Map on 3D

Highly accurate three-dimensional map making software
based on the IMS3【Dual Cam】

Capture, Process and fast Delivery of 3D & 2D Maps !

2011

Iwane Laboratories, Ltd.

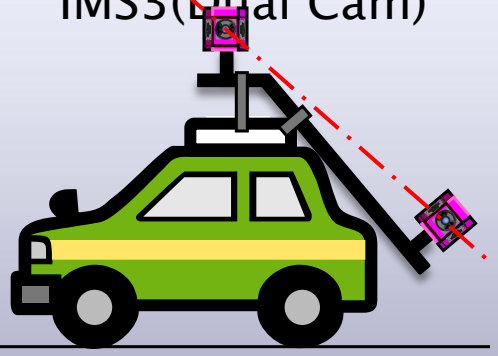
Objectives

- Introduction of a highly accurate three-dimensional map making system termed as “Map on 3D” based on the IMS3【Dual Cam】

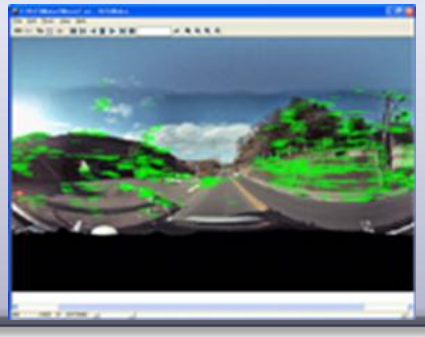
- Map on 3D can detect **three-dimensional shape** of the road white lines marking directly with high accuracy the results of which are detailed in this document.

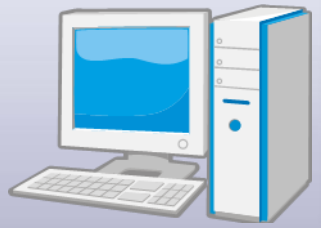
Work Flow Chart to Make 2D Maps

Shooting Using IMS3(Dual Cam)



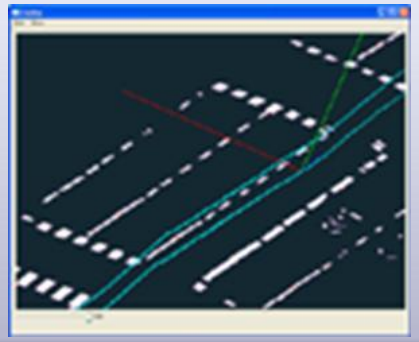
【Auto】 CV Process／Coordinate Integration Movie Making

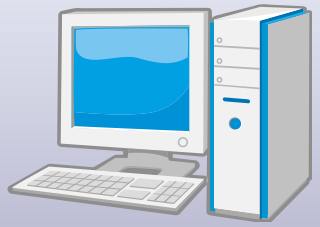




Map on 3D

【Auto】 White Lines Recognition/ 3D Analysis／Map Making





【Manual】 Final Process /Quality Check

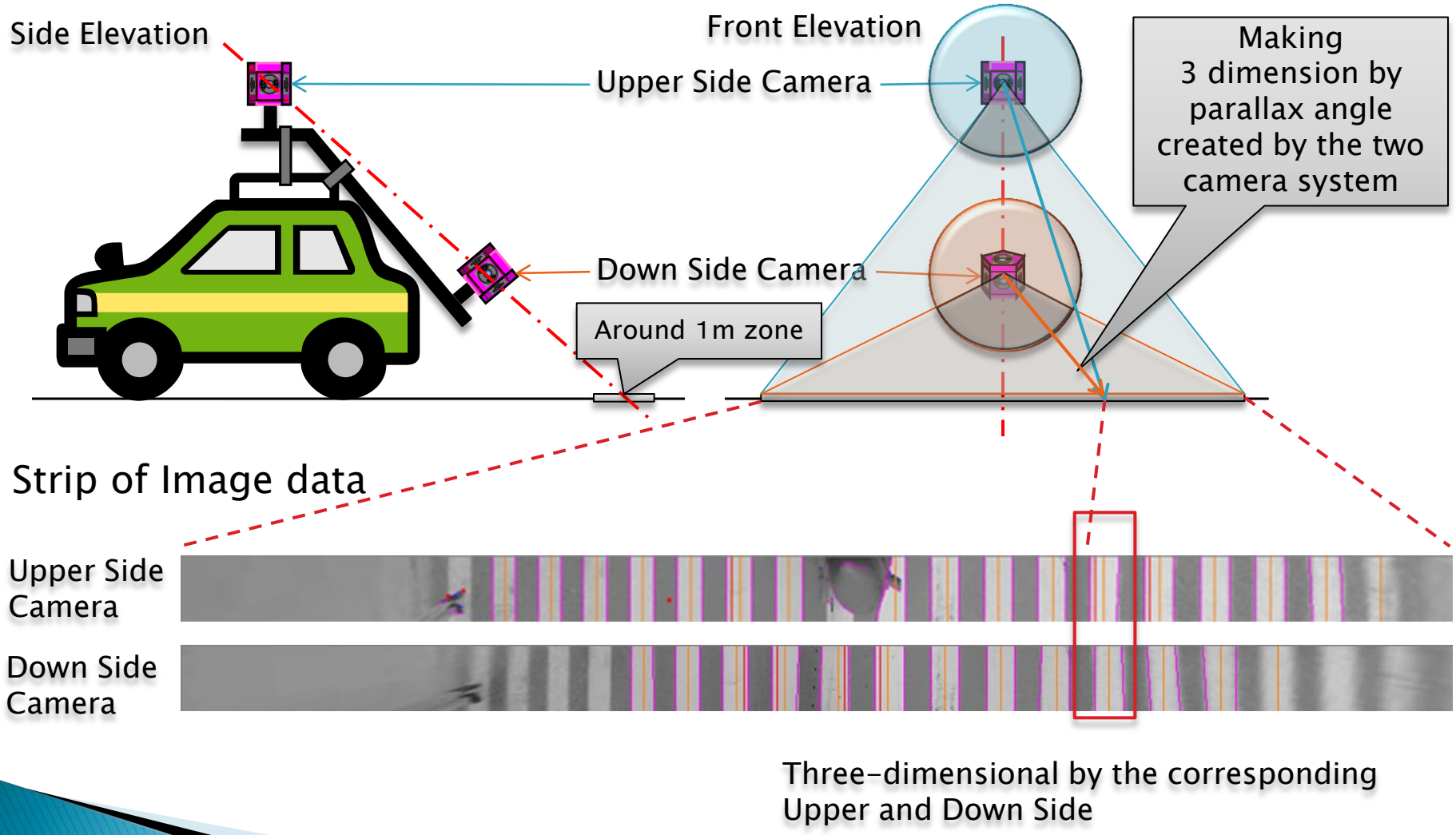
Design Concept of Map on 3D

- To create highly accurate three-dimensional map and the highly accurate road map using ortho-rectification.
- The road section processing is automated whereas other areas can be extracted using 3DPCCI (3D model can be created from CV image) in a semi automated process.

* **Please see the Error Evaluation document on website about the error and accuracy.**

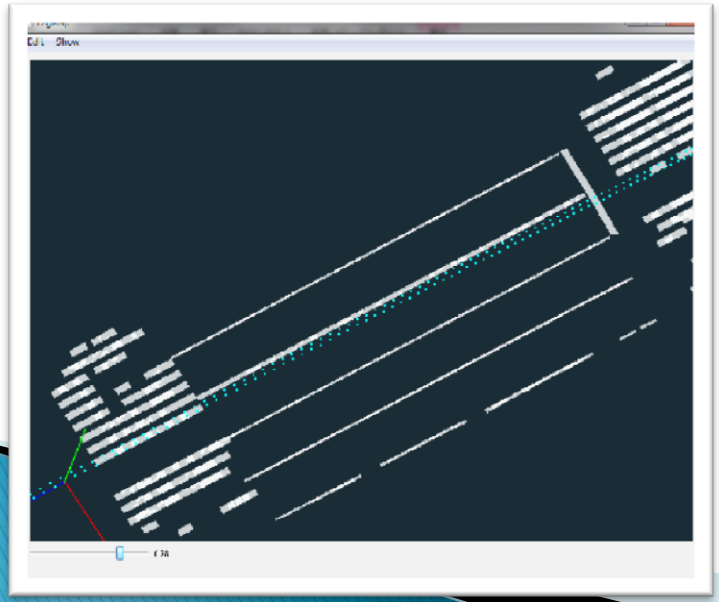
- The complete spherical (360degree) image without any dead angle can be used by the GIS industry besides the Survey vertical.

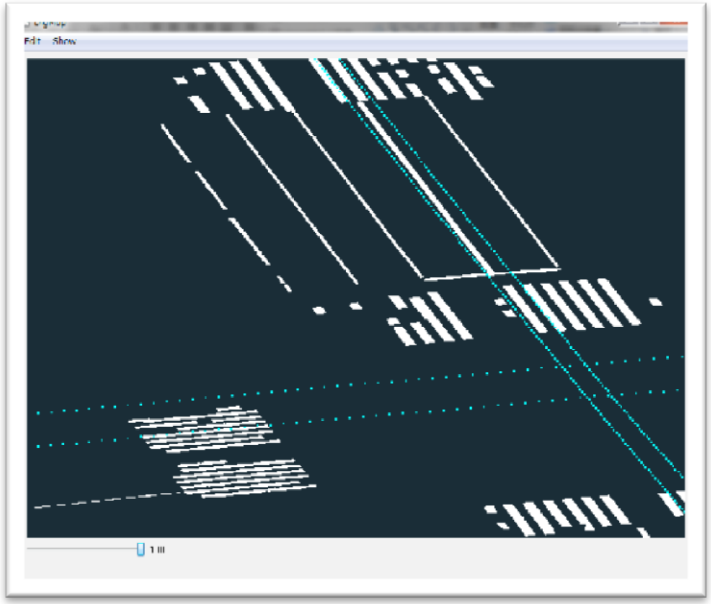
Principle Chart for 3D Analysis



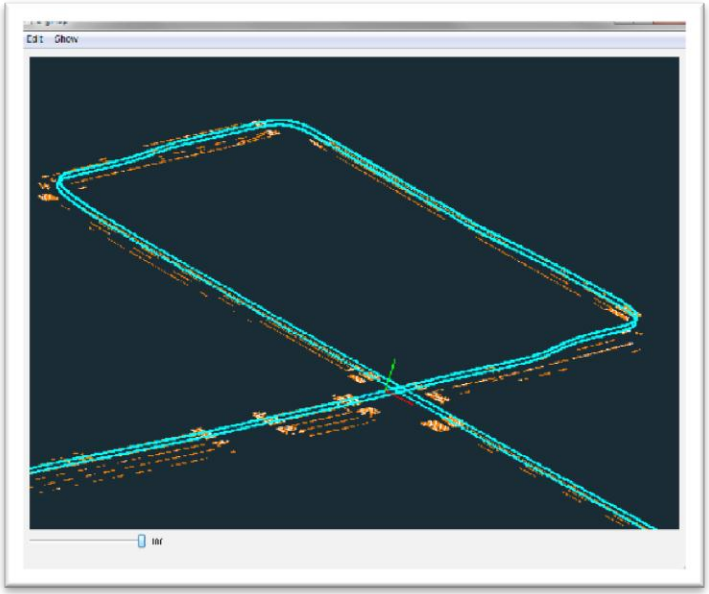
3D Vector Data

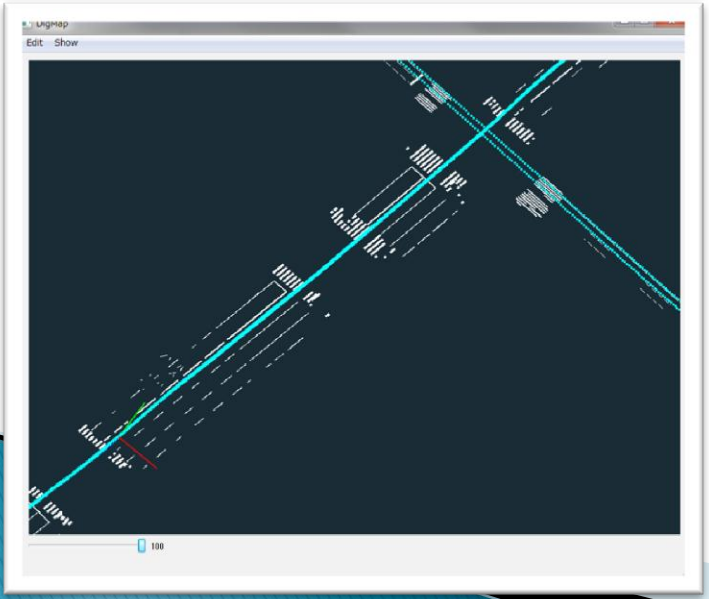
- This output is during data processing phase and consists of group of 3D shaped rectangles in the form of vector lines each 1 meter in length. (Blue lines are camera tracks)
- We can align the shape and re-convert this original data to one complete white line in the final stage of data processing.
- We generate these 3D shape rectangles through CV figure only without the use of GPS/IMU data as this is for our accuracy check . Integration of GPS/IMU data, aligning white lines, and making continuous white line are performed while making Ortho map during the final phase of data processing. (Available without GPS till here)
- Road maps can be produced as a final product by projecting these 3D vector data on to Ortho plane.





Accuracy of 3D Data





- Based on tracking of street surface by surface facing camera, highly accurate CV figure can be achieved.

- The combination of frames is sufficient enough to estimate that 3D error (relative accuracy) is around 1-2 cm (our assumption) on the white line with a width of 15cm.

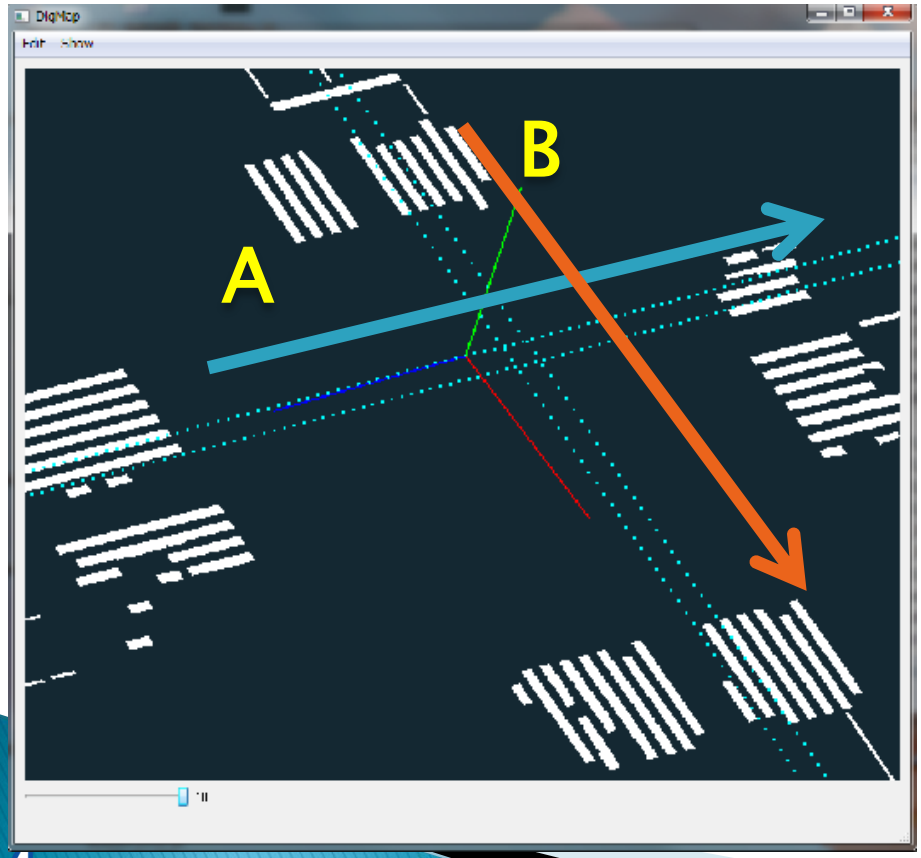
- All the above steps are fully automated process.

- Possible to process CV image of streets having 4 lanes with high accuracy. Measuring the distance between the white line accuracy ± 2 ~ 3 cm

- If the accuracy is not sufficient in case where there are more lanes, we can use 3D coordinate integration which we have demonstrated before. For example, we acquire two-way street image data(both directions) and combine them based on this CV integration technique.

Integration of Coordinates at Intersection

We can resolve the gap between CV figure of image A and B at intersections by integration of coordinates (Inco). We use the common objects in both images and adjust CV figure using Inco. This is an unique advantage of CV technology which is not available in other options.



■ Capabilities of Inco

・Image A & B captured at different time intervals can be integrated and used in the same 3D space and coordinate.

・Several images can be integrated and used in the same 3D space and coordinates.
Each object certainly will have the same coordinates on each image. Capable of handling a wide range by this integration of coordinates.

・Relative accuracy can be improved further.

・Automated updating is available between several images captured by different cameras at different time.

Ortho Projection of 3D Data

* This data is acquired only by CV processing without GPS.

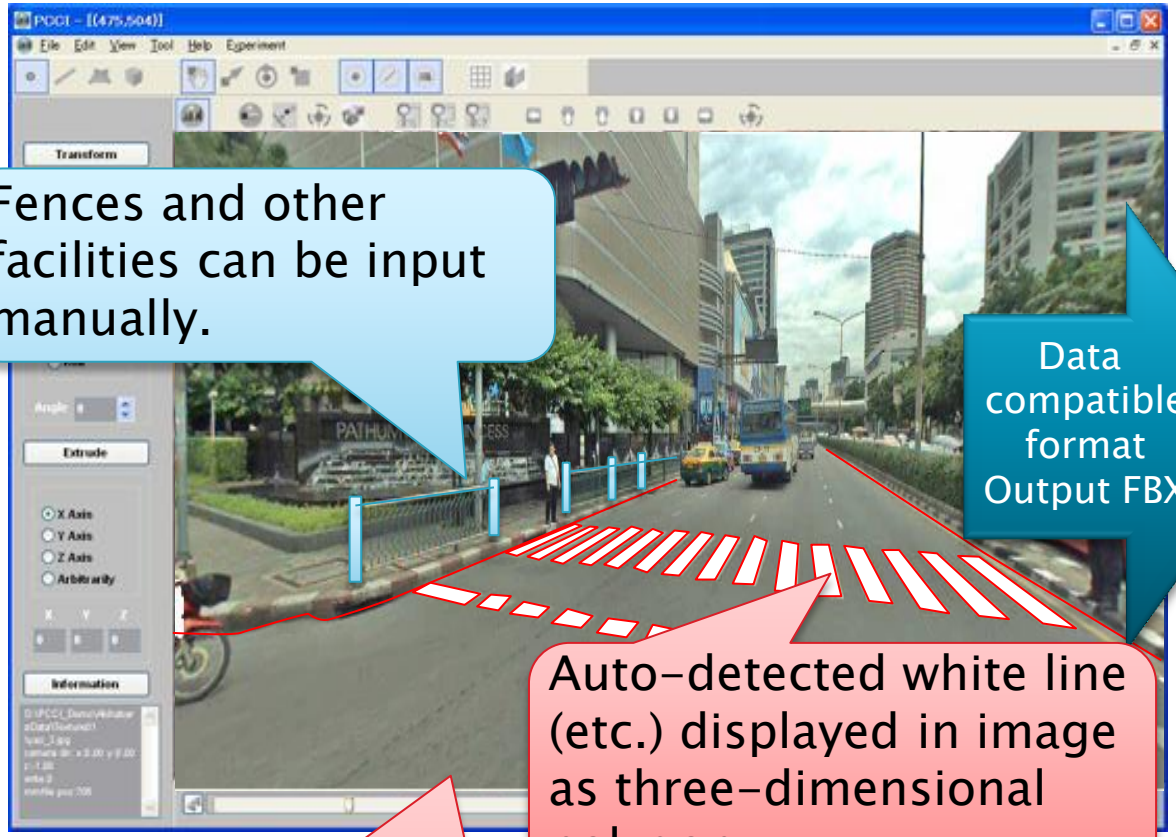
Future Development Plan

- In Map on 3D, our current focus is only on white lines located on both sides of the camera for recognition and converting them into 3D vector lines. However, we can also secure the same accuracy for other objects.

- Going ahead, we will develop Automatic 3D Map which can recognize other feature objects on the streets such as curb, manhole, rain water mass, pavement side, ground boundary, signal, signboard, and building shape, etc.

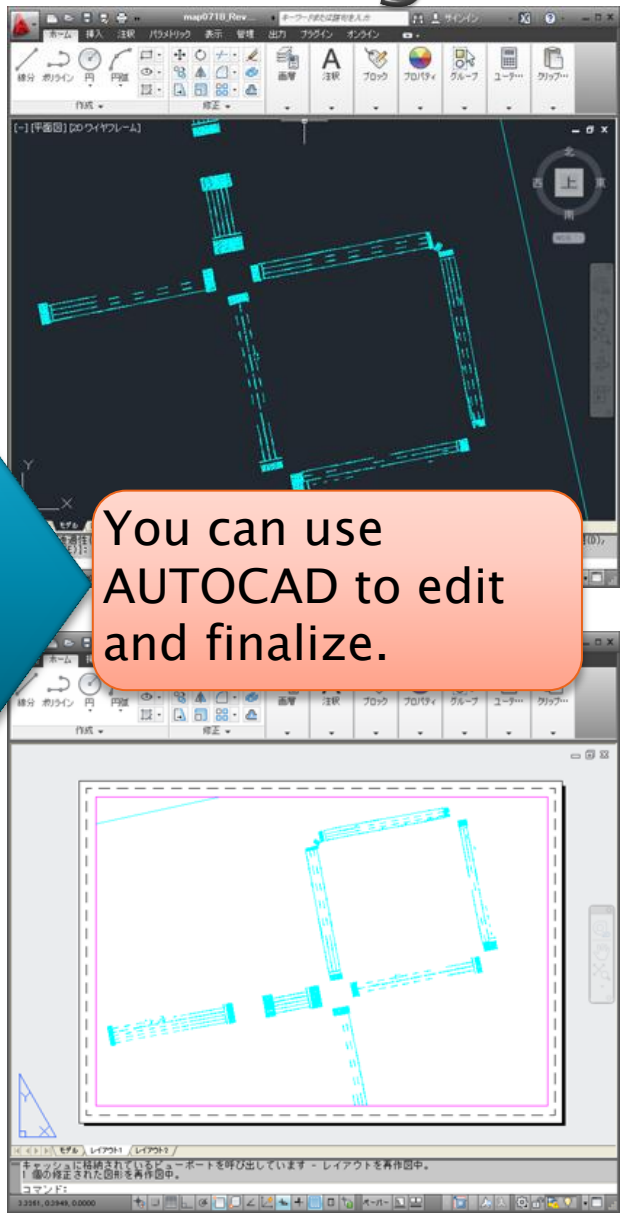
Map On 3D (Improved version) UI Image

It can be used for editing polygon (adding, modification, deletion) freely because it is based on 3D CG modeling tool (3D PCCI).



Fences and other facilities can be input manually.

Data compatible format Output FBX

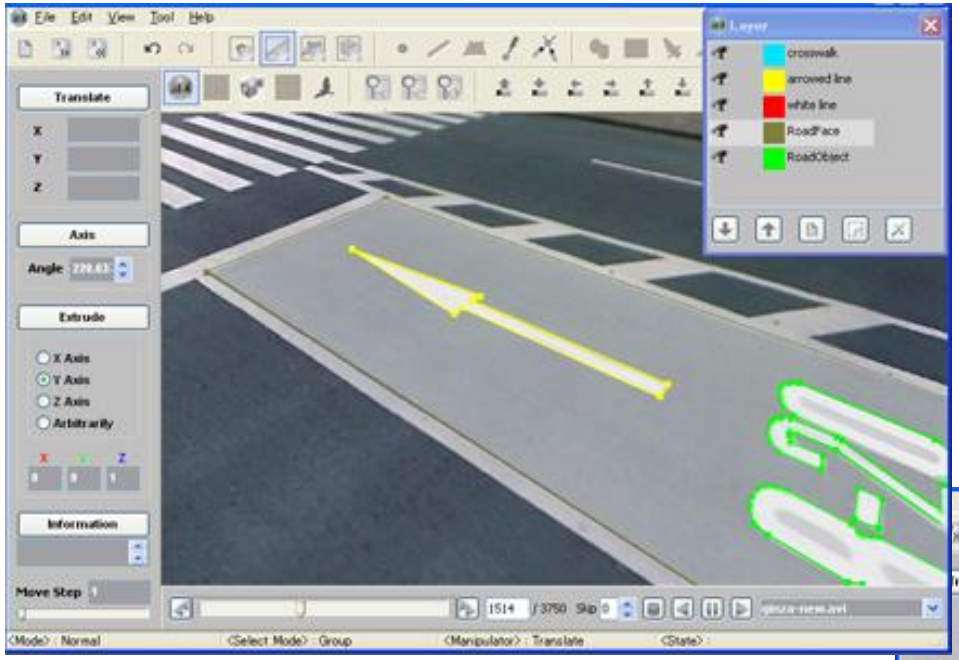


You can use AUTOCAD to edit and finalize.

Auto-detected white line (etc.) displayed in image as three-dimensional polygon.

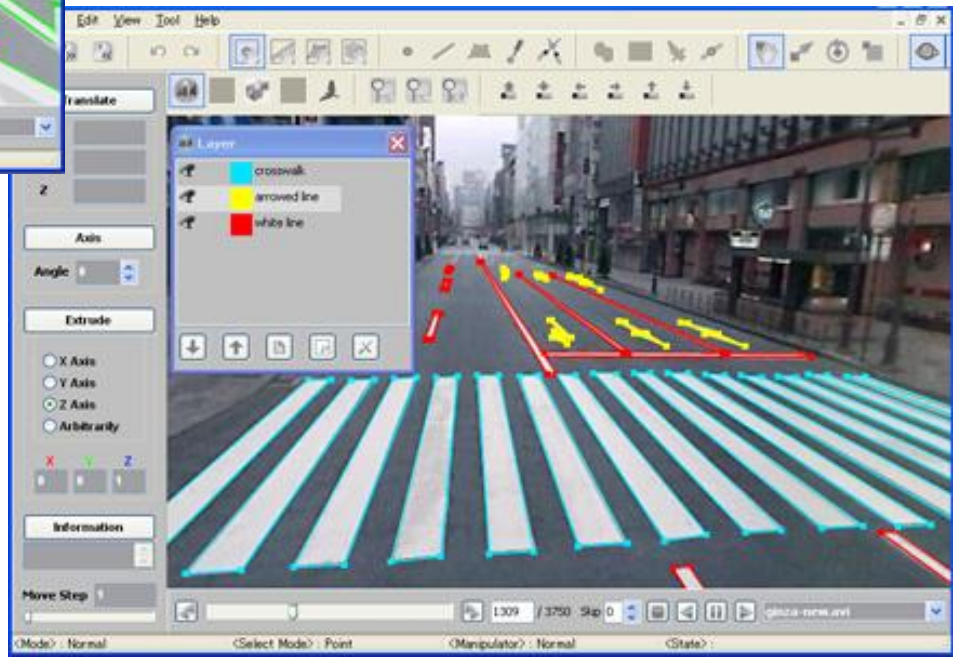
Manual editing is possible (Adding, modification, deletion).

Map On 3D (Under Development) Edit UI



- Enables creation of three-dimensional objects on the road surface

Enables creation of objects and the feature to create / edit an object in three-dimension for the polygons on the road surface and the building surface.

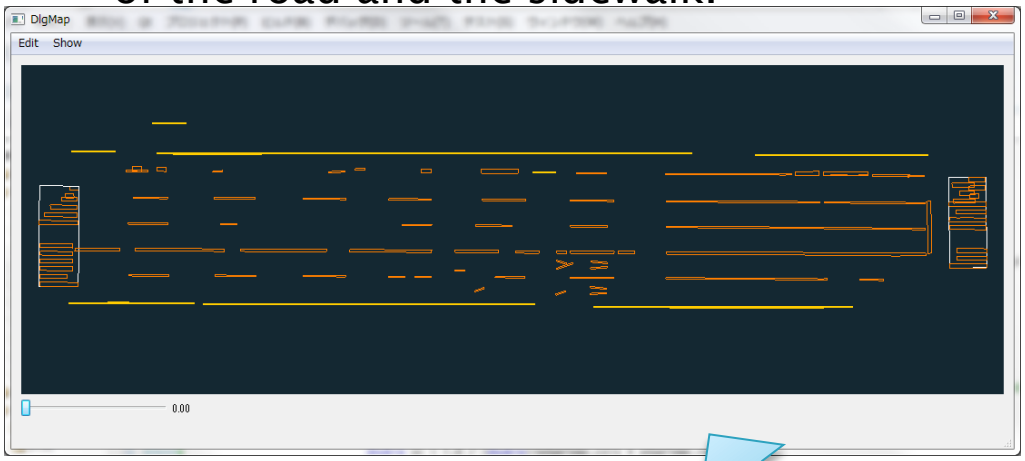


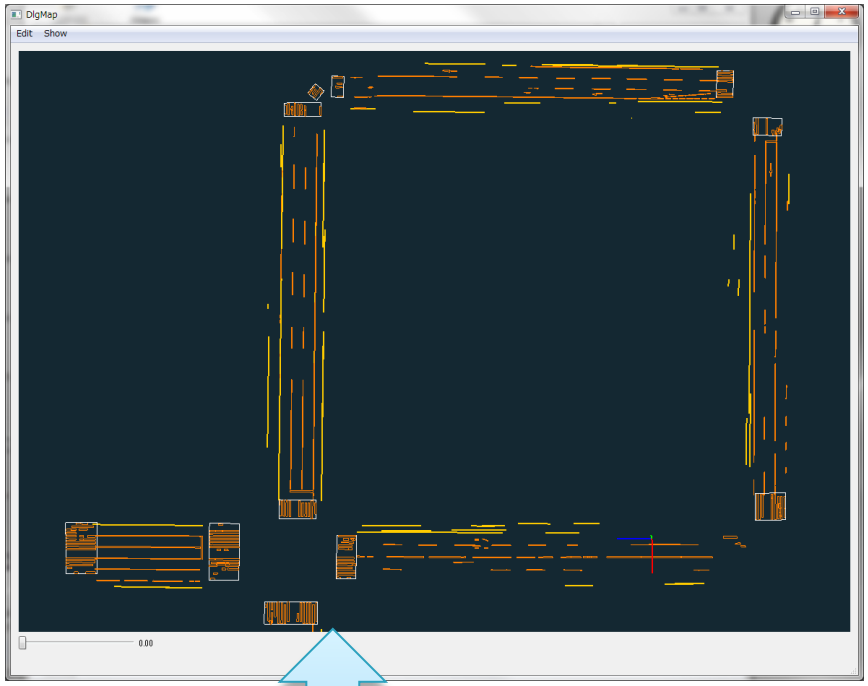
- Layer Control

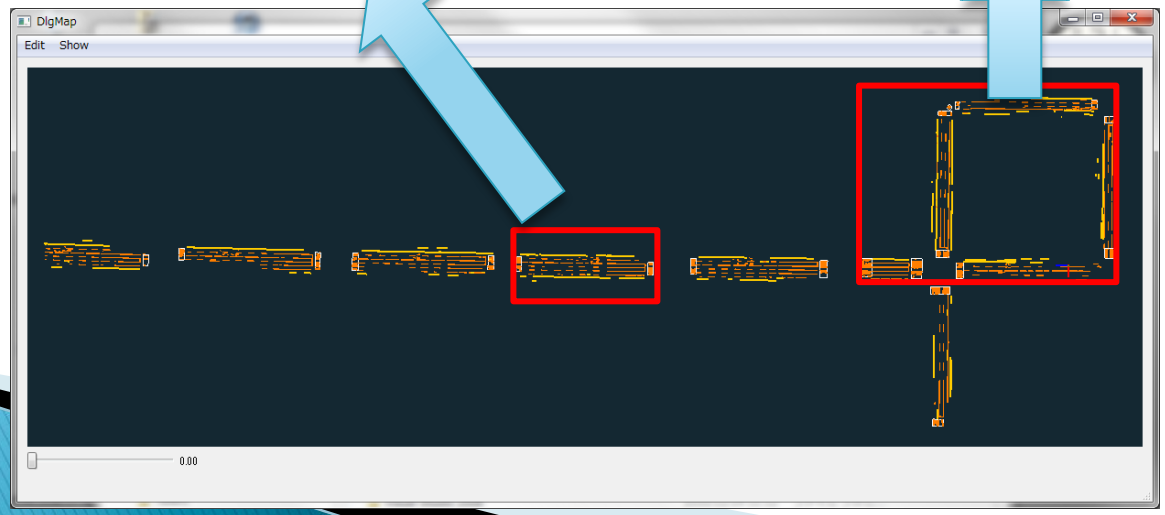
Road infrastructure and Facilities Construction can be managed separately for each object layer. Layers can be added which enables comprehensive asset management.

More than white line detection :Curb Detection

- The principle is similar to white line detection, technique developed to detect the curb “curb-only process" using the image features of the curb.
- Curb detection demarcates the boundaries of the road and the sidewalk.







– Map on 3D – Capture, Process and Quick Delivery of 2D & 3D maps

- Using several ways like IMS3【Dual Cam】, Street surface tracking , compound epipolar plane, CV accuracy has improved considerably and reached to the unit of millimeter in a relative figure. In addition to this, we have also achieved 1 or 2 centimeter (relative accuracy) in 3D measurements based on distance from the camera position.(relative scale of objects within 10 meter from the camera).

- In the near future, we can produce 2D maps within a few hours of capturing street imagery by IMS3.

- Our final target is to achieve a 95 % fully automated process and we aim to achieve a process with less than 5% manual intervention. Iwane's 3D PCCI tool is partially automated.

- This technology can be also applied directly for both ACCI (Fully Automated Technology for Creation of 3DCG) and Machine Map.

The accuracy of IMS2 is less than IMS3 (Dual Cam) and IMS2 is the best suitable for GIS, ALV-2 for Arc GIS Digital Street Scanner-2 (Ortho making Software) , 3D PCCI-2 and iiCosmo .

On the other hand, IMS3 (Dual Cam) can produce highly accurate maps and can also be used to create ALV-2for ArcGIS , Digital Street Scanner-2 (Ortho making Software) and iiCosmo.