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Building The Tree Inventory Application for City of East Jakarta

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ABSTRACT

Trees are essential elements of an urban space. The presence of trees in urban areas is not only appreciated as physical attribute, but beyond this, it serves a fundamental function in balancing and conserving urban ecosystem. Especially in tropical countries like Indonesia which receive high levels of solar radiation, trees contribute to the protection of urban areas from the impact of excessive micro-climatic conditions. But, the presence of trees sometimes resulted in the accidents for the residences because of broken branches and human injuries. This situation leads the city to prepare a tree inventory system, which is beneficial in giving the information about tree conditions and thus the information that would be useful for tree maintenance activities. The tree inventory on application for the city of East Jakarta was built for this purpose, comprising a tree inventory and easy access to the database. The application connects the database source with the GIS map, so that the users could retrieve information for each kind of data.

1. INTRODUCTION

a. Background

The development of urban areas that is focused on physical construction has much more neglected urban greenery, especially on greenery of road. This is in turn affecting on the physical condition of trees, indicated by the trees indury. The lack of trees health will become a serious problem for comfort and safety of traffic users. In rainy season with storm and hurrycane, this will induce stem breaking and tree fallen down. This is why we want to monitore physical condition of trees, especially of urban roadtrees. The monitoring of trees condition involves the checking of trees induries, both caused by pest and diseases, and by mechanical induries.

In order to know the intensity of trees monitoring, it would be known some data including trees inventory, greenery facilities inventory, and the intensity of trees maintenance programs, and other related data. The problem faced by the municipal government of East Jakarta City in management of road-trees and greenery open spaces, is the lack of information of trees maintenance. The information management system for tree maintenance is the fundamental guidance which is essential for the judgement of development management of road-trees and greenery open space, due to earn the more efficient maintenance management.

b. The Purposes

The purpose of this study is to build information management system of trees and greenery open space for the area of East Jakarta City. This information would be usefull for some reasons: (1) the availability of information of trees and greenery management which is accessible and accurate, (2) the increasing of efficiency in budget and time for monitoring and maintenance, and (3) the increasing of communication between municipal government and citizen of Jakarta.

2. METHODOLOGY

a. Time and Location

This study was conducted by observation of trees at road and some park of East Jakarta during October 2006. The study areas comprises ca. 187.77 km² or about 28,37% of the area of Jakarta Metropolitan. The study location was limited for five protocol roads and two parks. The protocol roads includes: (1) Jalan Raya Bogor, (2) Jalan Mayjen Sutoyo, (3) Jalan Jenderal Ahmad Yani, (4) Jalan Raya Kalimalang, (5) Jalan Kayu Putih Raya. While the parks includes: (1) Taman Hutan Kota at Pondok Kelapa, (2) Taman Dermaga, at Duren Sawit.

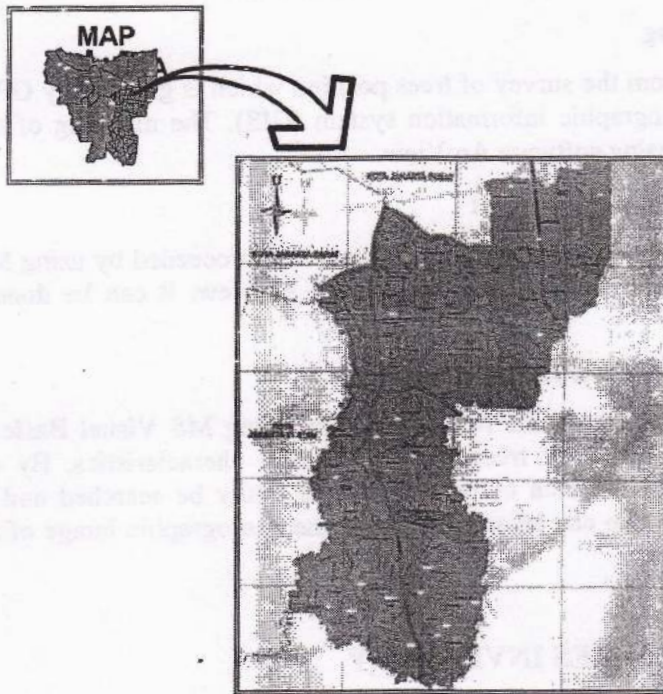


Figure 1. Study Location at East Jakarta City, Indonesia

b. Facilities

Materials. The materials needed for the study includes: (1) Topographic map of East Jakarta, (2) Landsat TM-7, (3) Data of management of trees and greeneries, and (4) Trees at sites.

Tools. Some softwares were used for the study, includes: (1) Arc View GIS v 3.2 3D *Spatial Analyst Extensions*; (2) Microsoft Access; (3) Visual Basic 6. While the hardware used includes: PC Pentium P4 1800 MHz SSE Ready, DDR RAM 256 MB. The tools needed for survey includes: (1) GPS Garmin Etrex Vista, (2) Compass of Suunto, (3) Digital camera, (4) Abney level, and (5) Roll-meter.

c. Data Collecting

The method for data collection conducted for this study comprises of survey and reference study. The survey of tree condition was conducted by surveying along the tree condition at study location, while the reference study was conducted due to find the information of trees maintenance standard applied at East Jakarta. In general, the study was conducted into four steps: (1) trees data and management data collection (2) mapping of trees data, (3) management of trees database, (4) user interface development.

- **Trees data and management data collecting**

- **Tree Physical Inventory.** Inventory on trees includes 5 aspects: (1) diameter at breast height (DBH), (2) tree height, (3) canopy width, (4) canopy form (symmetrical of canopy), and (5) location of trees (UTM).
- **Trees Health Valuation.** Tree health valuation was done based on three kinds of injury factors, i.e. (1) pest and disease, (2) mechanic, (3) technique. Then the value of trees injury was classified into four categories (modification of Grey and Deneke, 1978): (1) Category 1 (best) with the injury up to 15%, (2) Category 2 (good) with the injury 15 – 30%, (3) Category 3 (bad) with the injury 30 – 50%, and (4) Category 4 (worse) with the injury more than 50% or dead.

- **Trees Mapping**

Data earned from the survey of trees position which is grasped by GPS, was inputted for program of geographic information system (GIS). The mapping of this UTM data was conducted by using software ArcView.

- **Trees Database Management**

Data of trees including the number and text was proceeded by using MS Access. And, to make a link data between MS Access and Arcview, it can be done by operating MS Visual Basic 6.

- **User Interface Development**

The user interface program was built up by using MS Visual Basic 6, comprising the geographical position of trees and its physical characteristics. By operating the user interface project, the data of trees would be easily be searched and retrieved, and the location on the map can be seen. Besides, the photographic image of individual tree can also be seen.

3. RESULT OF TREES INVENTORY

Based on the field survey, the result showed that there was the data of trees population along the location of study comprised of 4227 trees. The trees were composed of 42 species, which was distributed unevenly. Among those trees, there was 14.9% of trees that is in bad to worse condition, or the trees in good to best condition was about 85.1%. The trees were distributed in seven location (of five roads and two parks). The location at Jl. Mayjen Sutoyo and Jl. Kali Malang contributed large number of trees with bad condition. The injury of trees usually was mostly caused by vandalism activity. The form of vandalism involved by painting, push the trees with nails, for hanging commercial items, and some by cutting branches in order to build kiosk behind. This situation leads to have to strengthen the regulation to maintain trees against vandalism, especially for all trees located near commercial activities.

The distribution of trees at seven location and those health condition is described as below:

a. Jl. Raya Bogor

Trees were distributed along west and east sides of road, making a line of trees with the north-south orientation, from the point of Pasar Rebo fly-over to Cililitan Shopping Center. The number of trees is 436 composed of 19 species, involving at west-side 348 trees and east-side 88 trees. Among the trees, there was 92 trees in bad condition and 4 trees worse.

b. Jl. Mayjen Sutoyo

Trees were distributed along west and east sides of road, road median, and at viaduct with the north-south orientation from the point of Cililitan Shopping Center to Cawang

fly-over. The number of trees is 485 composting from 17 species, comprising 90 trees at west-side, 123 trees at road-median, 181 trees at east-side, and 91 trees at viaduct lot. Almost one-third of those trees were in bad condition.

Table 1. Trees Condition at Study Area of East Jakarta City

No.	Location	Number of Tree Condition				
		total	best	good	bad	worse
1	Jl. Raya Bogor	436	143	197	92	4
2	Jl. Mayjen Sutoyo	495	192	126	167	-
3	Jl.A. Yani	826	513	244	48	21
4	Jl. Kali Malang	842	605	21	216	-
5	Jl. Raya Kayu Putih	427	225	167	34	1
6	Taman Darmaga	213	169	39	2	3
7	Taman Hutan Kota	988	975	13	-	-
	Grand Total	4227	2822	807	559	29
			66,8%	19,1%	13,2%	0,7%
	Indury: best: 0-15%; good: 15-30%; bad: 30-50; worse: >50%					

c. A. Yani Street

Trees were distributed along west -sides of road in the north-south orientation from the point of Jatinegara fly-over to Pramuka intersection, and at east-side running to Jl Suprpto intersection. The number of trees is 882 composting from 15 species, comprising 359 trees at west-side and 523 trees at east-side. Almost one-third of those trees were in bad condition. Lest than 10% of trees at this site was in bad – worse condition.

d. Kalimalang Street

Trees were distributed along north and south sides of road, with the west-east orientation from the point of Cipinang Muara to Pasar Sumber Artha. The number of trees is 842 composting from 12 species, comprising 255 trees at north-side and 587 trees at south-side. Among the trees, there was about one fourth in bad condition.

e. Kayu Putih Raya Street

Trees were distributed along west and east sides of road, road median, and west separator and east separator, with the north-south orientation from the point of Tanah Mas Kayu Putih intersection to Perintis Kemerdekaan intersection. The number of trees is 427 composting from 13 species, comprising 51 trees at west-side, 42 trees at west separator, 131 trees at road-median, 168 trees at east separator and 35 trees at east side. Almost one-third of those trees were in bad condition. Among the trees, lest than 10% was in bad condition.

d. Dermaga Park

The location of Dermaga Park is at Jl. Duren Sawit Raya. The Dermaga park was consisted of 11 lots, the lots varied in the size of area of 200 to 500 m². The number of trees at Dermaga park is 213 involving 21 species. Most of the trees were in a best condition, and only a little was in bad to worse condition.

e. Hutan Kota Park

The location of Dermaga Park is at Jl. Dogol, Pondok Kelapa. The Dermaga park was consisted of 3 lots, the total area consisting 2 ha. The number of trees at Dermaga park is 988 involving 18 species, distributed as 381 trees at Lot-1, 317 trees at Lot-2, and 290 trees at Lot-3. All of the trees were in a good to best condition.



Table 2. Trees Inventory Data Divided For Species

No.	Local Name	Botanical Name	Jl. Raya Bogor				Jl. Mayjen Sutowo				Jl. A. Yani				Jl. Kali Malang				Jl. Raya Kayu Putih				Taman Darmaga				Taman Hutan Kota													
			SH		RS		RR		PS		RB		SH		RS		RR		SH		RS		RR		SH		RS		RR		SH		RS							
			total		total		total		total		total		total		total		total		total		total		total		total		total		total		total									
1	Taksia	<i>Acacia auriculiformis</i>	2	1	1	0	0	25	17	8	0	0	0	4	2	2	0	0																						
2	Apokak	<i>Persea americana</i>																																						
3	Angsana	<i>Pterocarpus indicus</i>	73	4	39	29	1	74	32	18	24	0	390	155	172	44	19	705	495	7	203	0	149	48	97	2	1	69	37	27	2	3	49	36	13	0	0			
4	Keam Keranj		93	19	40	31	3	1	1	0	0	0	2	0	0	1	2	0	2	0	0																			
5	Belimbing	<i>Averhoe bilimbi</i>																																						
6	Belimbing Wuluh	<i>Averhoe sp.</i>																																						
7	Beringin	<i>Ficus benjamina</i>	23	12	7	4	0	85	21	14	50	0	5	1	4	0	0	29	19	0	10	0	3	3	0	0	3	3	0	0	13	13	0	0	0	0	0			
8	Beringin laut	<i>Ficus elastica</i>																																						
9	Bintaro	<i>Cerbera manghas</i>																																						
10	Bunga Kupu-2	<i>Bauhinia purpurea</i>																																						
11	Casara Angin	<i>Cassia sp.</i>	4	1	0	3	0	7	2	1	4	0																												
12	Dadap Merah	<i>Casuarina equisetifolia</i>																																						
13	Dadap Serep	<i>Erythrina crista-galli</i>	1																																					
14	Durian	<i>Erythrina sp.</i>																																						
15	Flamboyan	<i>Durio sebastinus</i>	1																																					
16	Glodogan	<i>Delonix regia</i>	17	3	12	2	0	4	2	0	2	0	1	1	0	0	17	16	1	0	0	1	0	1	0	0	0	3	2	1	0	0								
17	Glodogan Tiang	<i>Eugenia aquatica</i>	16	15	1	0	0	6	4	1	1	0	61	60	1	0	0	5	5	0	0	0	0	0	0										353	353	0	0	0	
18	Jambu Air																																							
19	Jaranan																																							
20	Jati Mas	<i>Tectona sp.</i>	5	0	5	0	0	116	37	28	51	0	4	4	0	0	0																							
21	Kapak Randu	<i>Seiba peritandra</i>	8	1	7	0	0	4	0	0	4	0	1	0	1	0	0	4	4	0	0	0	0													4	4	0	0	0
22	Kayu Putih																																							
23	Kelapa Gading	<i>Cocos nucifera</i>	1																																					
24	Kersen																																							
25	Ketapang	<i>Terminalia catappa</i>																																						
26	Kinujuan	<i>Samanea saman</i>	3	1	1	1																																		
27	Lantoro																																							
28	Mahoni	<i>Swietenia mahagoni</i>	172	84	73	15	0	107	49	34	14	0	56	46	9	1	0	1	1	0	0	11	11	0	0	0	13	9	4	0	0	135	135	0	0	0				
29	Mangga	<i>Mangifera indica</i>	10	3	4	3																																		
30	Mindi	<i>Melia sp.</i>																																						
31	Miandingan																																							
32	Nangka	<i>Alocarpus integrus</i>	5	0	3	2																																		
33	Palem Putri																																							
34	Palem Raja	<i>Roystonea regia</i>																																						
35	Pinus	<i>Pinus mercurii</i>																																						
36	Salak	<i>Salaca edulis</i>																																						
37	Sawo	<i>Acras zapota</i>																																						
38	Sikat Botol																																							
39	Sukun	<i>Alocarpus sp.</i>																																						
40	Tanjung	<i>Mimosaops eleani</i>																																						
41	Walisongo	<i>Secifera sp.</i>	1																																					
42	Waru		1																																					
	JUMLAH	4227	436	143	197	92	4	485	192	126	167	0	826	513	244	48	21	842	605	21	216	0	427	225	167	34	1	213	169	39	2	3	988	975	13	0	0			

4. THE BUILDING OF GEOGRAPHIC INFORMATION MANAGEMENT

a. Geographic Information Management

The GIS of trees resulted from the observation was built up by using ArcView. User can retrieve the location and condition of individual tree by opening this program. In order to get operation of this program, the user should proceed some steps:

- (1) Open the program of ArcView
- (2) Activate all available extension tools
- (3) From File menu/ Open Project/ select the project with the extension format *.apr.

Figure 2 below shows the view of the project of GIS in retrieving trees located at specific road. User can also look up the directory of trees at spesific location, including the information of trees health condition.

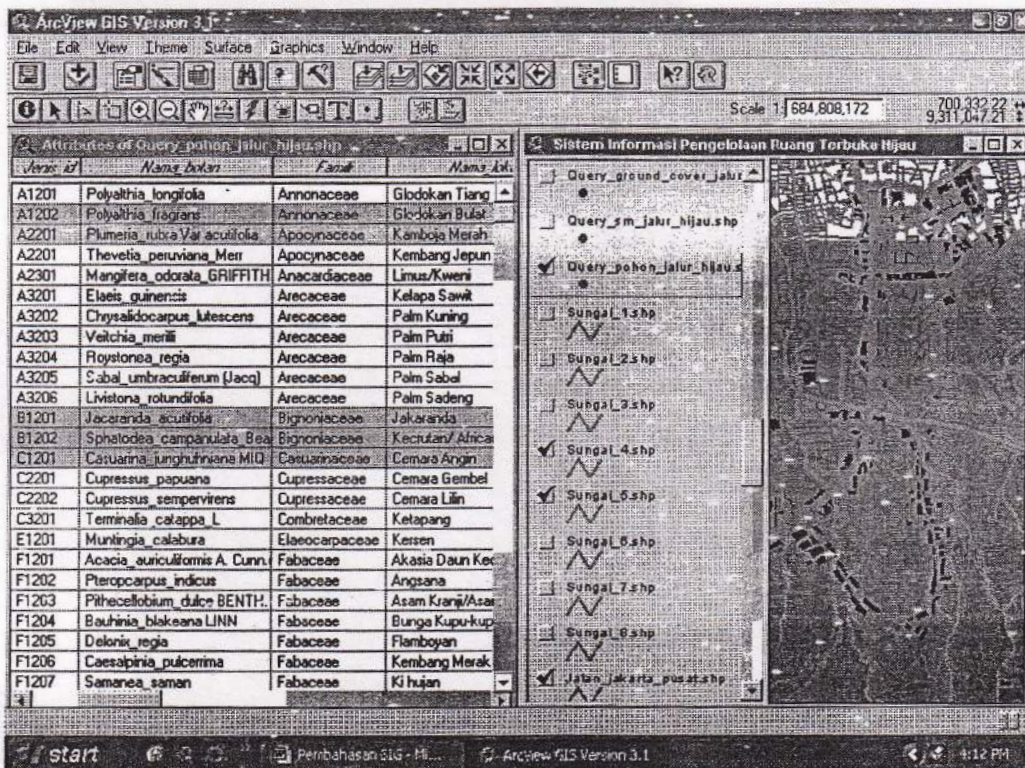


Figure 2. GIS for Trees Inventory Database of East Jakarta City, Indonesia



Figure 3. Opening View of Trees Inventory Application

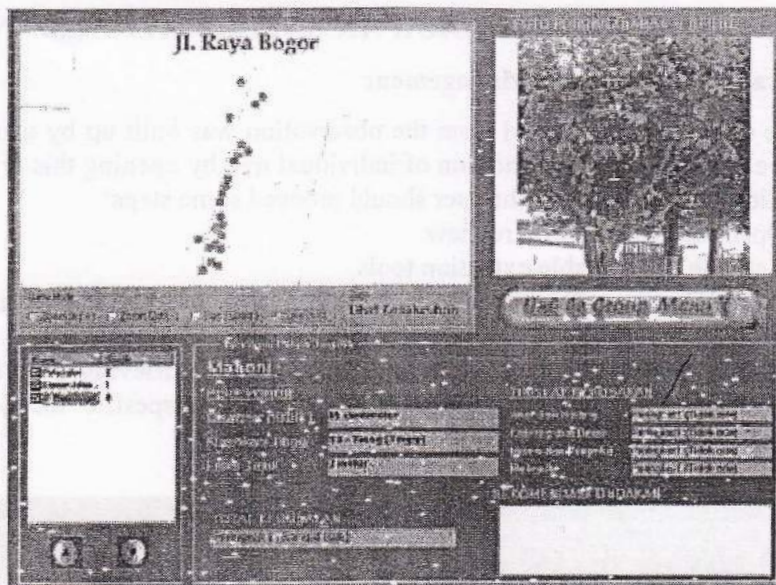


Figure 4. User interface for urban trees mangement

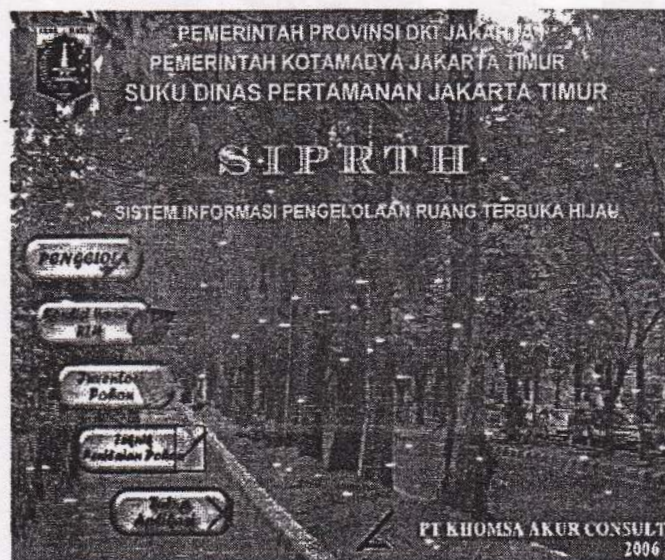


Figure 5. Retrieving information of individual tree at spesific location

b. Object-Base Information System

- **Database and Database Management System**

The database was designed in esay way for retrieving data. The information was divided into some tables, and every table stores specific entity. This was done by dividing the table for data of trees inventory and table for data of trees health valuation

- **Access 2000 DBMS For Windows**

MS Access is one of a good database application, was very useful for trees database management, because it contains of DBMS (database management system) which is facilitated with query. The query is very important for building a statement to look up the information.

- **Application of Database Management with MS Visual Basic 6.0**

MS Visual Basic is a programming language working in the area of MS Windows, that is why MS Visual Basic can optimize MS Windows. This language was successfully building up the application for trees database management. Even, the application can be built to retrieve image data in form of GIS. By making a user interface project using MS Visual Basic, a user can easily retrieve the data and information within it. The illustrations below show views of user interface built up as MS Visual Basic project.

5. CONCLUSION

Urban trees condition in a form of database that comprises of huge number of trees can managed in a simple way, and can easily retrieve by user. By using the capacity of MS Visual Basic 6, the database of urban trees condition even can be retrieved as an information in form of GIS. This capacity could be used worldwide for all urban areas, due to evaluate the natural resources in the cities.

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