

HTT005-01

会場:202

時間:5月25日 14:15-14:30

## 日本シームレス地質図Googleマップ版の開発 Development of Seamless Digital Geological Map of Japan (1:200,000) Google Maps version -intuitive geological map-

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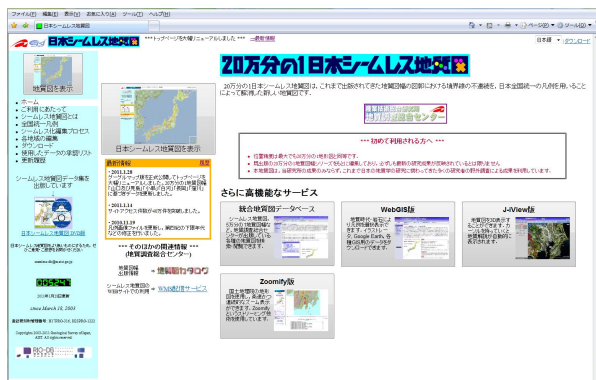
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Seamless Digital Geological Map of Japan (<http://riodb02.ibase.aist.go.jp/db084/index.html>) is a digital geological map in scale of 1:200,000 published by Geological Survey of Japan (GSJ), National Institute of Advanced Industrial Science and Technology (AIST). It has a structurally and stratigraphically smooth geological boundary, and is based on a nationally-standardized legend based on the geological map of Japan 1:1,000,000 3rd edition (GSJ, 1992). It was developed by (1) creating nationally-standardized legend, (2) digitizing existing paper-based geological maps in vector format, (3) replacing each geological attributes by the nationally-standardized legend, (4) smoothing geological boundary of adjacent maps on GIS (Geographic Information System). It's been published on the Web since 2003, and users are able to select from among several user interfaces in accordance with the intended use and preference. Methods of data representation have been modified to suit the needs of the uses. Google Maps version is the latest and default user interface which uses Google Maps API (Application Programming Interface) and Google Earth API provided by Google, and it's been repeatedly improved with the help of comments by users. The major characteristics of the Google Maps version are intelligible operability and fast imaging speed.

Fast operation of Google Maps version is provided by "Image Pyramid" and "AJAX (Asynchronous JavaScript and XML)". The image pyramid, also known as "tile matrix set" in WMTS (Web Map Tile Service) standard defined by OGC, consists of a base image tile and a series of consecutively smaller sub-image tiles in lower resolution. As users zoom in or out on the map, different resolution level of image is displayed, and the image pixels of geological map are only loaded when a tile section comes into view. AJAX is a group of interrelated web development technique used for creating interactive web applications on client-side. It allows web pages to retrieve small amounts of data from the server, and update parts of a web page without reloading the entire page.

Google Maps version was developed with a goal of making and releasing geological maps in foolproof way. It is designed especially for end-users; therefore, users are able to change opacity of the geological map, zoom in or out, and search a specific location intuitively. Google Maps version doesn't require any plug-in unlike other user interface within our website, hence it is less reliance on user environment such as OS and browser. Development of Google Maps version serves as the foundations for future development of user-friendly digital geological map.



Keywords: GIS, Seamless, Geological Map, Google Maps API, AJAX, Image Pyramid

HTT005-02

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時間:5月25日 14:30-14:45

## Open Cafe System による低コストかつ使用が簡易な現地調査支援システム Low-cost and User-friendly Field Survey Assisting System powered by Open Cafe System

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In traditional field survey in natural environment, the survey values are recorded in the paper such as field notes, and they are digitalized and analyzed indoors. The digitalization of this method is so complex that it is time-consuming. Then, the system into which digital data can be inputted directly in the field has developed recently. However, it is so expensive and the manner of operation is so complex that it doesn't become popular. In this study, we tried to develop low-cost and user-friendly Field Survey Assisting System (FSAS) in natural environmental field with open source software.

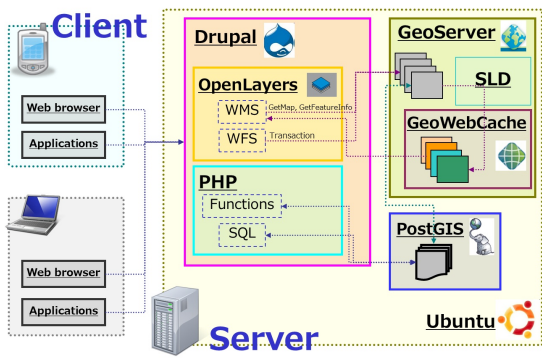
In this study, the positional information was treated as the main survey item by FSAS. So we used Free and Open Source Software for Geospatial (FOSS4G). Then, to improve usability of FOSS4G, we developed a package called Open Cafe System (OCS) and FSAS was powered by OCS. OCS has two features to improve the usability for users of FSAS. They are Web-GIS architecture and wrapping of FOSS4G with content management system (CMS). Web-GIS stimulate users without technical knowledge to use the system because users can use Web-GIS with just web browsers which they are familiar with. CMS manages web contents integratedly. In general, CMS makes it easy for users without technical knowledge to use the system. In OCS, users work with interface made by CMS, without struggling with FOSS4G.

The architecture of OCS is shown in Figure. OCS is composed by two main components: OCS server and OCS client. In OCS server, FOSS4G applications and Drupal (CMS) work on Ubuntu OS. Spatial data is stored by PostGIS (spatial extension of PostgreSQL). GeoServer works as GIS server which supports WMS (Web Map Service) and WFS (Web Feature Service). SLD (Styled Layer Descriptor) describes the appearance of map layers. GeoWebCache accelerates the processing by caching request. Drupal works as user interface and manages FOSS4G applications integratedly. PHP scripts controls database queries. WMS and WFS works on web pages with OpenLayers. In OCS client, users access the server with web browsers or specific applications. Client devices are laptops, smartphones, PDAs, and so on. They can get web pages made by CMS with web browsers, or can use the functions of OCS server easily with optimized applications.

The workflow of a field survey with FSAS consists of three steps. First, users make a format before the survey. The format has information of the survey such as title, date, item, note, area of the survey and base maps. Because users can freely customize survey items, FSAS can be used in various fields such as forests and rivers. Second, users input data on the survey. They just input the location on the GUI map and value of items into the format, because the format has information of the survey. All data is stored into the same table on the database. Each data has fields of belonging format, location, and value of items. Third, users export data after the survey. They can choose the export file type from CSV and KML. In this way, they can manage and use data for each survey in the unified way.

To examine the utility of FSAS in various fields, we did field surveys on water quality and tree position as an application study of FSAS. The study area is spring water in Hadano (Kanagawa, Japan) and street tree of Itabashi (Tokyo, Japan). Citizens in those places survey water quality or tree position with FSAS. They inputted the obtained data into FSAS with Android smartphones and iPhones. Participants could browse the results of the survey on site with the client devices.

We had a questionnaire after the survey to get the users' impression of FSAS. From the results of questionnaire, we thought that FSAS was easy for participants to use, nevertheless they did not have technical knowledge. The function of inputting data and browsing the result on site assisted them. It is suggested that FSAS has high usability in various natural environmental fields.



Keywords: field survey, digital data, GIS, FOSS4G, content management system, open cafe system

HTT005-03

会場:202

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## 地理情報システムを用いた重力データからのカルデラ構造の輪郭抽出 Extraction of caldera rims from gravity data using GIS

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岩手・宮城内陸地震では、栗駒火山周辺において大規模な地すべりと中小規模の斜面変動が発生した。これらの発生要因の一つとして、当該地域において多数分布するカルデラ（布原ら、2010）の存在があげられる。Prima and Yoshida (2010) は東北地方に分布する多くのカルデラが負の重力異常を示すという特徴を持っているとし、この特徴を利用して重力異常の空間分布に対して水文解析を適用し、カルデラ構造の輪郭抽出を試みた。しかしながら、古いカルデラの輪郭が必ずしも明確ではなく、また重力データが持つ固有のノイズによって、一部で、抽出されたカルデラ輪郭とこれまでに推定されてきた輪郭との間に、不一致が認められる。野崎（1997）によれば、重力異常の振幅スペクトル分布は、浅部の大局的構造を表すトレンド成分、深部の地下構造を表しているシグナル成分、そしてデータ生成時に発生した誤差によるノイズ成分に大別できる。本研究では、バンドパスフィルタを用いて重力異常値のノイズ成分を除去し、抽出されるカルデラ輪郭の改善を試みたものである。ここでは、重力異常値のデータとして、地質調査総合センターが発行したもの（地質調査所、2000）を使用した。当該重力異常値の仮定密度は 2.0, 2.3, 2.67 g/cm<sup>3</sup> で提供されているが、東北地方の基盤構造をより反映している、仮定密度 2.67 g/cm<sup>3</sup> を用いた。本研究では、ノイズ成分遮断フィルタの波長を 1-10 km に設定し、カルデラ構造の輪郭抽出を行なった。ノイズ成分遮断フィルタの波長が短ければ、抽出したカルデラ構造の輪郭が詳細なものとなり、遮断フィルタの波長が長ければ、大まかなカルデラ構造の輪郭が抽出される。東北地方で報告されている多くのカルデラ構造について、輪郭を抽出した結果、カルデラ構造の輪郭を最もよく抽出できる遮断フィルタの波長が約 4 km であることを確認できた。なお、バンドパスおよびカルデラ構造の輪郭抽出の一連の作業は GMT と ArcGIS で自動化しており、遮断フィルタの波長の変更によるカルデラ構造の輪郭形状の変化を即時に確認できる。

キーワード: カルデラ構造, GIS, 重力異常値, バンドパスフィルタ

Keywords: Caldera rim, GIS, gravity anomaly, band pass filter

HTT005-04

会場:202

時間:5月25日 15:00-15:15

## Flood Disaster Risk Management in Ratnapura, Sri Lanka based on GIS and Remote Sensing Techniques Flood Disaster Risk Management in Ratnapura, Sri Lanka based on GIS and Remote Sensing Techniques

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### Introduction

Sri Lanka is prone to natural disasters commonly caused by floods, cyclones, landslides, droughts and coastal erosion for generations with increasing losses to life and property in the past few decades. Floods are more of a common occurrence in Sri Lanka than the other natural disasters. Flood has been one of the most costly disasters in terms of both property damage and human casualties in Sri Lanka.

As other less developed countries, Sri Lanka is in the initial stage of the adoption of geo-information for in disaster management although new world trends to Web GIS, real time warning system, satellite earth observation for rapid damage assessment, data standard and highly advanced Technologies that could be used for disaster management activities.

### Motivation

For a number of reasons the most frequent choice should be protection from the flooding by means of physical control of the river, but there is also a need for a broader and comprehensive program for managing flood hazard in the study area. Flood protection has been helpful and must be continued. Side by side other preventive tools like effective planning for the growth of the city, creation of a computerized GIS database for the flood prone areas and a detail flood risk assessment mapping and zonation are required to minimize the harmful effects of flood hazard. Therefore, an attempt has been made to apply modern techniques like Geographical Information System and Remote Sensing for the assessment of flood hazard. The presence of risk assessment mapping will help the concerned authorities to formulate their development strategies according to the available risk to the area. Of course, the GIS and Remote sensing techniques can contribute to evaluate the environment and to minimize the risk of disaster.

### Methodology

1. Evaluate the physical environment using remote sensing and GIS techniques (Terrain analysis, hydrological drainage analysis and other analysis).
2. Evaluate the social environment through the field work (interview the people, to know how they use their land, to know the governmental treatment like land use regulation or master plan).
3. Overlay the physical evaluation and social evaluation.
4. Design the optimal land use plan based on the both environmental analysis.
5. Share the optimal land use plan with people.

キーワード: Geographical Information System, Remote Sensing, Flood risk assessment, Vulnerability, Hazard mapping  
Keywords: Geographical Information System, Remote Sensing, Flood risk assessment, Vulnerability, Hazard mapping

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会場:202

時間:5月25日 15:15-15:30

## Hydrologic Response to Land use Change and its Impact on Coastal Ecosystem of Fiji Hydrologic Response to Land use Change and its Impact on Coastal Ecosystem of Fiji

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Healthy coral reefs are a vital part of the coastal ecosystem and support a huge amount of sea life and fulfill a variety of human needs, like subsistence, fisheries, tourism and shoreline protection. These fragile coral reef ecosystems are rapidly deteriorating with intense anthropogenic perturbations in the river basins of northwest Viti Levu, Fiji, due to large terrigenous material run-off loads from the steeply-sloping watersheds. The cropland expansion has vastly altered the structure of natural watersheds and their ecosystems through accelerated conversion of forest land and marginal land to agriculture or urban area. Therefore, it is crucial to ascertain the temporal and spatial change pattern of coral cover and assess the environment factors, which directly/indirectly influence the reef ecosystem. This study focuses to find out intense and sustained environment pressures generated by anthropogenic activities and land use change on the coastal ecosystem using remote sensing and GIS. In this research benthic cover is analyzed temporally (1992-2007) and spatially to find out the impacts of terrestrial runoff from 14 adjoining agriculture dominated watersheds in the coastal area. To accomplish this task, an integrated modeling framework with land use change has been constructed to simulate the transport of runoff, sediment yield and nutrient pollution using ArcView interface based SWAT (Soil and Water Assessment Tool) model. The benthic cover change analysis using Landsat TM/ETM+ shows that coral cover reduced by 33.5% from 1992 to 2007 while the algae and seagrass cover increased by 139.3% and 70.6% respectively due to the fine sediments and nutrients carried by eroding sediments from the sugarcane fields. The land use change analysis indicates that maximum agriculture expansion is in small watersheds of the study area. Results reveals that during 1992-2007, forest land (27.04%) and shrubland/grassland (20.96%) was replaced by agriculture (46%) and barren land (2%) in small watershed (area 12.10 km<sup>2</sup>). Therefore, the hydrological response impact from these watersheds cannot be ignored as soil loss and nutrient loss are high, especially during the heavy rainfall event. In addition, Landsat data interpretations (1992-2007) for coral reef ecosystem also infer that there is an enormous increase in the degraded reef areas (59.39 %) around these coastal watersheds.

キーワード: Coral reefs, runoff, sediments, nutrients, remote sensing, SWAT

Keywords: Coral reefs, runoff, sediments, nutrients, remote sensing, SWAT

HTT005-06

会場:202

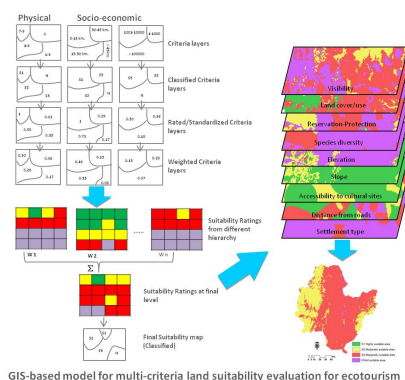
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## Site Suitability Evaluation for Ecotourism using GIS & AHP: A Case Study of Surat Thani Province, Thailand

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The present study aims to identify and prioritize the potential ecotourism sites using Geographic Information System (GIS) and Analytical Hierarchy Process (AHP) in Surat Thani Province, Thailand as a case study. The method used is the AHP which is integrated in ArcGIS. This study identifies the following criteria as indicators suitability within land ecosystem: landscape/naturalness, wildlife, topography, accessibility and community. The evaluating process for ecotourism site was conducted based on 9 chosen factors which are visibility, land cover/use, reservation/protection, species diversity, elevation, slope, proximity to cultural sites, distance from roads and settlement size. These factors were selected according to the professional opinions given. AHP was effectively used in order to calculate the detail of the factor and class weights. The methodology proposed was useful to identify ecotourism sites by linking criteria deemed important with actual resources of Surat Thani Province.



キーワード: Site Suitability Evaluation, AHP, GIS, Ecotourism, MCDM  
Keywords: Site Suitability Evaluation, AHP, GIS, Ecotourism, MCDM

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会場:202

時間:5月25日 15:45-16:00

## 人口分布に基づいたアクセス系集線設計 Aggregation planning for access network based on population distribution

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In industrialised countries, population decline will occur in next decades. Japanese population is estimated to decline by 20% in next 30 years. Population decline tends to expand the inefficiency of infrastructure. Infrastructure planning needs to consider population distribution of the region.

Fiber to the home (FTTH) has been widely deployed for providing broadband access services in recent years. In Japan, FTTH occupies over 50% of broadband access service markets now. FTTH is expected to be deployed in rural areas with low subscriber density.

Access network planning has focused on urban areas. In urban areas, subscriber density is high because there are large population. In such areas, subscribers' lines are aggregated efficiently.

On the other hand, in rural areas, small population causes the inefficiency of aggregation. The same problem occurs when subscriber density declines along population decline in the decades to come. The inefficiency of aggregation increases deploying cost.

It is important to establish a planning method based on population distribution. Subscribers' lines need to be aggregated efficiently anywhere. Especially, minimizing the deploying cost of the aggregation is an important issue.

This study proposes the planning method which can minimize the aggregation cost by applying three types of aggregation depending on the subscriber density. The types of aggregation are as follows. They are shown in the figure.

### (a) single aggregation

Single aggregation is an existing aggregation type. Subscribers' lines are aggregated by large switches on every node. Each switch is connected to edge routers individually. This type is optimized for the areas with high subscriber density.

### (b) cascade aggregation

Cascade aggregation is a proposed aggregation type. Subscribers' lines are aggregated by small switches on every node. Switches are mutually connected and compose ring networks. Each ring is connected to edge routers. This type is expected to improve the equipment efficiency in areas with low subscriber density.

### (c) node-integration

Node-integration is the other proposed aggregation type. Subscribers' lines are not aggregated on nodes with insufficient number of lines. They are connected to another node and aggregated by any switch. Switches are connected to edge routers by single or cascade aggregation.

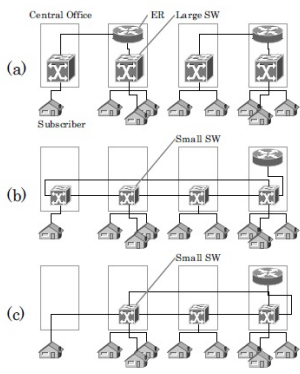
The planning method is based on a location-allocation model which is used to find mathematically the optimal location. It uses distribution of population and nodes and existing links as input layers. The number of subscribers' lines of each node is computed. Whether the node should be integrated and which size of switch should be applied are decided depending on the number of subscribers' lines. After that, it finds all combinations of the connections between small switches. For each combination, the optimal connections between switches and edge routers are found considering the existing links. Finally, it finds the optimal aggregation.

The proposed method was implemented into Quantum GIS (QGIS). QGIS is free and open source software for geospatial (FOSS4G). The method was implemented as the plugin of QGIS. It was written in Python. Shape files are read as input layers and. The calculation procedure is performed with QGIS API. Optimal solution is exported as shape files.

I did computer simulations in multiple scenarios. The scenarios have different population distributions. The simulation result shows that the proposed method can derive the optimal aggregation which can minimize the aggregation cost. It was suggested that the optimal aggregation differs from the population distribution. In urban areas whose population are large, the optimal aggregation is (a). On the other hand, the optimal aggregation is (c) in rural areas. Application of (b) and (c) in areas with low subscriber density reduces the deploying cost. (c) has more effect on cost reduction than (b). They are not suitable for urban areas



because of inefficiency.



キーワード: アクセスネットワーク, アクセス系集線, 立地配分モデル, 人口減少  
Keywords: access network, aggregation, location-allocation model, population decline

HTT005-08

会場:202

時間:5月25日 16:00-16:15

## MMS データを用いた三次元建物モデルの生成手法 Generating Method for Three-Dimensional Building Model with Mobile Mapping System Data

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景観シミュレーションの分野では、効率的かつ蓋然性高いデジタルシティの構築方法が模索されている。一般に、周辺環境に存在する建物の表現には、基盤地図情報の建築物の外周線に対して、建物階数や LIDAR データで得られた高さ情報を付与して上空に押し出す多角柱モデルが主に用いられている。この多角柱モデルは生成が簡単であるものの、テクスチャ処理でしかファサードの表現ができないモデルである。そこで本研究では、高精度 GPS 移動体計測装置である MMS (mobile mapping system) で取得された点群データ (以下、MMS データと呼ぶ) を用い、ファサードの形状を有する三次元建物モデルの生成を試みた。MMS はすでに道路台帳更新のための地形測量などに用いられ始めているが、そのデータの特徴として 1) 地物の遮蔽効果がなくパース表示にした場合に奥が透けて見える、2) 観測点から距離が離れるほど点間隔が広くなり精度も粗くなる、3) データを三次元上に展開した場合において観測点以外の位置からはイメージの把握が困難である、などが挙げられる。基本的に地表面やトンネル部など、観測距離が短い場所にある表面の把握に適したデータである。これらの特徴から、MMS データは本質的に image-based なデータであるといえる。そこで、景観デザインのためにデータの操作が困難な image-based な状況から、操作可能な model-based への展開を図るため、点群データから三次元建物モデルの生成を試みることにした。なお、先行研究でキューブモデルによる建物モデルの構築を試みたが、視覚的なリアリティが欠けたものとなった。そこで、サーフェイスモデルによる建物モデルの構築を試みた。

本研究で使用する主なデータは MMS データ、MMS 車両軌跡、建築物の外周線 (基盤地図情報) である。MMS データはポイントデータであり、X, Y, Z 座標 (m) と観測時の GPS 時刻 (小数以下 4 桁, 秒) を有す。MMS 軌跡はラインデータであり、属性は車両位置座標 (x, y, z) と GPS 時刻 (小数以下 1 桁, 秒) である。以下、提案する三次元建物モデルの生成フローを示す。

### (1) 回帰式の作成

オリジナルの MMS データ (以下、 $P_{MMS}$  と記す) を精査し、観測距離 (x) とデータ間隔 (y) を最小自乗法により回帰式に当てはめることで、距離ごとのしきい値を求める。今回は平坦な 3 箇所の交差点の平均値から  $y \leq 0.1e^{0.165X}$  (式 1) を得た。

### (2) 観測距離の付与

各  $P_{MMS}$  が観測されたときの MMS 車両位置を GPS 時刻の内挿により推定し、各  $P_{MMS}$  の観測距離を求める。

### (3) ラインの作成

同じ時刻の  $P_{MMS}$  を連結して、ラインに変換する。

### (4) 長い線分の除去

ラインを構成する線分の内、観測距離に対して長くて式 1 を満たさないものは除外する。

### (5) 地物の縁を構成するポイントの抽出

残ったラインから線分間の交角が約 90 度である部分を地物の縁を構成するポイントとして抽出する。ラインの端部も同様にポイントとして抽出する。以下、抽出したポイントを  $P_{EDGE}$  と記す。

### (6) 外壁線の入力

$P_{EDGE}$  と建築物の外周線を目印に、ユーザにより外壁線の位置を入力させる。入力されたラインを基に、建築物の外周線を再定義する。また、入力されたライン周辺の  $P_{EDGE}$  の最高高さを建物高さとして暫定する。

### (7) 手摺壁線の入力

$P_{EDGE}$  と建築物の外周線を目印に、ユーザにより手摺壁の位置を入力させる。入力されたライン端部周辺に存在する  $P_{EDGE}$  を改めて抽出する (以下、 $P_P$  と記す)。

### (8) 手摺壁位置の推定

$P_P$  を集約して昇順ソートした後、式 1 を用いてグループ化する。設定したグループは、その最高値が手摺壁の上端、最低値が手摺壁の下端と対応する。

### (9) サーフェイスの生成

これらの情報を基に，最終的にサーフェイスを生成する．

この一連の手続きを GIS 上でシステム化し，ほぼ自動的に三次元建物モデルを生成するシステムを開発した．

本研究で提案した手法により，建築物ファサードのおおまかな形状を半自動的に再現することができた．しかしながら，今回のモデルは屋根部分については再現できておらず，景観シミュレーションでよく使用されるフライスルーなどに利用できない．今後は屋根部分の再現方法を実装しなければならない．また，より自動化を進めるに当たって，樹木や電柱などで位置データが取得できていない部分の推定方法を検討しなければならないと考えている．

キーワード: 建物モデル, デジタルシティ, ファサード, モービルマッピングシステム, 蓋然性

Keywords: building model, digital city, facade, MMS, probability