Use of LIDAR In Transportation

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Abstract

Surface terrain information is required to economically site new or relocate existing infrastructure facilities & make final design plans. In today scenario field surveying & photogrammetric mapping are the most widely used method to acquire. The data But these method are time & resource consuming as significant date collection & its refinement is required at later stage to draw some conclusion. Light Detection and Ranging (LIDAR) is relatively new technology to obtain terrain information more efficiently. This technology has gaining popularity in the recognition of roads & road same objects. A thorough review of available literature is conducted to inform the advancement in mobile Lidar Technology & their application in road information inventory. This review present a more in depth information of Current LIDAR studies on road & transportation. Finally the challenges & future trend are discussed.

Keywords: Mobile LIDAR, Transportation, MLS: Mobile Laser scanning, Pavement cracks, Roads, Road Marketing

I. INTRODUCTION

Remote sensing technologies for road information inventory are undergoing rapid development. The possibility of acquiring 3 D information of large area roadway with survey grade accuracy of high speed is opening new & effective way for road & transportation inventory. This paper provides the in depth review of available literature to highlight advancement in mobile light detection & ranging (LIDAR) technology, technique& current & emerging application in transportation. LIDAR is solely a 3 D laser scanning from a vehicular platform. This platform may be an aircraft, helicopter etc or it may be mobile van, both of them carry the requisite instruments like Laser emitter & receiver Camera & GPS etc. This review also highlighted current challenges the industry is facing, the guidelines that currently exist, and what else is needed for the adoption of LIDAR by transportation agencies. LIDAR can easily & advantageously used by Road, Rail, sea and air transportation facility.

II. LIDAR TECHNOLOGY

Most considerable disadvantage of current data collection method is that a significant amount of time is either required in the field to collect & reducing the collected data in form which can be quickly analyzed. But with the help of LIDAR terrain information can be collected more rapidly than the existing data collection techniques. LIDAR is an active remote sensing system that utilizes a base beam as the sensing carrier. Laser scanners measure 3-Dimensional point on the surface of earth.

Although widely used to acquire surface terrain information, photogrammetry has secured limitations that adversely affect the location process.

Traditional, system of information, imagery acquired to be obtain during beat off condition [i.e. no beams on trees) & with ground tree of snow.

LIDAR is attractive because data can be collected & reduce fairly rapidly compared to traditional photogrammetry. LIDAR can potentially be collected under a much wider range of condition than aerial photography] including winter months if snow lover is not present. One of the critical benefits of mobile LIDAR is its greater safety over other traditional surveying methods because mobile LIDAR performs road survey with fewer surveyors at traffic speed, day & night. Therefore a growing number of transportation agencies around the world has considered mobile LIDAR for Road Inventory & for transportation related application.

III. MOBILE VS AIR BORNE SCANNING

Key difference between mobile LIDAR & airborne LIDAR & use include

- Airborne scanning is performed looking down on the ground from a considerable altitude due to which data is collected less dense. Mobile LIDAR system will collect data more densely close to
- The base foot point on the ground is normally much larger for airborne LIDAR than for mobile.
- Mobile LIDAR System can capture surfaces underneath bridges & in tunnels.
- Mobile Lidar system is limited in collecting data within short range of navigable roadways. Airborne platform have more flexibility of where they can collect data.

Airborne LIDAR	*Mobile LIDAR*
– *Direct view of pavement & Building top* – *Poor view of vertical focus* – *Faster coverage* – *Larger footprint* – *Laser travel much faster Not limited to area visible from Roadway*	– *Good view of pavement* – *Direct view of vertical focus* – *Cannot capture building top* – *Slower coverage* – *Smaller coverage* – *Limited to object close & visible from roadway*

IV. USES IN TRANSPORTATION

Transportation Planning – LIDAR data for Road help engineer to understand it & give roadmap for the building it tis LIDAR are highly accurate technology help to understand width, elevation & length of existing road. Road engineer use LIDAR data for various applications such as

1) Calculate cut & fill, culvert sizing, amount of vegetation removal, grade calculation & more
2) Height clearances
3) Right of way & surface conditions

V. ACCIDENT STUDY

Ground based LIDAR can be used to capture the accident & crime scene. LIDAR technology can be used quickly to record the accident scene. This allows the traffic to flow smoothly if there is any accident.

VI. RAILWAY INFRASTRUCTURE

Traditional railway track measurement was done by regular survey system LIDAR can quickly perform the measurement of the railway track and the topographical & surrounding area of railway path.

VII. AIRPORT INFRASTRUCTURE

LIDAR is used to capture features in the airport like runway, terminal building, hanger and other objects. This allows airport authority to manage & operate airport system smoothly.

VIII. CURRENT CHALLENGES & FUTURE TRENDS

Review reveals that Mobile LIDAR offer a huge potential for road information inventory amazingly due to its improved safety, efficiency, flexibility & data reusability. More importantly mobile LIDAR, as an active remote sensing technology, provides highly accurate point clouds with high point density However, several challenges exist when implementing mobile LIDAR data in road related application.

Note that mobile LIDAR technology will certainly not replace current conventional methods of topographic data collection. The mobile LIDAR data in most cases may need to be supplemented by data collected from conventional surveying. Therefore it is not an umbrella as it requires using other different technologies.

But in future it can become the most advance technology to study & evaluation of surface terrain. Thus in the foreseeable future, a consistent guideline in urgently required to standardize the adoption of mobile LIDAR by transportation agencies. Standard & best practices such as control requirement, accuracy standards, data interoperability & management.

IX. CONCLUSION

Roads plays a vital role in people's daily lives in all countries because it brings people together for business or pleasure by connecting a country with its neighbors to enable the safe movement of goods people & serve to safely keep people on move, transportation department in cities or countries have to be periodically perform road survey. Surveyed data are used not only for transportation department to maintain and reconstruct the current. Roadways & bridges & to manage traffic & parking infrastructure:- A mobile LIDAR mounted on top of vehicle, captures the data in 3 D, therefore providing accurate 3 D information of Roadways. Till date, use of LIDAR technology for road survey has been proven for safety, cost, efficiency & data confidence Mobile LIDAR system are gaining widespread acceptance with time. Due to the various advantage as mentioned in report, a growing no of transportation agencies have been considering mobile LIDAR for Road Information inventory.

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