



2019 INTERNATIONAL SYMPOSIUM ON ELECTRICAL AND ELECTRONICS ENGINEERING



CERTIFICATE

OF PRESENTATION

is presented to

DR. FLORENTINUS BUDI SETIAWAN

for the presentation of

Landslide Detection Method Using Laser Beam

at The 2019 International Symposium on Electrical and Electronics Engineering
Ho Chi Minh City, October 10-12, 2019

Prof. Thuong Le-Tien
General Chair

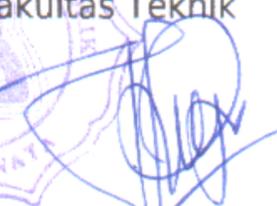
Surat Tugas

Nomor : 00064/K.6.4/ST.FT/10/2019

Dekan Fakultas Teknik Universitas Katolik Soegijapranata dengan ini memberikan tugas kepada:

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Waktu : 10 - 12 Oktober 2019
Tempat : Ho Chi Minh City University of Technology (HCMUT)

Harap melaksanakan tugas dengan sebaik-baiknya dan penuh tanggungjawab, dan setelah selesai harap memberikan laporan.

Semarang, 07 Oktober 2019
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Telah Melaksanakan Tugas

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Ho Chi Minh City University of Technology.

() October 10, 2019

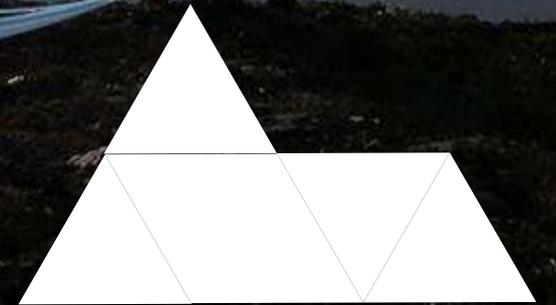
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Landslide Detection Method using Laser Beam

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HCMC University of Technology, October 10-12, 2019



Outline

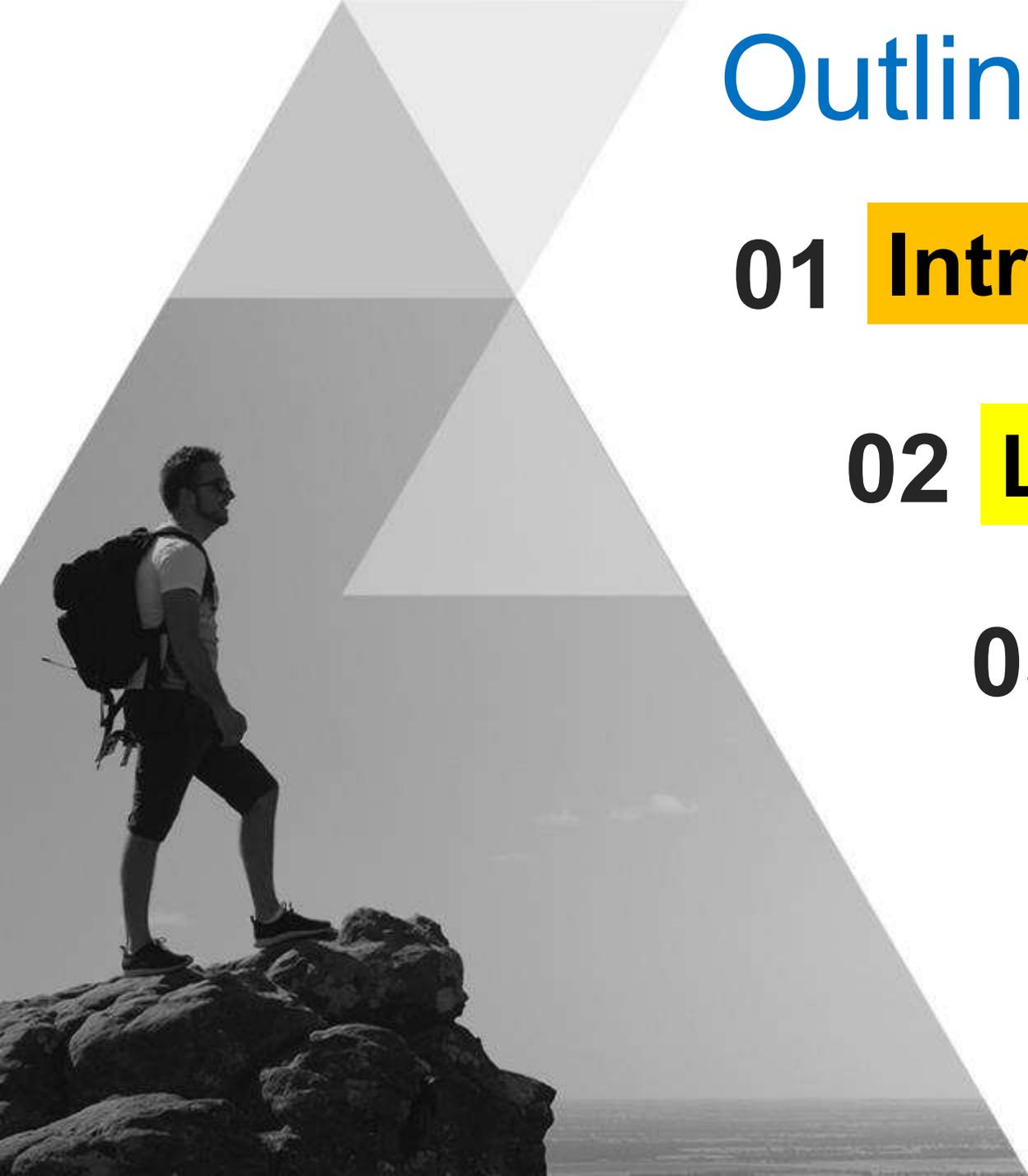
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04 Result

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Introduction

Introduction

Movable land are a serious threat faced by the world's population.

Magnitude of landslides → measured scientifically, predicted correctly.

The limited amount of power → simple but efficient telemetry model.

Need to read the soil conditions → sent to data centers → analysis

Introduction

Inclinometer : measuring soil movements → detect ground slope only

but land shifting to the starting point cannot be detected.

measure amount of soil displacement within a certain period of time.

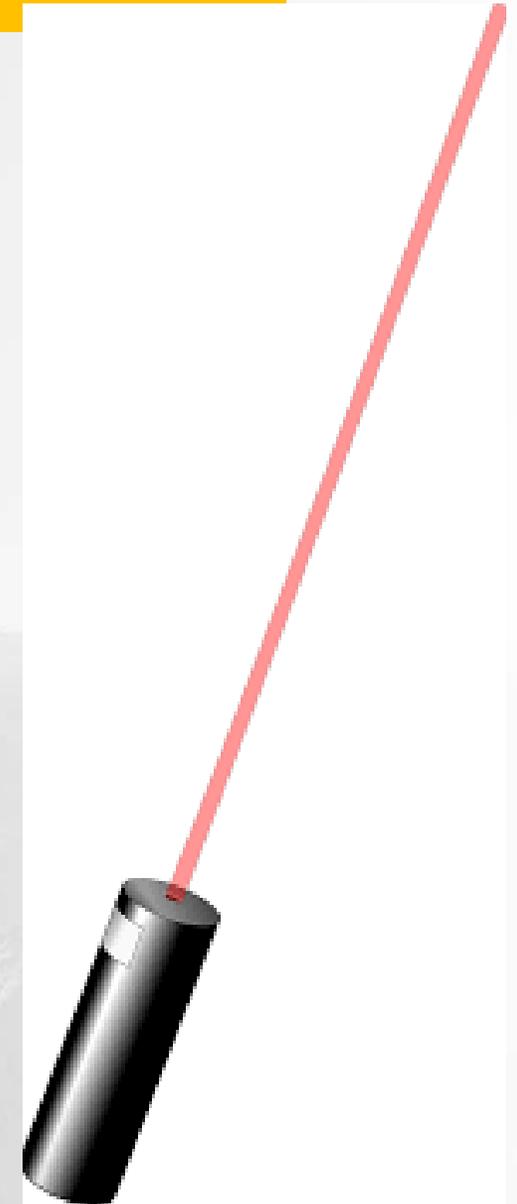
Introduction

Purpose : telemetry system for monitoring the shift of land at low speeds with high quality.

Obtain a laser-based sensor design method (telemetry system) for monitoring land shifts.

Aim : development of monitoring methods using laser light that have not been done so far.

The signal is sent using an internet network → can be monitored continuously.





Landslide Measurement

Slope Stability\

Ground movement : mass of a material of the earth moves by the gravity of the earth

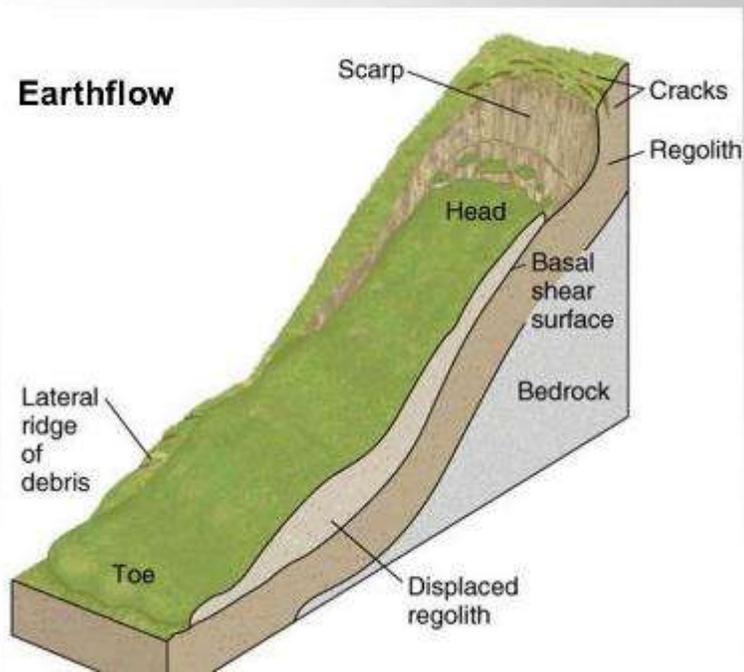
Slope movement : imbalance of forces inside the soil surface and triggers of external forces acting on the slope.

Inner forces caused by:

- type of soil;
- density of soil;
- level of shear strength of each soil parameter
- underground water flow.

The types of soil vary, including soil density level.

In conditions of sloping soil layers, different types of soil and density levels can cause different slope failures.



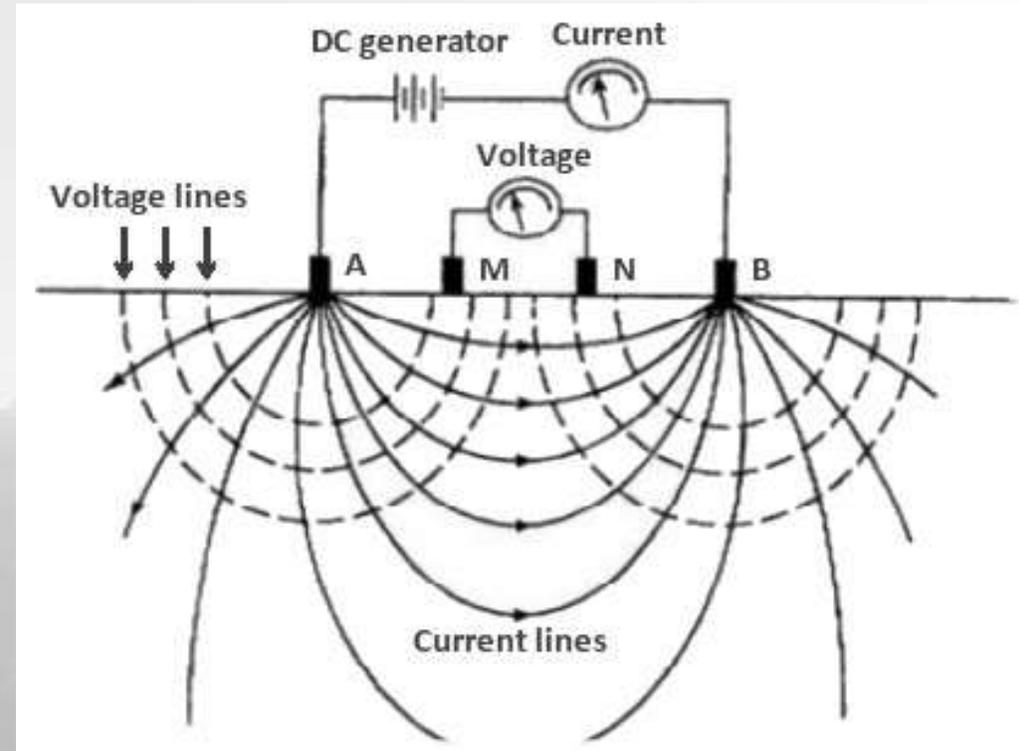
Geoelectric Test

Geoelectric Test : measure "resistivity" of material below the surface of the earth.

resistance of this type of material is carried out by flowing electric current into the ground.

Electric characteristics → different for various material

This potential electricity flow is measured;



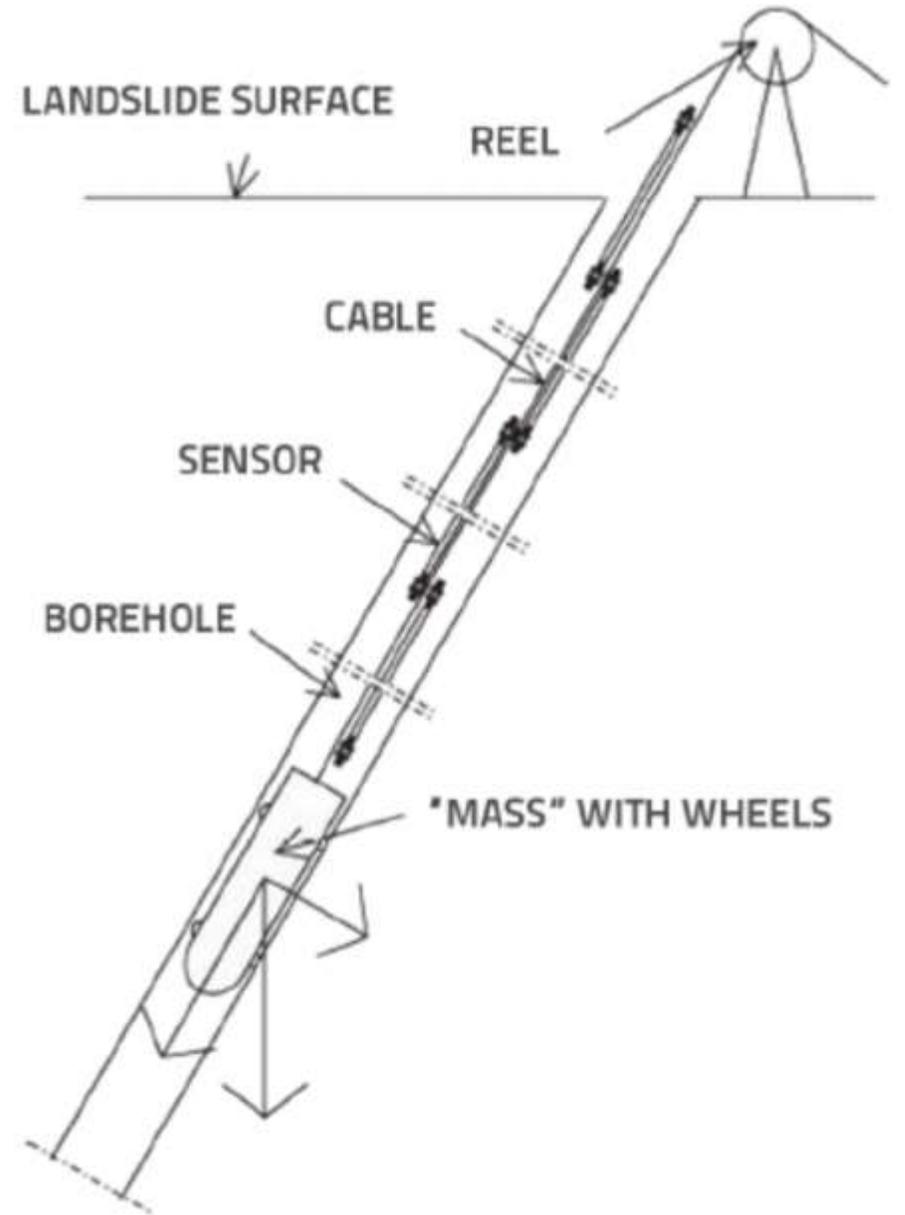
Inclinometer

Inclinometer : measuring ground motion.
identify the depth and speed of soil movement.

The shape : like a pendulum

- outer part is a wheel to slide while to determine the ground movement
- launched on a pipe that has been previously planted.

Inclinometer



Centre Cluster

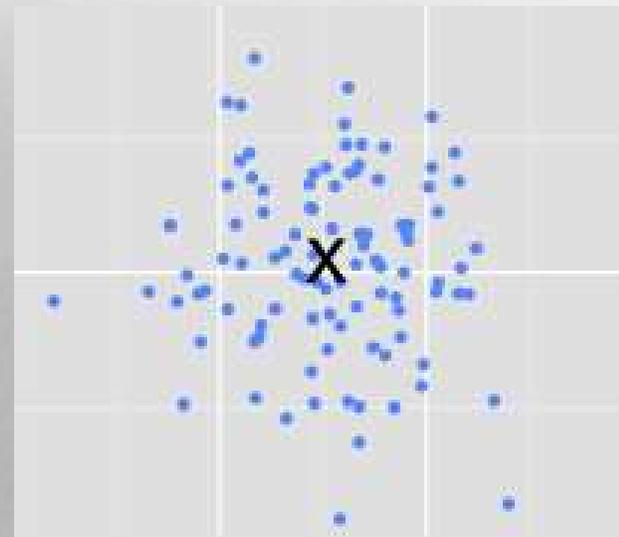
Center detection :

Clustering is a grouping of objects so that objects in the same group are more similar to each other.

Clusters include groups with small distances between cluster members, dense areas of data space, intervals or certain statistical distributions.

The centroid of a finite set of k is

$$C = (x_1 + x_2 + x_3 + \dots + x_k) / k$$





Methodology

Landslide in Kaligarang River Area

Pilot/experiment of this system :
landslide around the Kaligarang River,
Semarang, Indonesia.

UNIKA is our university nick name of
Soegijapranata Catholic University.

UNTAG is neighbor university that located on
the south west of UNIKA.

The land between UNIKA and UNTAG is tend
to slide into Kaligarang River.



Part of Landslide detection system

A silhouette of a person sitting on a hill, holding a flashlight that is turned on, creating a bright glow. The person is positioned on the left side of the slide, looking towards the right.

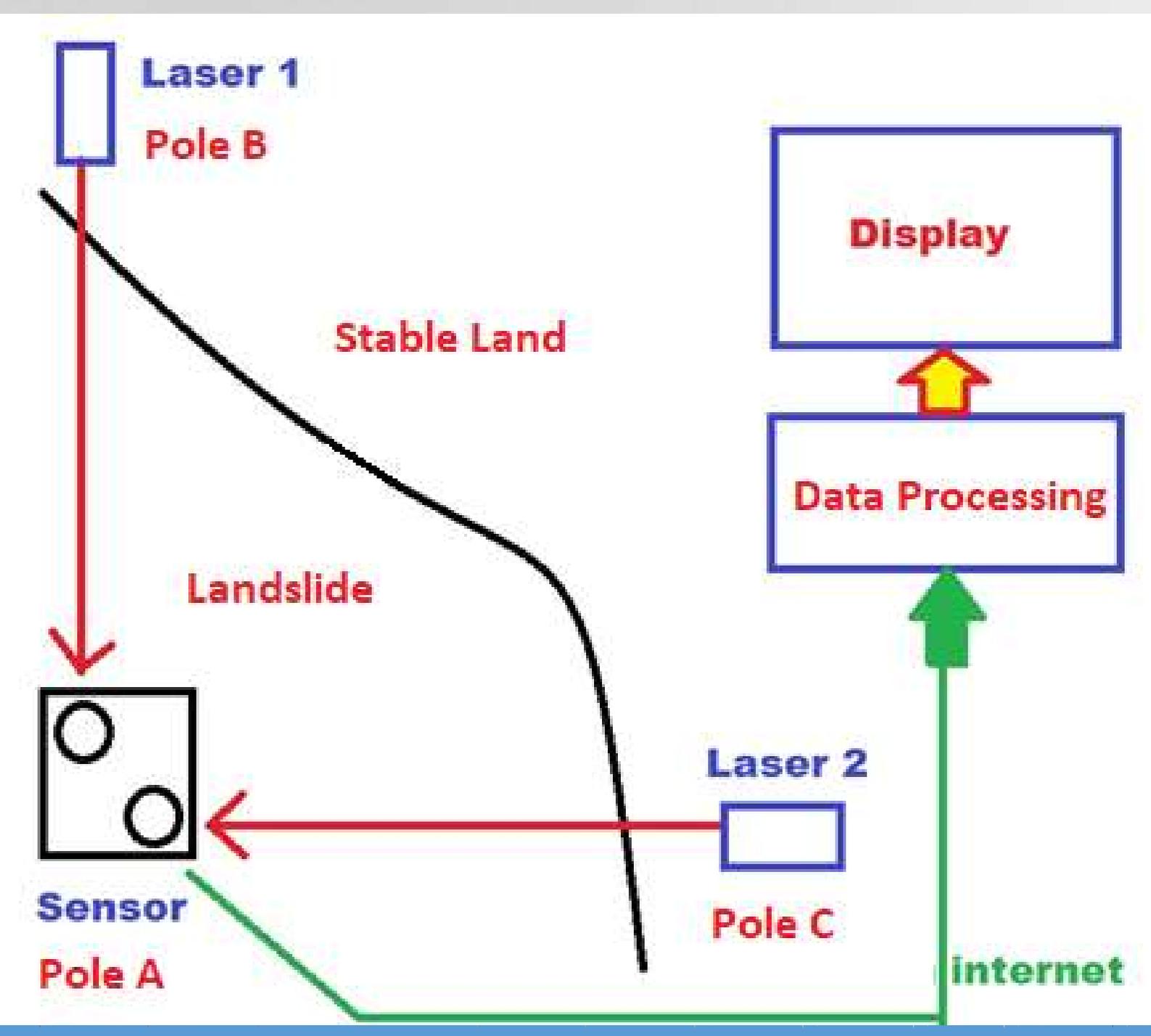
1. Sensor system

2. Amplifier

3. Signal Transmission

4. Data Processing Center

5. Display



Laser Beam to Detect Landslide

Two camera as sensors

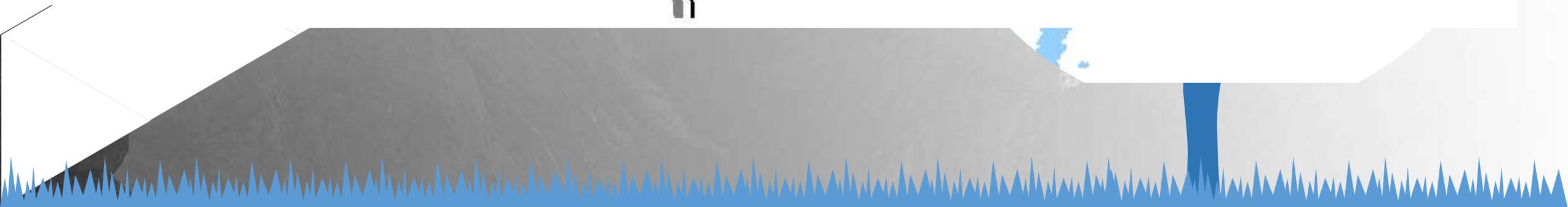
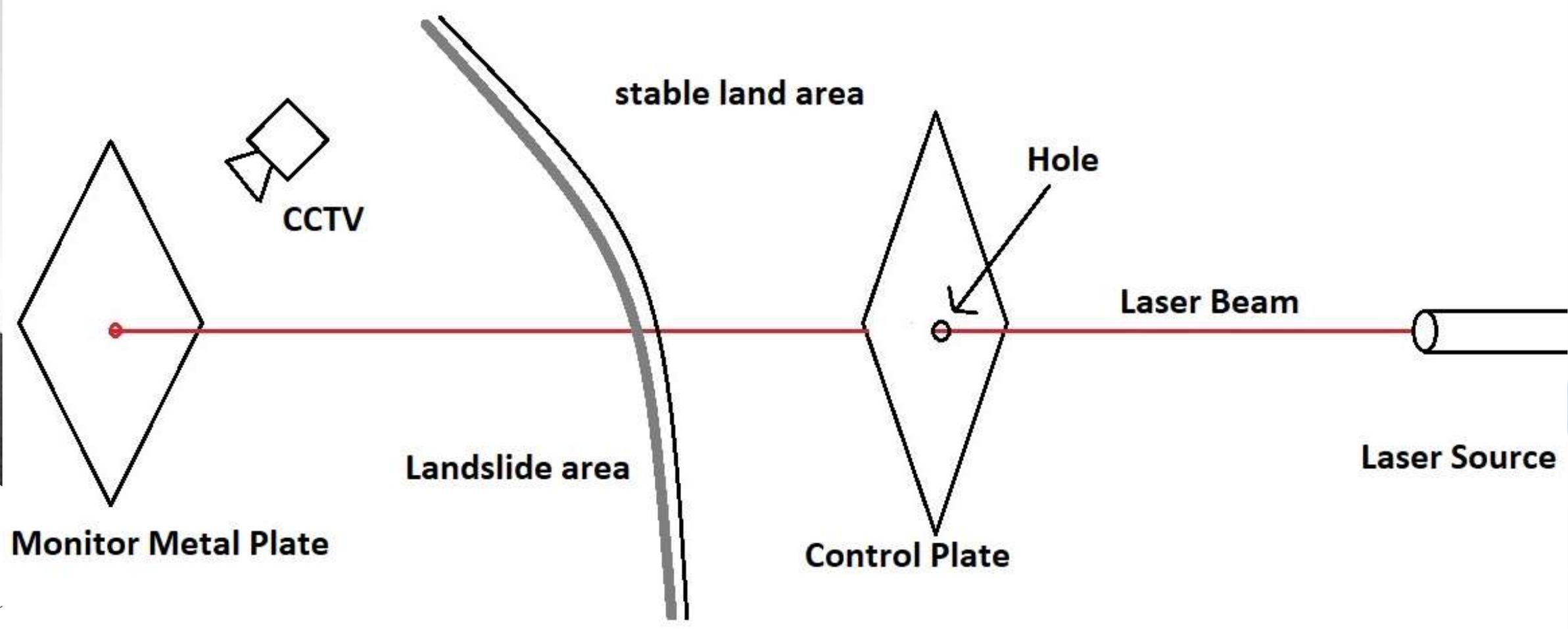
Camera is placed in the area monitored for soil movement.

Two laser beam sources are placed which will be directed to a plate mounted on pole B and C.

The use of a laser beam is needed to obtain measurement accuracy.

Therefore it is necessary to place a light transmitter that is strong enough to not change easily by changes in weather and humidity.

Laser Beam Adjustment



For long period measurement, laser beam direction → change into other direction because of any climate condition.

Point or dot that reflected into monitor metal plate become inaccurate.

Control plate is placed between laser source and monitor metal plate → ensure that the beam is on the right direction.

If the laser beam do not pass the hole of the control plate, the laser beam direction needs to be adjusted.

Detection of the Laser Beam Center

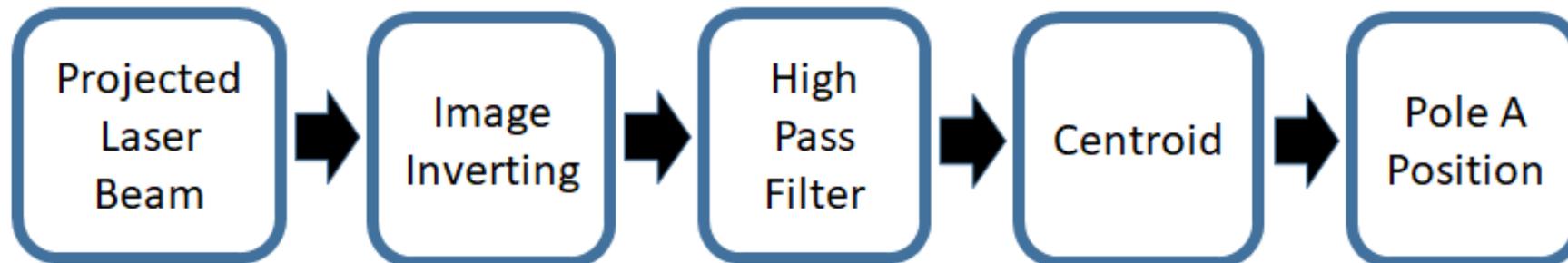
Laser beam projection on the monitor metal board is too big to decide translation of landslide per certain period.

There is about one centimeter radius.

More precision measurement → central cluster method

Based on imaging signal processing system, by using inverted signal and center cluster method, the center of beam is calculated.

Center of laser beam will be change when there are any landslides on pole A.





Result





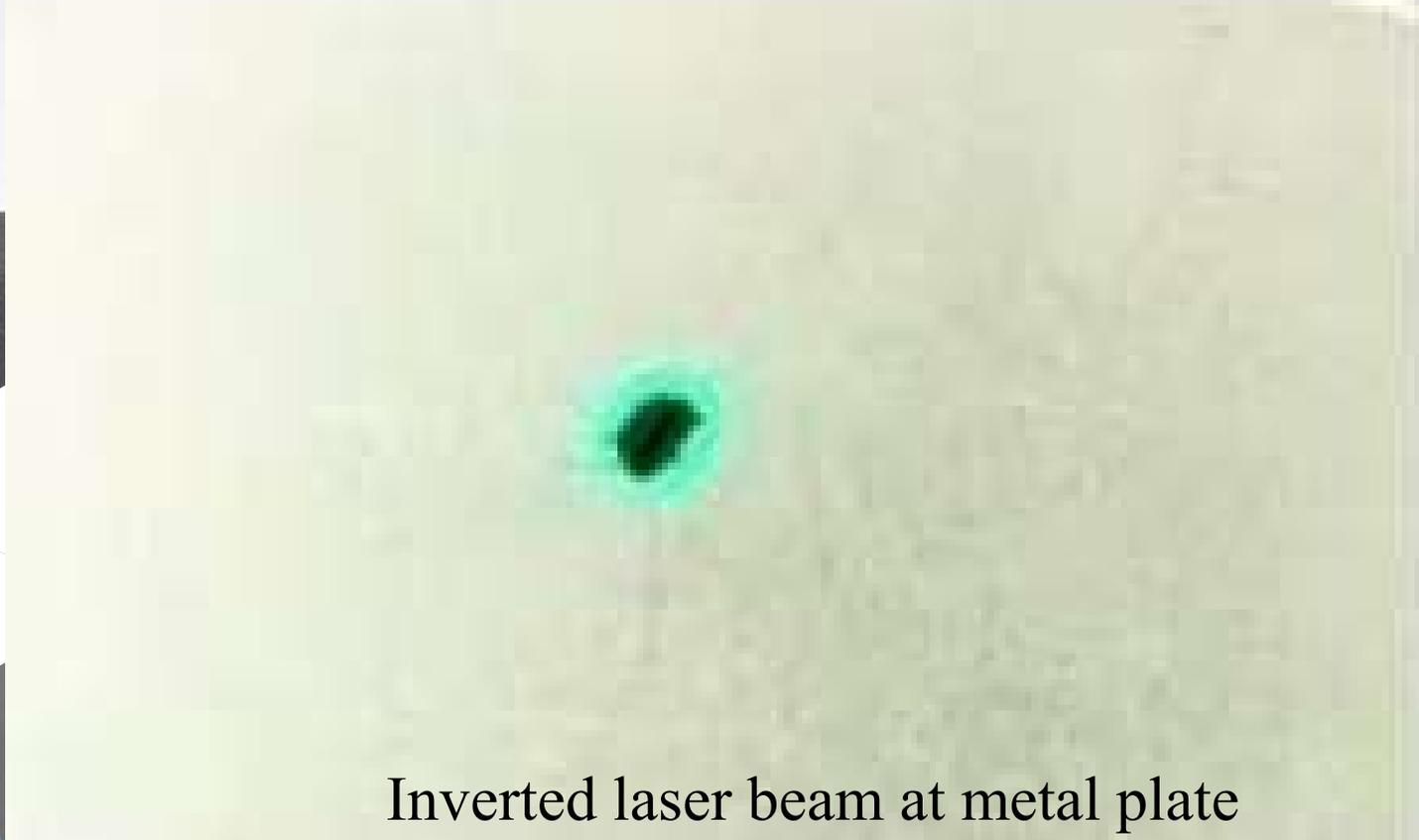
Laser beam at monitor metal plate on Pole A



Laser beam projection on the monitor metal plate that placed on Pole A. Projection of this beam is too thick to be detected of its centre, because of long distance between laser source and monitor metal plate.



By using signal processing calculation, the image will be inverted in order to get much contrast of image. But transition between white and black area are still appear in this image. High pass filter is applied to much contrast.

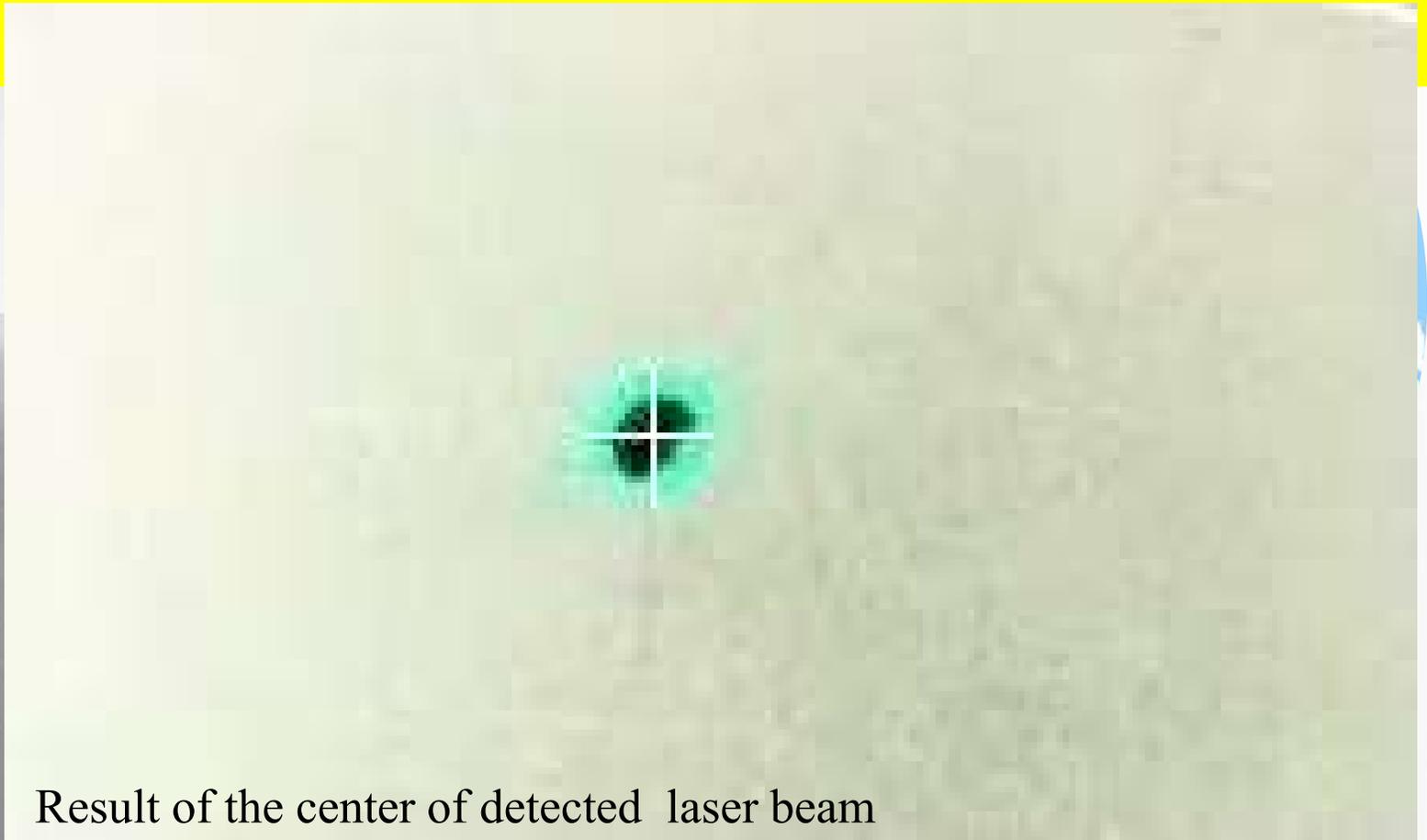
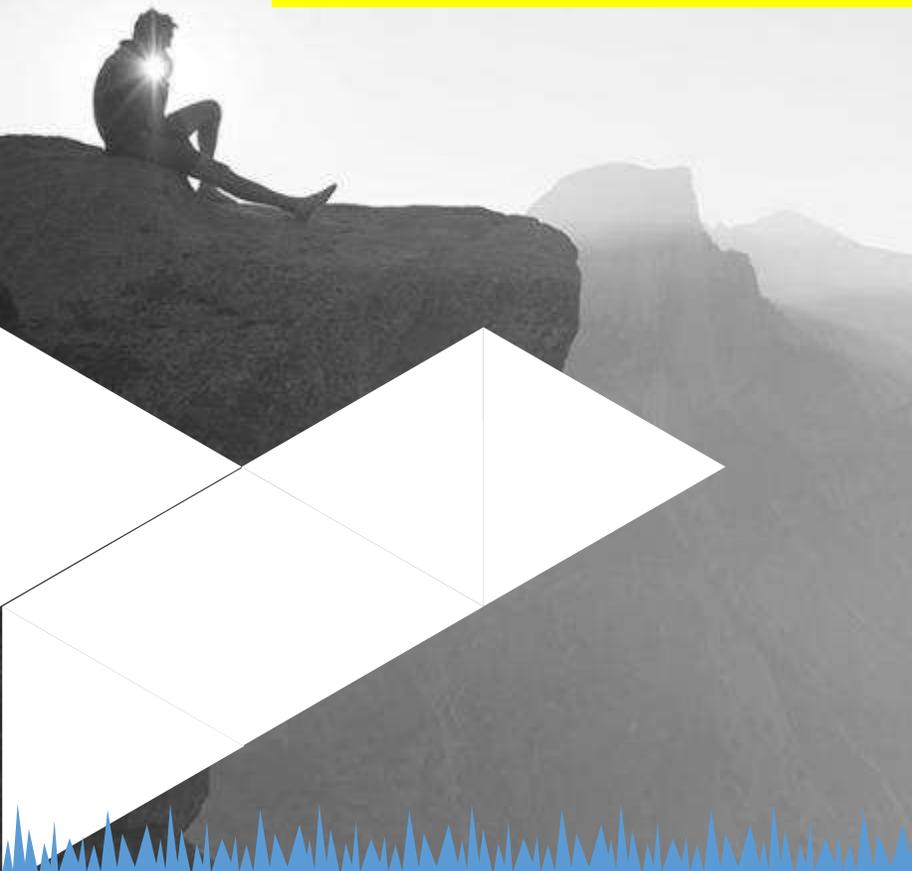


Inverted laser beam at metal plate





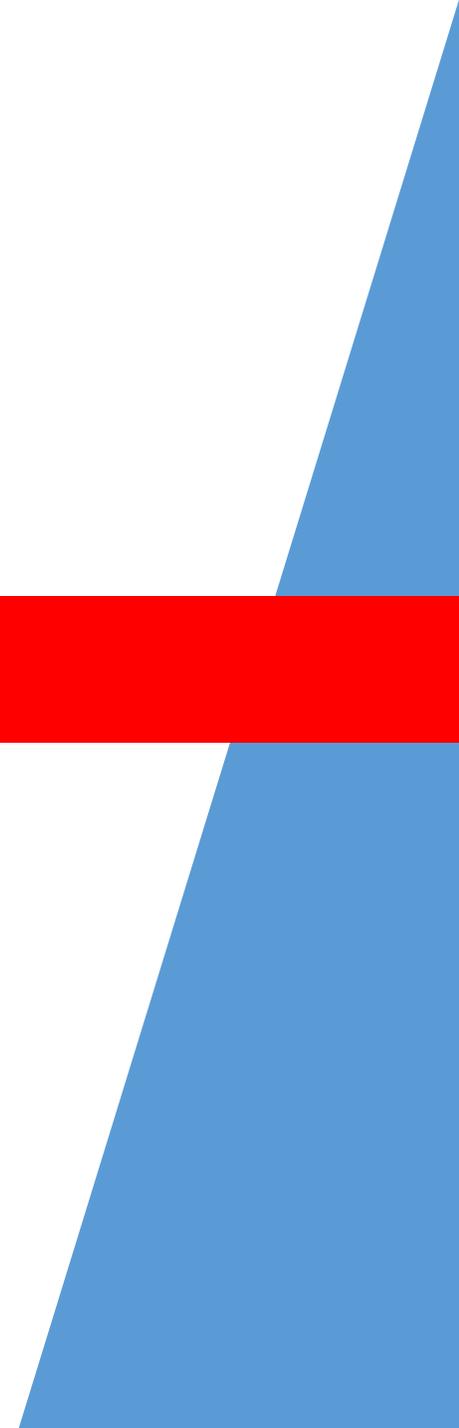
Centre of projected laser beam is calculated using centre cluster method to obtain the right position of Pole A. this centre will be changed when there are any landslide on Pole A position.



Result of the center of detected laser beam



Conclusion



Conclusion

- Landslide could be detected using laser beam projection to obtain the precision measurement.
- One plate control with a hole must be installed in place between laser beam source and target plate to adjust the laser beam direction.
- The centre of beam could be calculated by using centroid method.

A hiker with a backpack stands on a mountain peak at sunset. The scene is framed by a large white triangle graphic. The hiker is silhouetted against the warm, orange and pink sky. The text "Thank you" is overlaid in white, with a large white triangle graphic partially obscuring the end of the word.

Thank you