

ISBN : 978-1-5090-4357-6
IEEE Catalog number : CFP16WOF-ART

2016 2nd International Conference on Science and Technology - Computer (ICST)

October 27-28th, 2016 / Yogyakarta, Indonesia



UGM
Publication Agency
and Academic
Publisher



Advancing Technology
for Humanity

PROCEEDINGS

**2016 2nd International Conference on Science and
Technology-Computer
(ICST)**

**27-28 October 2016
Yogyakarta, Indonesia**

COPYRIGHTS

2016 2nd International Conference on Science and Technology-Computer (ICST)

Copyright ©2016 by Institute of Electrical and Electronics Engineers, Inc. All rights reserved.

Copyright and Reprint Permission:

Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint, or reproduction requests should be emailed to IEEE Copyrights Manager at pubs-permissions@ieee.org. All rights reserved. Copyright ©2016 by IEEE.

IEEE Catalog Number : CFP16WOF-ART

ISBN : 978-1-5090-4357-6

Additional copies of this publication is available from

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA

+1 845 758 0400

+1 845 758 2633 (FAX)

Email: curran@proceedings.com

WELCOME NOTE FROM THE CONFERENCE CHAIR



The honorable Rector of Universitas Gadjah Mada, the honorable President of the University of Surrey UK, dear distinguished guests, invited speakers, participants, ladies and gentlemen, on behalf of the organizing committee I would like to welcome you all to the 2016 2nd International Conference on Science and Technology-Computer (ICST). This is the second affair of the International Conference on Science and Technology Series. The 2015 1st International Conference on Science and Technology was a success.

The science and technology can only be advanced through research and publication and we are bound and happy to do so.

This time, we received 70 contributing papers in the field of Computer Science and its related fields, and 37 of them were selected to be published to IEEE Xplore. Each paper was reviewed by 2-4 independent peers. Among the peer reviewers, 25% are of foreign affiliations, and 75% are of Indonesian affiliations. The plagiarism check was performed with CrossCheck.

The organizing committee feels grateful to have full assistance from Universitas Gadjah Mada to make this event a success.

It would be impossible to organize this big and important meeting without full support from everyone in the organizing committee. We wish to thank you for spending countless hours of diligent work to make this event a reality. We especially are also indebted to everyone in the the scientific committee and reviewers for reviewing the manuscripts in a very limited time.

We do hope that this conference will prove to be inspiring experience for you and are looking forward to meeting you at the 2017 3rd International Conference on Science and Technology.

With best regards,

Dr. Roto, M. Eng.
Conference Chair

International Advisory Board

- Prof. Khairurrijal, Institut Teknologi Bandung, Indonesia
- Prof. Mohamed Bououdina, University of Bahrain, Kingdom of Bahrain
- Prof. Harno Dwi Pranowo, Universitas Gadjah Mada, Indonesia
- Prof. Hiromi Taniguchi, Saitama University, Japan
- Prof. Hadi Nur, Universiti Teknologi Malaysia, Malaysia
- Prof. Ahmad Fauzi Ismail, Universiti Teknologi Malaysia, Malaysia
- Prof. Chang Uk Jung, Hankuk University of Foreign Studies, Korea
- Prof. Kusminarto, Universitas Gadjah Mada, Indonesia
- Prof. Atsushi Kohno, Fukuoka University, Japan
- Prof. Muhammad Mat Salleh, Universiti Kebangsaan Malaysia, Malaysia
- Prof. Suratman, Universitas Gadjah Mada, Indonesia
- Prof. G.Q. Max Lu FAA FTSE, University of Surrey, United Kingdom
- Prof. Lianzhou Wang, University of Queensland, Australia
- Prof. Jasper Knoester, University of Groningen, Netherlands
- Prof. Mohamed S. El-Aasser, Lehigh University, Pennsylvania USA
- Prof. Dr. Praptiningsih G. Adinurani, Universitas Merdeka Madiun, Indonesia
- Dr. Roy Hendroko, Ma Chung University, Indonesia
- Dr. Zane Vincevica-Gaile, University of Latvia, Latvia
- Dr. Maizirwan Mel, International Islamic University Malaysia
- Dr. Justin B. Runyon, US Forest Service Program for Grasslands, Shrublands and Desert Ecosystem, USA
- Dr. Tony L. Palama, Institut des Sciences Analytiques High-Field NMR Center, France
- Dr. Andrea Lubbe, Lawrence Berkeley National Laboratory, California USA
- Dr. Isao Watanabe, RIKEN Nishina Center, Japan
- Dr. Hendrik Oktendy Lintang, Universiti Teknologi Malaysia, Malaysia

UGM Organizing Committee

Chairman : Dr. Roto, M.Eng., Ph.D.

Secretary : Dr. Tri Rini Nuringtyas, S.Si., M.Sc.

Members :

Dr.Eng. Kuwat Triyana, M.Si.

Dr. Suprpto, M.Kom.

Dr.Eng. A. Kusumaatmaja, S.Si., M.Sc.

Diana Mustikareni, S.Hut.

Muslim Mahardika, S.T., M.Eng., Ph.D.

Suharman, S.E.

Prof. Dr. Tata Wijayanta, S.H., M.Hum.

Nanik Setyowati, S.E.

Dr. Mutiah Amini

Nur Fitriyah A.T. Sari, S.Pd.

Lisna Hidayati, S.Si., M.Biotech.

Devita Shiyamawati, S.T.

Dr. Dyah R. Hisbaron, S.Si., MT., M.Sc.

Murdani

Dr. Estuning T.W. Mei, M.Si.

Sofiyah, S.Fil.

Ratih F. Putri, M.Sc., Ph.D.

Khusnun Fauziyyah, S.P.

Agung Satriyo, M.Sc.

Azri Zulfikar Luthfi

Indriana Kartini, S.Si., M.Si., Ph.D.

Nurul Hasanah

Dra. Tutik D. Wahyuningsih, M.Si., Ph.D.

Dr.rer.nat. Nurul H. Aprilita, M.Si.

Drs. Iqmal Tahir, M.Si.

Dr. Iman Santoso, S.Si., M.Sc.

Dr.rer.nat. Sintia W. Niasari, M. Eng.

Faizal Makhrus, S.Kom., M.Sc., Ph.D.

Dr. I Wayan Mustika ST., M.Eng.

Dr.Eng. Adhika Widyaparaga, S.T., M.Biomed.E.

Moh Edi Wibowo, Ph.D.

Halim Perdanakusuma

dr. Mukhamad Sunardi

drg. Astrid Nur Annisa

Novia Risa

I Made Saka Wijaya

Aruna Bagas Kurniadi

Febri Adi Susanto

Astri Kustianti

Muhammad Rafieiy

TABLE OF CONTENTS

Numerical Simulation of The Effect of Axial Distance Between Two Rotors in Counter-Rotating Wind Turbines.....	1
Yosua Heru Irawan, M. Agung Bramantya	
Block-based Tchebichef Image Watermarking Scheme using Psychovisual Threshold.....	6
Ferda Ernawan, Muhammad Nomani Kabir, Mohamad Fadli, Zuriani Mustaffa	
Exploring Mobile Wallet Adoption in Indonesia Using UTAUT2 An Approach from Consumer Perspective.....	11
Simon Megadewandanu, Suyoto, Pranowo	
CPU and Memory Performance Analysis on Dynamic and Dedicated Resource Allocation using XenServer in Data Center Environment.....	17
Haydar Ali Ismail, Mardhani Riasetiawan	
Comparison of Fuzzy Filters on Synthetic Aperture Radar Image.....	23
Ardhi W Santoso, Dwi Pebrianti, Tien Sze Lim, Luhur Bayuaji, Habibah Lateh, Jasni M Zain	
Spinal Curvature Determination from Scoliosis X-Ray Image Using Sum of Squared Difference Template Matching.....	29
Bagus Adhi Kusuma, Hanung Adi Nugroho, Sunu Wibirama	
Automated Detection and Classification Techniques of Acute Leukemia using Image Processing: A Review.....	35
R.G Bagasjvara, Ika Candradewi, Sri Hartati, Agus Harjoko	
Combination Schemes Reversible Data Hiding for Medical Images.....	44
Aulia Arham, Hanung Adi Nugroho, Teguh Bharata Adji	
State of Charge Estimation of Lithium Polymer Battery using ANFIS and IT2FLS.....	50
Wahyuni Eka Sari, Oyas Wahyunggoro, Silmi Fauziati, Adha Imam Cahyadi	
Evaluation of XBee-Pro Transmission Range for Wireless Sensor Network's Node under Forested Environments Based on Received Signal Strength Indicator (RSSI).....	56
Iswandi, Herlina Tri Nastiti, Ina Eprilia Praditya, I Wayan Mustika	
An Optimal Input for Role-Playing Game's Combat Pace using an Active Time Battle System Algorithm.....	61
Agrivian Anditya, Agus Sihabuddin	
Geographical Information System for Mapping Accident-Prone Roads and Development of New Road Using Multi-Attribute Utility Method.....	66
Anik Vega Vitianingsih, Dwi Cahyono	
Overview on computational-based B-cell epitope prediction: dataset, method and accuracy.....	71
Binti Solihah, Afiahayati	
Convolutional Neural Network Implementation for Image-Based Salak Sortation.....	77
Rismaniyati, Azhari SN	
On the New-Message Notification of Information Systems.....	83
Prastowo B. N., Dhewa O. A., Putro N. A. S.	
Feature Extraction and Classification of the Indonesian Syllables Using Discrete Wavelet Transform and Statistical Features.....	88
Domy Kristomo, Risanuri Hidayat, Indah Soesanti	

State of Charge (SOC) and State of Health (SOH) Estimation on Lithium Polymer Battery via Kalman Filter.....	93
Paris Ali Topan, M. Nisvo Ramadan, Ghuftron Fathoni, Adha Imam Cahyadi, Oyas Wahyunggoro	
Simulation and Experiment Based Optimization of Calligraphy Manufacturing Using a 5-Axis CNC Milling Machine.....	97
Muhammad Akhsin Muflikhun, Muslim Mahardika, Subarmono, Heru Santoso Budi Rochardjo	
Enhancing Quality of Service for eGovernment Interoperability Based On Adaptive Ontology.....	102
I Wayan Ordiyasa, Lukito Edi Nugroho, Paulus Insap Santosa, Wahyudi Kumorotomo	
Indonesian Traditional Dance Motion Capture Documentation.....	108
Ega Hegarini, Dharmayanti, Abdus Syakur	
Combat Aircraft Effectiveness Assessment Using Hybrid Multi-Criteria Decision Making Methodology	112
Agus Suryo Wibowo, Adhistya Erna Permanasari, Simi Fauziati	
Design Optimization of Tri Core PM Linear Generator Using SA and FPA for Wave Energy Conversion System in South Coast of Java Island.....	118
F.D.Wijaya, Sarjiya, Muhammad Rifa'i P.S, Kukuh Daud P.	
Development of Semi-Supervised Named Entity Recognition to Discover New Tourism Places.....	124
Khurniawan Eko Saputro, Sri Suning Kusumawardani, Silmi Fauziati	
Increasing the Security of MP3 Steganography Using AES Encryption and MD5 Hash Function.....	129
Rini Indrayani, Hanung Adi Nugroho, Risanuri Hidayat, Irfan Pratama	
Power Estimation of G.A. Siwabessy Multi-Purpose Reactor at Start-Up Condition Using Artificial Neural Network with Input Variation.....	133
Nazrul Effendy, Nur Chalim Wachidah, Balza Achmad, Prasojo Jiwandono, Muhammad Subekti	
A Visual Recognition Supporting Tool for Mapping Environmental Data using Handheld Measurement Instruments.....	139
Luthfi Zharif, Balza Achmad, Faridah, Mohammad Kholid Ridwan	
Palm Oil Plantation Area Clusterization for Monitoring.....	145
Aufaclav Frisky, Agus Harjoko	
SHA-2 and SHA-3 Based Sequence Randomization Algorithm.....	150
Kuntoro Adi Nugroho, Arimaz Hangga, I Made Sudana	
Optimal Cell Selection Scheme in Femtocell Networks Using Bacterial Foraging Optimization Algorithm.....	155
Sahirul Alam, I Wayan Mustika, Selo, Heng Lalin	
Infant's Cry Sound Classification using Mel-Frequency Cepstrum Coefficients Feature Extraction and Backpropagation Neural Network.....	160
Yesy Diah Rosita, Hartarto Junaedi	
Epilepsy Detection On EEG Data Using Backpropagation, Firefly Algorithm and Simulated Annealing	167
Auli Damayanti, Asri Bekt Pratiwi, Miswanto	
Data Classification for Air Quality on Wireless Sensor Network Monitoring System Using Decision Tree Algorithm.....	172
Bambang Sugiarto, Rika Sustika	
Implementation of Multi-criteria Collaborative Filtering on Cluster Using Apache Spark.....	177
Ardhi Wijayanto, Edi Winarko	

Fingerprint Authentication System Using Back-Propagation with Downsampling Technique.....	182
Peter Juma Ochieng, Kani, Hastuadi Harsa, Firmansyah	
A Study on Algorithms of Pupil Diameter Measurement.....	188
Juni Nurma Sari, Hanung Adi N, Lukito Edi N, P. Insap Santosa, Ridi Ferdiana	
Stereo Camera – based 3D Object Reconstruction Utilizing Semi-Global Matching Algorithm.....	194
M.S.Hendriyawan Achmad, Widya Setia Findari, Nurnajmin Qasrina Ann, Dwi Pebrianti, Mohd Razali Daud	
Rating Of Indonesian Sinetron Based On Public Opinion In Twitter Using Cosine Similarity.....	200
Vincentius Riandaru Prasetyo, Edi Winarko	

Geographical Information System for Mapping Accident-Prone Roads and Development of New Road Using Multi-Attribute Utility Method

Anik Vega Vitianingsih
Informatics Department
Universitas Dr. Soetomo
Surabaya, Indonesia
vega@unitomo.ac.id

Dwi Cahyono
Informatics Department
Universitas Dr. Soetomo
Surabaya, Indonesia
dwikk@unitomo.ac.id

Abstract— The means of transportation development which are not offset by adequate roads construction will lead the traffic density exceeds the volume capacity of the roads. This will cause the access road difficult to pass thus often raises the risk of traffic congestion and lead to traffic accidents. This paper will discuss the use of Geographical Information System (GIS) technology in analyzing spatial data and attribute data (geoprocessing layer) in the form of mapping accident-prone roads and mapping dense traffic lanes as an alternative to the development of new road using Multiple-Attribute Utility Theory (MAUT) method. Geoprocessing layer test conducted on the roads in Gresik District, Indonesia shows the accident-prone roads mapping points, with the average yield of low-risk accident-prone roads are 58%, 24% are low-risk accident-prone roads and 18% roads condition are high-risk accident-prone roads. Geoprocessing for alternative development of new road as the consequences of the density of traffic lanes, in which the uncrowded road categories are 36%, dense road 32% and very dense roads 32%. This system can be used by the government of Gresik District as the decision makers to plan for the alternative development of new road area, therefore traffic density can be minimized.

Keywords— GIS; MAUT; geoprocessing, layer, dense traffic lanes; accident-prone lanes

I. INTRODUCTION

Gresik is an industrial area with a dense population. It is also categorized as an area that frequently passed by light vehicles to heavy vehicles. The highways in Gresik District reach 626.6 Km, which are consist of 67.62 Km state roads. 32.80 Km provincial roads and 525.84 Km district roads. From the total length of the district roads, the 25.30% are in good condition, the 44.37% are categorized as medium damaged roads, the 30.33% are lightly damaged roads and the 30.33% are heavily damaged roads category [1].

The unbalanced comparison between the volume of vehicles and the road capacity causes several traffic congestions, especially during rush hours. This is due to the lack of equal distribution of traffic density. In addition, traffic congestion is one of the factors that increase the number of accidents. Congestion in Gresik is affected by the roads condition and the traffic volume especially during peak hours. It frequently happens in the center of economic activity such as markets, schools, terminals, industries and parking lots in the roadside.

Geographical Information System (GIS) is designed to address this issue. It has the ability to map and analyze spatial data with spatial analysis as well as time analysis (temporal analysis) that generates an integrated analysis covering all aspects [2]. Informed decision-making and problem solving rely on effective communication, exchange of ideas and information, the type and amount of necessary information available to overcome the particular decision problem related to the complexity of the situation [3]. Spatial decision problems often require a lot of viable alternatives that can be evaluated based on multiple criteria. Spatial decisions are multi-criteria in nature [4].

The previous research as in [5] —Identification and Analysis of Accident Black Spots Using GIS stated that accident-prone areas occur because road users do not grasp the road condition, based on the number of accidents in the last three years using *ArcGIS software*. Other previous studies as in [6] — Prioritization of Accident Black Spots using GIS stated that the number of driving accidents throughout the world is estimated 3,00,000 people died and 1–1,5 million people were injured. Human population and the increasing number of vehicles are the main cause of driving accidents, by using *ArcGIS software* the largest number of those accidents is marked with black spot.

Geoprocessing layer or Spatial analysis in this paper use Multi-Attribute Utility Theory (MAUT) method to map accident-prone roads based on the parameter of road data, dense road data, and accident occurrence data. This method is also used for mapping dense traffic roads based on their parameters such as the number of industries, schools, markets, and parking lots. Prior to the using of MAUT method, the weight and the priority value were firstly set up to each criterion. Then the calculation process will be conducted using MAUT method.

This paper can be useful for further researchers as a reference to develop mapping technology using web-GIS based which can help people to find out information concerning accident-prone points and dense traffic lanes. Through this system, the government of Gresik as the decision makers can develop plans of new road areas, therefore the density of traffic lanes can be minimized. This is also an alternative to roadworks to reduce the number of accidents. This system can also help the government

to install traffic controller tools and more particularly at certain points that identified as accident-prone as a warning system to people so they will be more cautious.

II. RESEARCH METHODOLOGY

GIS can be defined as geoprocessing layer that has been processed into a form that is useful to the recipient. Geoprocessing layer in GIS uses separate thematic maps or data sets referred to as a map layer, coverage, or level. Object oriented GIS are alternative to layer approach in which the objects are intended to closely represent real-world elements. Regardless of spatial data, the ultimate goal of GIS is to provide support for spatial decisions with multi-criteria decision making [7]. *Geoprocessing layer* of this paper uses MAUT method to map accident-prone roads based on the parameters of road data, dense traffic lanes data and accident occurrences data, as well as mapping dense traffic roads based on the data parameter on the number of industries, schools, markets and parking lots. Prior to the using of MAUT method, the weight and the priority value were firstly set up to each criterion. Then the calculation process was conducted using MAUT method.

A. Parameter of Analysis

The data outlined in layers and tables subsequently determined the weight and the priority value in each parameter criterion to be used for the analysis using MAUT method [1].

- Analysis of map information of accident-prone roads' points. The parameter of this analysis determined by inputting weight in the road layer data, dense layer, and traffic accident layer as shown in Table I to Table III. The parameter priority value used is shown in Table IV.

Table I. Criterion Weight of Road Layer

Road Condition	Weight
Heavily Damaged Road	5
Medium Damaged Road	3
Good	1

Table II. Criterion Weight of Dense Traffic Lanes Layer

Density Level (on average per day)	Weight
0.91-0.1	5
0.81-0.90	4
0.71-0.80	3
0.61-0.70	2
0.51-0.60	1

Table III. Criterion Weight of Traffic Accident Layer

Total Accident Rate (death)	Weight
≥ 101	5
76-100	4
51-75	3
26-50	2
1-25	1

Table IV. Parameter Priority Value

Parameter	Priority Value	Total Criterion
Road Layer	20	3
Traffic Density Layer	50	5
Traffic Accident Layer	30	5

- Analysis to display the alternative information of new roads development as a consequence of the dense traffic lanes. Parameter on this analysis is determined by inputting weight on the road layer data as shown in Table 1, the number of industry layer, school layer, market layer, parking lots layer and terminal layer as shown in Table 5 to Table 8 below. The parameter priority value used is as shown in Table 9.

Table V. Criterion Weight of Industry Layer

Total Numbers of Industrial Sites on Criterion Road	Weight
≥ 21	5
16-20	4
11-15	3
6-10	2
≤ 5	1

Table VI. Criterion Weight of School Layer

Total Numbers of Schools on Certain Road	Weight
≥ 21	5
16-20	4
11-15	3
6-10	2
≤ 5	1

Table VII. Criterion Weight of Market Layer

Total Numbers of Markets on Certain Road	Weight
≥ 21	5
16-20	4
11-15	3
6-10	2
≤ 5	1

Table VIII. Criterion Weight of Parking Lot Layer

Total Numbers of Parking-Lot on Certain Road	Weight
≥ 21	5
16-20	4
11-15	3
6-10	2
≤ 5	1

Table IX. Parameter Priority Value

Parameter	Priority Value	Total Criterion
Road Layer	20	3
School Layer	20	5
Market Layer	20	5
Parking Lot Layer	20	5
Industry Layer	20	5

B. Geoprocessing Layer

The initial step in the process of geoprocessing layer is digitizing the analog map to input all the data attributes, parameters, and criteria. They will keep in the form of shape files (*.shp) which will be a layer. Then the buffer process was conducted to create a polygon from the layer area. After the layer buffer was formed, a union process was conducted to unite main layer data with area layer. The layer produced from the union process consists of several layers which were out of the reach

from the real layer. They were thrown away using intersect process. The process of analyzing accident-prone roads is shown in Fig.1, while the analytical process of the dense traffic lane is shown in Fig.2.

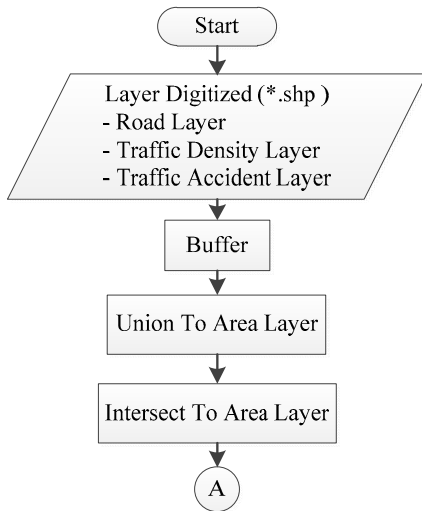


Fig. 1. Geoprocessing layer of accident prone roads

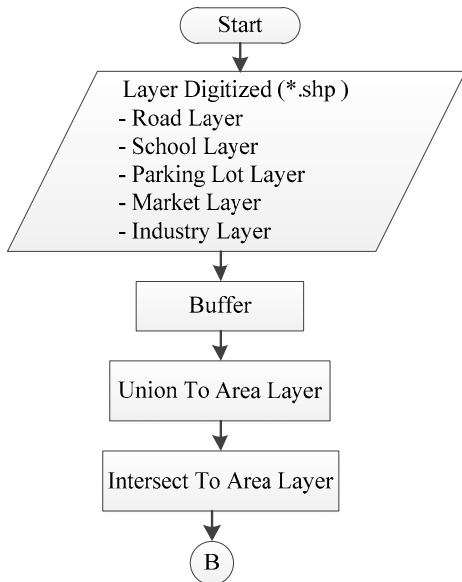


Fig. 2. Geoprocessing layer of alternative development of the new road

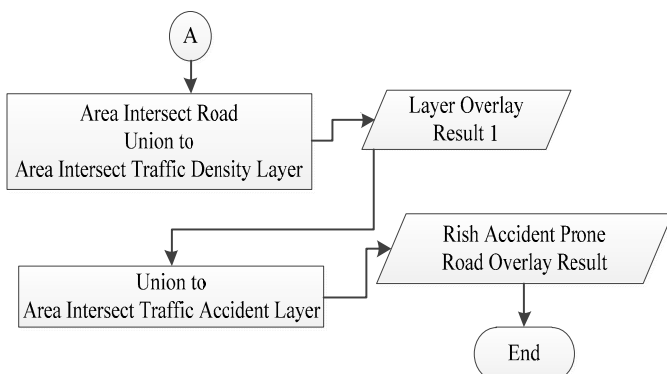


Fig.3. Overlay result of accident-prone road

The intersect layer resulted from the process shown in Fig.1 and Fig.2, which is to be used for the layer union process in each layer intersect that serves to get the overlay layer. The layer which is to be used for the analysis of accident-prone roads as shown at the overlay layer process in Fig.3 and the layer to be used for the analysis of new road development alternative as a result of the dense traffic lanes as shown in overlay layer process in Fig.4.

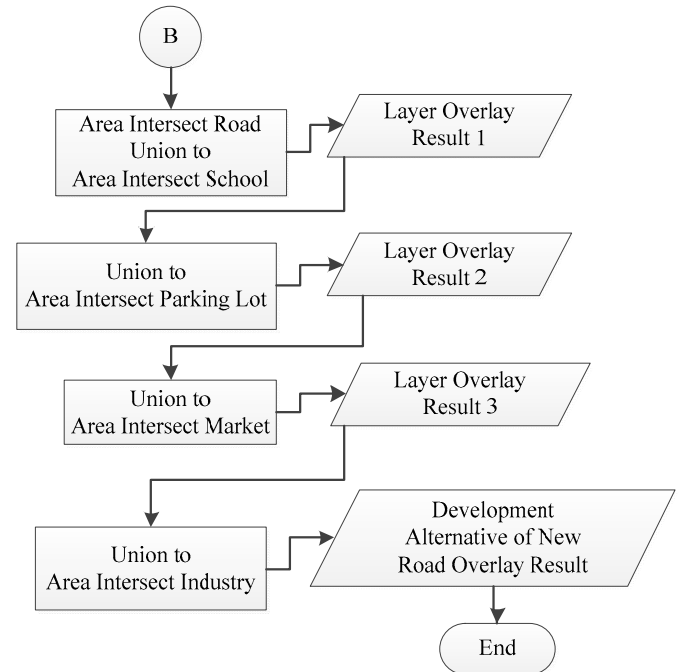


Fig.4. Overlay result of alternative development of new road as a consequence of dense traffic lanes

C. Framework for Spatial with MAUT

The method used to display the mapping information was MAUT method by determining the weight and the priority value for each parameter. GIS-based multi-criteria decision analysis is a process that combines and transforms spatial data into a resultant decision. The spatial layer is decision rule which defines a relationship between the processes of spatial data and attributes. The procedures use geographical data, the decision makers' preferences, data manipulation, and preferences according to decision rules. Considerations of critical importance for spatial with MAUT method are the GIS capabilities of data acquisition, storage, retrieval, manipulation, and analysis. Spatial layer with MAUT method is used to combine the ability of the geographical data and the decision maker's preferences into one-dimensional values of alternative decisions [8]. The most common is the additive model.

$$U(A_i) = \sum_{k=1}^K w_k u_k(x_{ik}), \tag{1}$$

where $U(A_i)$ represents the utility of the alternative i , w_k represents the weight of the criterion k , and $u_k(x_{ik})$ is the utility of criterion k of alternative i given that the value of criterion j of alternative i is x_{ik} . The utility of each criterion is not necessary to be linear. The spatial analysis to map the accident-prone roads using MAUT method is shown in Fig.5

and the spatial analysis to map the development of new road alternative using MAUT is shown in Fig.6.

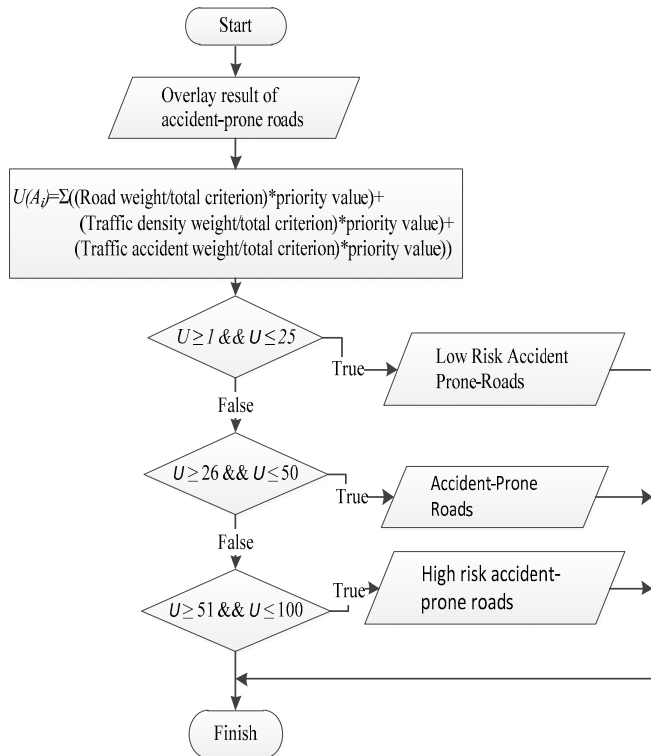


Fig.5. Geoprocessing layer flow of overlay layer on accident-prone road

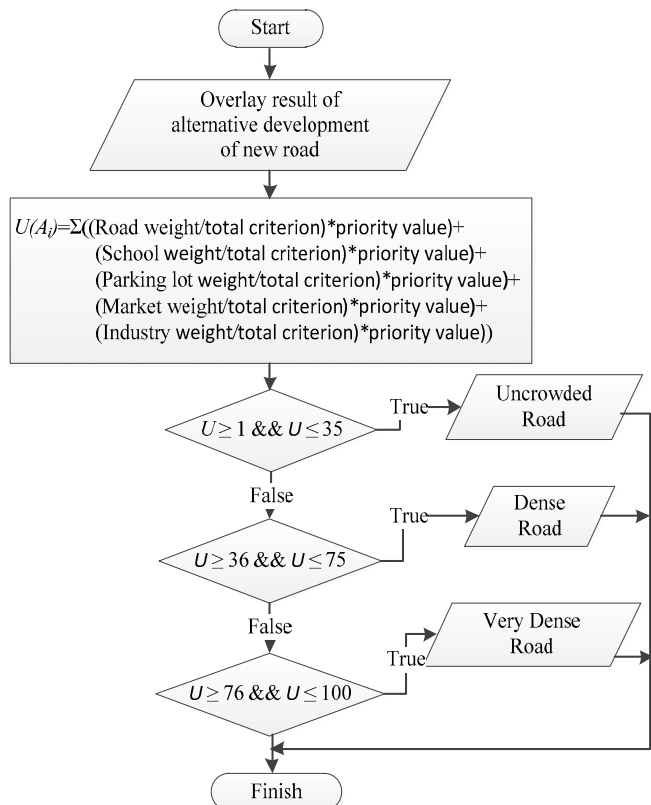


Fig.6. Geoprocessing layer flow of overlay layer for new road alternative development

III. RESULT AND DISCUSSION

There are 432 geoprocessing layer roads were researched, which are consist of provincial roads, district roads, and the highways in Gresik District. The test was conducted using sampling method.

Geoprocessing layer is to determine the mapping of accident-prone roads using MAUT method, as the result presented in Fig.7. The condition of the road is categorized as heavily damaged road with the weight of 5 which refers to Table I. The daily average of traffic density of the road is 0.92583 on average per day with the weight of 5 which refer to Table II. Total traffic accident number occurrences on the road were 8 with the weight of 1 which refer to Table III. After all the parameters included then the calculation process performed using MAUT method which refers to (1) in which the priority value of the parameter refers to Table IV. The calculation result is $U=89$. The result matches the flow in Fig.5 and it is concluded that Jl. Raya Cerme Lor Gresik, Indonesia is categorized as a very high-risk accident-prone road.

Case study at Jl. Raya Dampaan Gresik, Indonesia is shown in Fig.8. The condition of the road is categorized as a medium damaged road with the weight of 3, the daily average of traffic density of the road is 0 on average per day with the weight of 0. Total accident occurrences on the road were 0 accidents with the weight of 1. After all the parameters included then the calculation process performed which refers to (1) using priority value of the parameter, with calculated $U=26$. The result matches the flow in Fig.5, therefore it is concluded that Jl. Raya Dampaan Gresik, Indonesia is categorized as a low-risk accident-prone road.

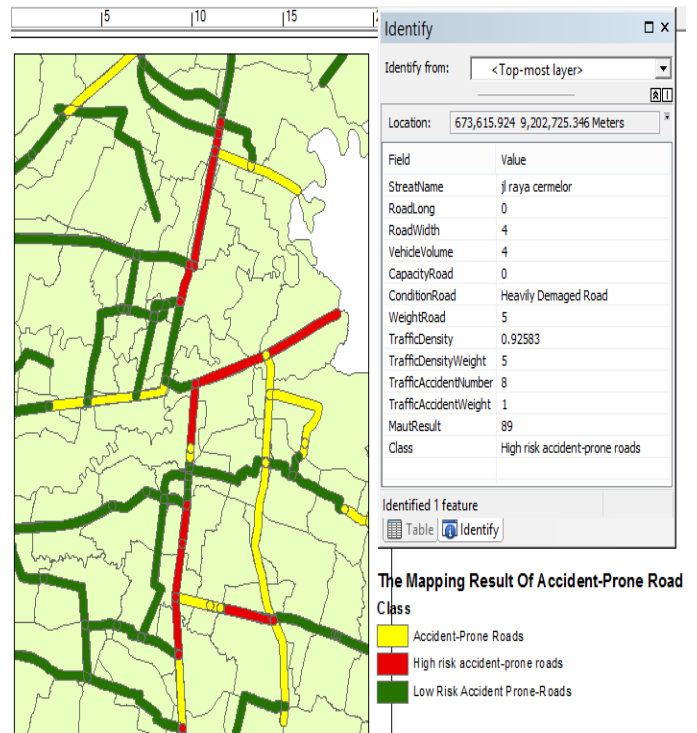


Fig.7. The mapping result of accident-prone roads (case study of high-risk accident-prone roads)

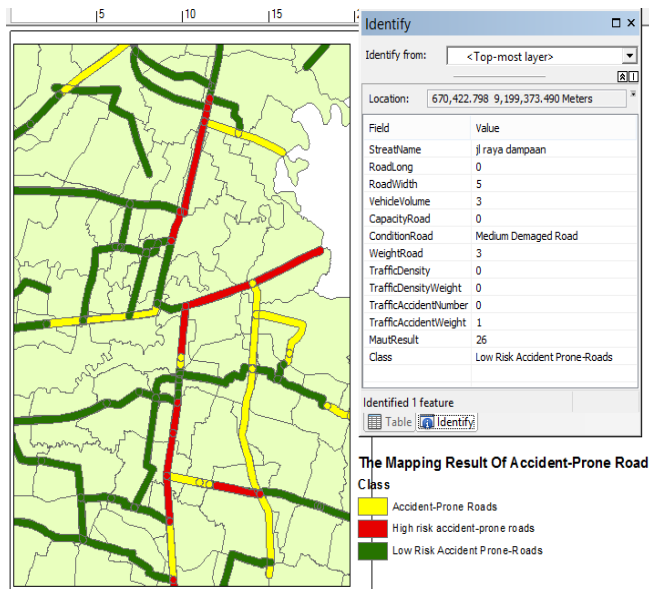


Fig.8. The mapping result of accident-prone roads (case study of low-risk accident-prone road)

Using MAUT method, geoprocessing layer considers the mapping of the alternative development of new road is a result of the dense traffic lane as shown in the result in Fig.9. The road is categorized as heavily damaged road with the weight of 5 that refers to Table I. The number of school on this road is 0 with the weight of 0, which refers to Table VI. The number of the markets on this road is 0 with the weight of 0, which refers to Table VII. The number of parking lot on this road is 0 with the weight of 0, which refers to Table VIII. The number of industries on this road is 24 with the weight of 5, which refers to Table V. After all the parameters included then the calculation process performed using MAUT method which refers to (1) in which the priority value of the parameter refers to Table IX with the calculated $U = 53$. The result matches the flow in Fig.6 and it is concluded that Jl. Raya Kedamean is categorized as a very dense road, therefore it is necessary to develop new road as the area around the road is categorized as an uncrowded traffic roads.

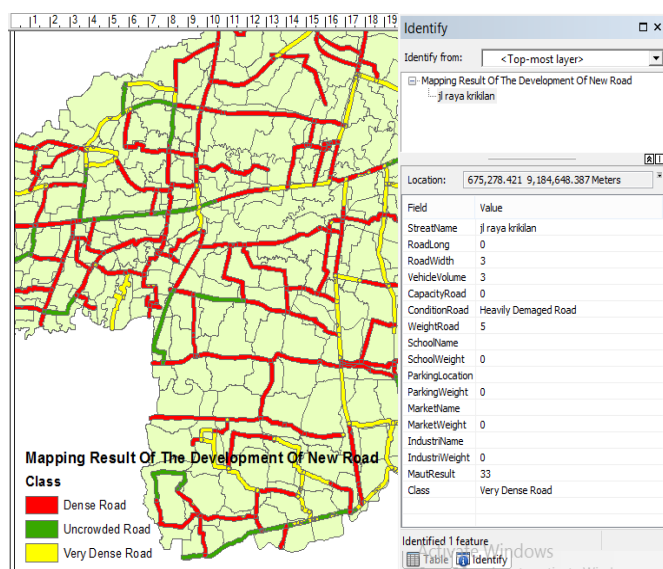


Fig.9. The result of geoprocessing on alternative development of new road as consequence of dense traffic lanes

IV. CONCLUSION

Based on the geoprocessing layer that has been done using MAUT method, the government of Gresik District as the decision makers can use this system as an alternative option to develop new road, by firstly consider certain lane points which not categorized as dense traffic lanes. These results will be used as a reference for further research to bring the system to the development of GIS application using web technologies.

ACKNOWLEDGMENT

This paper is the result of the first year of Competitive Research Grant (Hibah Bersaing) funded by Kopertis Region VII, East Java, by Ministry of Education and Culture, in accordance with the Agreement on Research Grant Implementation of the Private University Faculty Members–Kopertis VII in 2015, Number 005/SP2H/P/K7/KM/2015, on April 2nd, 2015. The result of the mapping will be a reference for further research in 2016 using web-GIS technology.

REFERENCES

- [1] Tim Perencanaan Pembangunan, Penelitian Dan Pengembangan Daerah Kabupaten Gresik, “Pemutakhiran Dan Penyerasian Analisis Dan Perencanaan Rencana Tata Ruang Wilayah (RTRW) Kabupaten Gresik”, Badan Perencanaan Pembangunan, Penelitian Dan Pengembangan Daerah Kabupaten Gresik, 2010.
- [2] Stanley Aronoff Handbook “GIS A Management Perspective”, Second Printing. Canada, 1991.
- [3] Redlands, Calif, “Understanding GIS The ARC/INFO Method”, Fourth Edition. Environmental System Research Institute Inc, 1997.
- [4] Chakhar S. and V. Mousseau, “Spatial multicriteria decision making”, In: Shekhar S. and H. Xiong, Eds. Encyclopedia of GIS, Springer-Verlag, New York, pp. 747–753, 2008.
- [5] Liyamol Isen etc, “Identification And Analysis Of Accident Black Spots Using GIS”, International Journal of Innovative Research in Science Engineering and Technology An ISO 3297: 2007 Certified Organization, Vol. 2, Special Issue 1, 2013
- [6] Reshma E.K, Sheikh Umar Sharif, “Priopitization Of Accident Black Spots Using GIS”, International Journal of Emerging Technology and Advanced Engineering ISSN 2250-2459, Vol. 2, Issue 9, 2012.
- [7] Nijkamp P. and P. Rietveld (1986). Multiple objective decision analysis in regional economics. In: P. Nijkamp (Ed.): Handbook of regional and urban economics. Elsevier, New York, pp. 493– 541.
- [8] M. Wang, S.-J. Lin, Y.-C. Lo, “The comparison between MAUT and PROMETHEE”, Industrial Engineering and Engineering Management (IEEM), 2010 IEEE International Conference, pp. 753-757, 2010.