

# RECONSTRUCTION OF ORIGINAL SCENERY IN THE EARLY 90'S HACHINOHE CITY USING ANTIQUE MAP

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## ABSTRACT:

There are many antique maps and pictorial maps in Japan, these maps which show situation of land use in those days often give important information for studying history of city planning, civil engineering or architecture in those days. In these circumstances, reconstruction of original scenery from antique maps or pictorial maps are recently received more attention. In order to reconstruct original scenery, both reliable city modeling and creating realistic environment are important issue. Generally, realistic environment is realized by five senses such as sight, hearing, smell, taste and touch. However, it is impossible to feel five senses even use 3D computer graphics.

With this motive, efficient city modeling and creating realistic environment are investigated in this paper, and visualization in the early 90's Hachinohe city where locate Aomori prefecture in Japan is demonstrated using 3D Computer Graphics.

## 1. INTRODUCTION

Existing antique maps or pictorial maps often give important information regarding city planning, civil engineering, architecture or culture in those days. In particular, visualization of reconstructed the past city model or landscape help to make understanding of situation at the time more efficiently. Therefore, virtual reality has recently received more attention from possibility that people can appreciate or experience the archaeological objects, the past space and art through the computer at any time and without going to the museum. However, huge labor and time are required for reliable object modeling, acquisition of geometric information for each object and geometric correction for deformed maps.

In these circumstances, the authors have been concentrating on recreating the past city model and visualization using the attribute data such as shrine, house, street, river and so on which exist in the antique maps, and visualization of historical town Tumago (Suzuki & Chikatsu, 2002) and Kawagoe (Suzuki & Chikatsu, 2003) were demonstrated using 3D Computer Graphics.

However, in order to reconstruct original scenery, creating realistic environment is important not only city modeling. With this motive, efficient city modeling is investigated in the first parts in this paper, and creating realistic environment is also investigated in this paper. Furthermore, visualization for original scenery in the early 90's Hachinohe city where locate Aomori prefecture in Japan is demonstrated in this paper.

## 2. HACHINOHE

Hachinohe city with a population 250 thousands is located in the north part from Tokyo about 600km. The city planning of Hachinohe had started in 1630, and main frame of Hachinohe had been almost formed until 1645. Now castle or houses in

those days are not remain, city design such as blocks or streets which are shown in Figure 1 still exist, and current Hachinohe is outstanding industrial city in the north area of Japan. Figure 2 and 3 shows current and Taisho Period's Hachinohe along the same street.



Figure 1 Pictorial map of Hachinohe



Figure 2 The present Hachinohe city



Figure 3 Hachinohe city in Taisho Period

### 3. RECONSTRUCTION OF ORIGINAL SCENERY

In order to reconstruct the original scenery of Hachinohe in the early 90's, pictorial map (Figure 1) of Hachinohe in Taisho Period (1920) was used in this paper.

The representative houses for fish shop, greengrocery, butcher or mercer in Taisho period were modelled previously by manually under the historical materials. Furthermore, after acquisition of geometric data such as the center of gravity, area and direction for each residence area, and attribute data such as kind of houses from the pictorial map, these house models are modified and arranged automatically according to the geometric and attribute data.

Furthermore, in order to create realistic environment, human model and sound effects are used in this paper. The detail procedures are as follows.

#### 3.1 Representative House Models

Hachinohe in the Taisho period was commercial city with a population 20 thousands, and the streets were lined with 3,000 shops. Therefore, 2 kinds of residence houses, shrine and temple, 12 kinds of commercial house models were created respectively under the historical materials. Figure 4 shows house models which were recreated previously. The Model 1 and 2 show residence house, Model 3 shows shrine, Model 4 shows Ryokan and Model 5, 6 and 7 shows some kinds of commercial house which have warehouses.

Furthermore, Hachinohe police station and educational district consist of elementary, junior and high school were created separately since these were typical structures in Hachinohe.

#### 3.2 Geometric and Attribute data

##### 3.2.1 Geometric Correction

The pictorial map used in this paper was drawn like a bird's-eye view. Therefore, the pictorial map was corrected using a present map by following procedures.

TIN models were generated using common feature point both of the pictorial map and a present map, and geometric correction was performed by affine transformation.

Figure 5.1 and 5.2 show TIN models for the pictorial map and a present map, and Figure 5.3 shows corrected pictorial map by affine transformation.



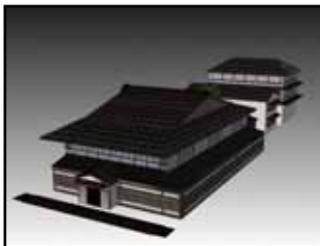
Model 1



Model 2



Model 3



Model 4



Model 5



Model 6



Model 7



Hachinohe police station



Educational institution district

Figure 4 House models



Figure 5.1 TIN models for the pictorial map

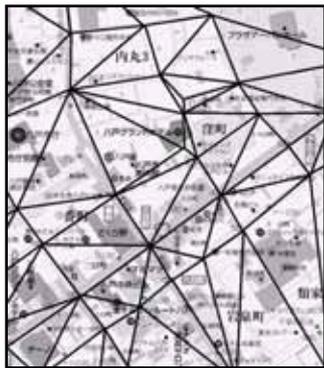


Figure 5.2 TIN models for the present map

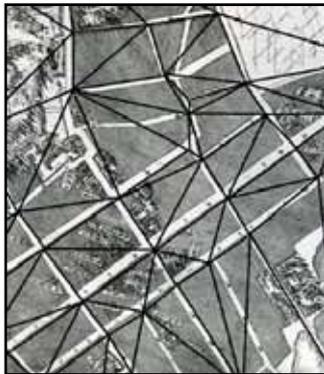


Figure 5.3 Affine transformation

### 3.2.2 Geometric Data

In order to extract corner for each block which are shown in Figure 1, line extraction was performed using image-processing procedures such as binarization, noise reduction and canny operator, and both ends of point for the extracted lines were used as a corner points for the blocks.

On the other hand, in order to perform automatic arrangement of house models, geometric data such as centre of gravity, area, and direction for each residence area were acquired by the following procedures since each residence area did not recorded on the pictorial map.

At the first, in order to presume number of houses for each block, the length of the block was computed from the block corner coordinates which were acquired the above procedures, and long side length for the block was divided by house width. Finally, house models were arranged so that front of those models faced to the street automatically.

### 3.2.3 Attribute data

In order to acquire the attribute data automatically, extracted each block was classified using colours since blocks in those days Hachinohe were classified by land use categories.

Figure 6 shows classification by land use categories, and kind of the house models for each residence area are determined along this colour information.

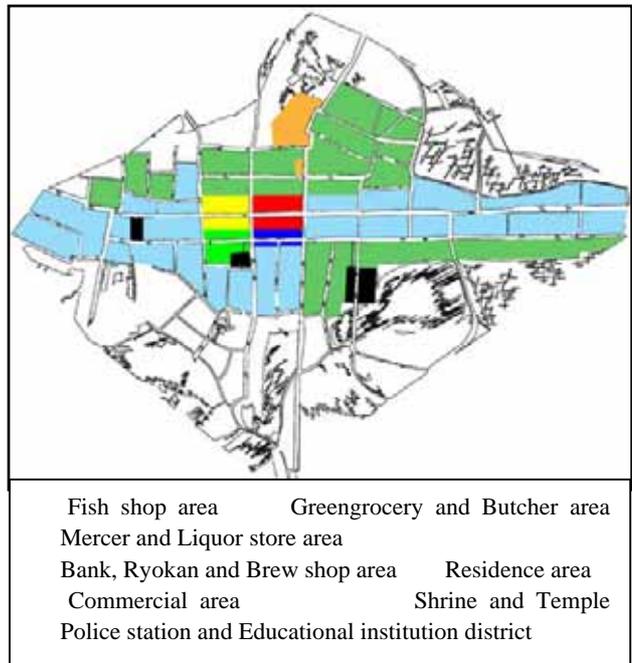


Figure.6 Classification by land use categories

### 3.3 City Modeling

Automatic classification, modification and arrangement of the house models was developed by the authors using geometric and attribute data. Therefore, city modeling is performed automatically by exporting geometric and attribute data to 3D Computer Graphic software. Moreover, trees, telephone pole and topographic model can be arranged to reconstructed city model since the remarkable point of the method has ability to arrange additional objects models. Figure 7 show city model for the pictorial map which was recreated automatically.



Figure 7 City model

#### 4. CREATING ENVIRONMENT

In order to reconstruct original scenery, creating realistic environment is important issue not only city modeling. For this goal, individuality of each shop was described by arranging objects such as signboards and commodities. Furthermore, human models and sound effects were used in this paper. For example, human style reflects life style or culture in those days, and number of human models and sound effects reflects appearance a city vibrant with life.

Figure 8.1 shows the present rows of houses in Hachinohe. On the other hand, Figure 8.2 shows reconstructed city modeling and Figure 8.3 shows original scenery with environment in Taisho period for the same scene with the Figure 8.1. This block was fish market in the Taisho period, and it can be said that Figure 8.3 shows the characteristic for the block.



Figure 8.1 Present rows of houses



Figure 8.2 City model in Taisho period



Figure 8.3 Original scenery in Taisho period

#### 5. CONCLUSION

In generally, huge labor, time and expense are needed for city modeling using 3DCG since the house models should be recreated and arranged manually one by one. However, these issues are drastically reduced by the method which was developed by the authors. Moreover, trees, telephone pole and topographic model can be arranged to reconstructed city model since the developed method have ability to arrange additional objects models.

On the other hand, in order to reconstruct original scenery, creating realistic environment is important issue not only city modeling. With this motive, individuality of each shop was described by arranging objects such as signboards and commodities. Furthermore, human models and sound effects were used from the view point that human style reflects life style or culture in those days, and number of human models and sound effects reflects appearance a city vibrant with life.

Visualization for original scenery in the early 90's Hachinohe city where locates Aomori prefecture in Japan was also demonstrated in this paper, it is concluded that original scenery which was pictured on the antique maps or pictorial maps can be reconstructed by reliable objects modeling and creating realistic environment. Similarly, it can be said that the developed method have ability to use wider landscape simulation.

#### 6. REFERENCES

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