluation of the processes, limitation and accuracies are done.

1-6 Scope of Work

The projects do will consist of the following chapters:

Chapter one (Introduction):This chapter gives an introduction about the project,its aims , goals and the working methodology used it

Chapter two: Introduces the principles of terrestrial laser scanners

Chapter three: The Application of Laser Scanner in different fields

Chapter four :Shows result and their Test Analysis of data collected by the laser the laser scanner and compared to the real measurement

Chapter five: Shows the Conclusions and recommendations of the project