

Musasabi: 2D/3D intuitive and detailed visualization system for the forest

Takuya Kato Akira Kato Naomi Okamura Taro Kanai Ryo Suzuki Yuko Shirai
Waseda University / Graduate Program for Embodiment Informatics

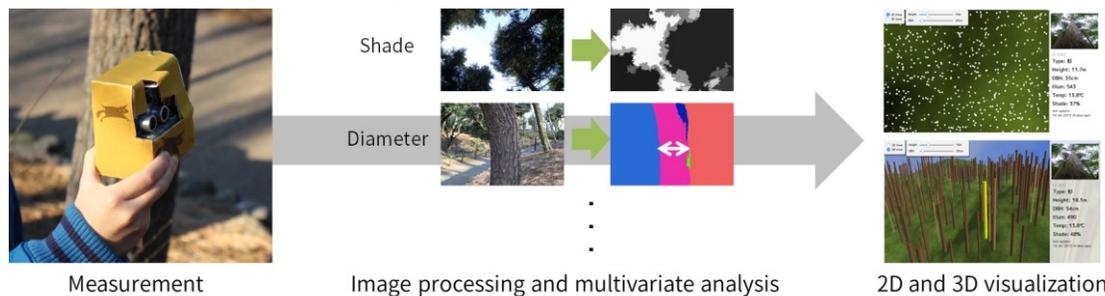


Figure 1: The system flow of “Musasabi”. Users collect data by the hardware and visualized in 2D 3D map automatically.

1. Background

Trees have been a pillar of our lives not just for human but for all the species living in the earth. Despite of its blessings for our lives, the heaps of problems around forestry have not been solved. One of the major problems in this field is that most of the forest are not been sorted into an organized database. Detailed natural data have never been provided even in famous map applications, Google earth for instance, induced from its difficulty. The forest database has been demanded in many regions as it provides beneficial information for both industrial and environmental aspects. It even helps many divisions such as CG animations to simulate not only a tree itself but also the mountain or the forest as a whole depending on given natural conditions.

One of the major solutions to efficiently collect data of the forest is to use the image and 3D data that are acquired from the sky as represented by the method proposed by [Vihervaara et al.2015]. While these algorithms showed the effectiveness to many regions, they only provided solutions to areas that can easily measure from the sky. In addition, these data are not understandable for unspecialized users. As a result, it has been questionable to be used in many areas with more intense natural environment and less technical knowledge such as tropical areas. Summarizing the above, the system which satisfies the usability for both the measuring process and visualization system is required.

We propose a novel device and interface, which we named “Musasabi” to create database automatically from the acquired data from our original measuring device and visualize it onto the 2D/3D map. Our unique device enables us to acquire many different data of the forest with easy manipulation that cannot be acquired from long range sensors proposed in previous work. Our system allows users interactive and intuitive controls to the database to easily use and develop for various demands without deep knowledge of forestry, device and coding.

2. Overview of “Musasabi”

Figure 1 shows the flow of our system, “Musasabi”. The system is composed of two parts, the hardware and software. As for the hardware part, we aimed to measure the data which is critical for the tree condition. Therefore we created novel device to measure luminance, temperature, humidity, gradient of the mountain and image of the tree with few manipulations. As the software part, we developed analysis and visualization system.

Musasabi first analyze the data acquired from multiple sensors online using multivariate analysis to determine which tree to be tinned. As for the image processing technique, we implemented region segmentation technique proposed by [Felzenszwalb et al 2004] and multivariate analysis to calculate accurate diameter of the tree with single tree image. In order to determine the threshold for the trees to be tinned, we have determined variables and weights we need for the analysis with the help of several forestry companies in Japan. Using these acquired data, we developed our system to visualize type of the tree, height, diameter at breast height, luminance, temperature and shading conditions. The visualization system is created for both 2D and 3D in order to be used for multiple demands from diverse fields.

We developed our system using Siv3D, one of the easiest and most intuitively designed C++ libraries for graphics visualization in which one of our authors have developed. Thanks to this library, Musasabi only requires around 300 sentences of intuitively organized code for whole system for visualization. By using this library, it allows many users without special knowledge can easily and intuitively develop Musasabi applications on their own

3. Summary and future work

We proposed a novel device and interface called “Musasabi” which creates 2D and 3D intuitively designed database of the forest automatically. We archived to collect and visualize the data of the forest in detail that allows us to understand the condition of the forest intuitively. We aim to integrate our system to helpful for multiple divisions. One of our goals is to collect the data to simulate the growth and changes of the mountains and the forest depending on the species of the tree and the land conditions for graphics synthesis of the mountain and the forest.

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¹e-mail: takuya_lbj@ruri.waseda.jp

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