



Asset Inventory Maintenance System Using the Genetic Algorithm Method at the National University

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ABSTRACT

Scheduling the maintenance of asset inventory is very important in increasing effectiveness and work efficiency. National University has fixed assets as supporting lectures such as computers, air conditioners, printers, projectors, and others. However, the asset inventory management at the National University has not yet reached effectiveness and good efficiency, the National University does not yet have a special asset database to facilitate scheduling and improvement in maintaining asset inventory. This makes it difficult to track down asset damage. This problem often makes it difficult for asset managers at the National University to know the condition of the assets, whether damaged or lost. That makes asset management not good. Therefore, a system that can run an asset management business process is neat and structured so that asset managers can easily manage maintenance maintenance and repair assets. The design process uses the Genetic Algorithm method. it starts with identifying the asset management system at the National University and creating a proposed new system. From the design stage, a website-based information system is produced to manage the scheduling and repair of assets at the National University. it starts with identifying the asset management system at the National University and creating a proposed new system. From the design stage, a website-based information system is produced to manage the scheduling and repair of assets at the National University. it starts with identifying the asset management system at the National University and creating a proposed new system. From the design stage, a website-based information system is produced to manage the scheduling and repair of assets at the National University.

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1. Introduction

Maintenance is an activity that is needed to maintain the quality of a facility so that the facility can function in a ready-made condition, so that an operational activity is in accordance with what is planned.

Assets are the main capital in managing the performance of an organization. Assets also support the operational activities of an agency every day, the absence of appropriate information to manage assets can hamper operational activities. The need for information about data and information on an asset is very important in order to improve performance within an agency. Therefore, at this time it is very much needed an asset management system that can be used effectively.

The system is a network of interrelated procedures gathered together to carry out an activity or to complete a specific goal.

2. Research Methods

This research will design an asset inventory maintenance system for optimizing asset repair scheduling at the National University. The design of this system is expected to assist national universities in managing assets and reducing damage.

The research steps will be carried out as follows:



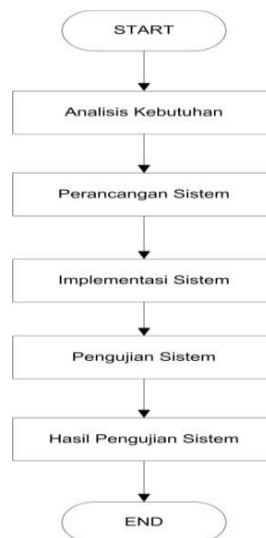


Fig 1. Research Process Flowchart

System Requirements Analysis which is used to minimize costs and maintain so that the asset inventory can be managed properly so that the useful life of the asset can be used as long as possible.

System design in asset management in accordance with the needs desired by national universities, especially asset care. Therefore the design is made according to need.

In the implementation phase this system is used by three accounts namely Admin, User and Technician. The three accounts will be mutually sustainable in performing asset maintenance

Testing which is done using genetic algorithms in the National university system

The results of testing the system according to genetic algorithm calculations and analysis of the results of the system built to produce the asset's decision on repair, replacement, upgrading or overhaul.

a. Genetic Algorithm

Genetic Algorithm (AG) is one of the heuristic search algorithms based on biological evolutionary mechanisms in dealing with optimization problems whose mathematical models are complex or even difficult to construct [4].

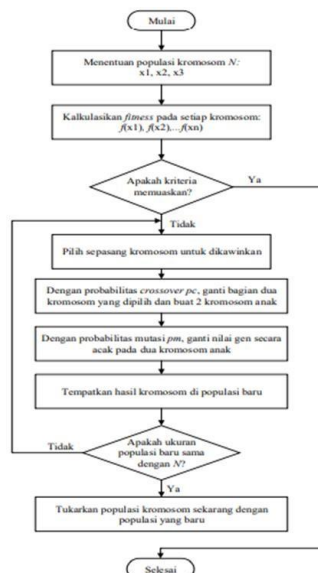


Fig 2. Research Procedures for Genetic Algorithms

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begin t = 0
initialization P (t)
while (not stopped) do reproduction C (t) of P (t)
P (t) and C (t) evaluation
selection P (t + 1) from P (t) and C (t) t = t + 1
end while end
    
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Formula:

find the maximum value of a function as follows:

$$\max y = f(x) = -x^2 + 14x - 13, \quad 0 \leq x \leq 15 \tag{2.1}$$

The graph of this function is shown in Figure 2. The maximum value of the function is $y = 36$ at $x = 7$.

b. Initialization Stage

Initialization is done to generate a new set of random solutions / randomly consisting of a number of chromosome strings and placed in a reservoir called the population. [5]

we specify popSize = 4 and we use binary chromosome representation (base number 2). The value of x is determined between 0 to 15 and binary numbers with length 4 can reach the value of x (remember 11112 = 15). So stringLen = 4.

we get the initial population and the conversion of the chromosome to x as follows:

c. Evaluation Stage

Evaluation is used to calculate repairs for each chromosome. The higher the repair value the better and vice versa if the repair value is small, the value produced is not good [7].

	Chromosome	x	y = f (x)	repair
Q1	[0 0 1 1]	2	0	20
P2	[0 1 0 0]	4	27	27
Q3	[1 0 0 1]	9	32	32
Q4	[0 1 0 1]	5	32	32
C1	[0 0 0 1]	1	0	0
C2	[1 0 1 1]	11	20	20

	chromosome	x	y = f (x)	repair
Q1	[0 0 1 1]	3	3	20
P2	[0 1 0 0]	4	4	27
Q3	[1 0 0 1]	9	9	32
Q4	[0 1 0 1]	5	5	32

d. Reproduction Stage

Reproduction is used to obtain derivatives. Two genetic operators used in this process are crossovers and mutations. [6]

Q1	[0 0 1 1]
Q3	[1 0 0 1]
C1	[0 0 0 1]
C2	[1 0 1 1]

Each offspring inherits the composition of genes (chromosome) from its parent value $pm = 0.2$ then there is $0.2 \times 4 = 0.8$ (rounded up to 1) offspring

resulting from the mutation process. we take P4 selected as a parent, we will get the 3rd offspring (C3) as follows:

P4	[0 1 0 1]
C3	[0 1 0 0]

The mutation process is carried out by randomly selecting one gene then changing its value. 3 individuals in the offspring shelter as follows:

chromosome

C1	[0 0 0 1]
C2	[1 0 1 1]
C3	[0 1 0 1]

e. Selection Stage

Selection is made to select individuals from a population and offspring that is maintained for the next generation. The greater the repair value of a chromosome, the greater the chance of being selected.



P (t + 1)chromosome	x	y = f (x)	repair
Q1 [0 1 0 0]	4	27	27
P2 [1 0 0 1]	9	32	32
Q3 [0 1 0 1]	5	32	32
Q4 [1 0 1 1]	11	20	20

Until this stage we have P2 (or P3) as the best individual because it has the largest repair value. This stage is carried out continuously until the derivative value is small or equal to 0 so that no repairs are made. [8]

3. Results and Discussion

A system is needed that can make the scheduling of good maintenance activities. A system that can print asset data reports in pdf format is needed.

Entity Identification

The following entities are involved:

- Administrators, parties from departments that have accounts in the system and have the task of editing data, scheduling maintenance
- User, party from the university to propose improvements to assets at the national university
- Technician, the party appointed by the National University to conduct Maintenance, Repair, Replacement, Upgrading and Overhaul.

Table 1
Example Divisions

Code	Division
DV001	faculty of Social Science and Political Science
DV002	faculty of Law
DV003	Faculty of Language and Literature
DV004	faculty of Economics and Business
DV005	Faculty of Engineering and Science
DV006	Faculty of Biology
DV007	Faculty of Agriculture
DV008	Faculty of Communication and Information Technology
DV009	Faculty of Health Sciences

Table 2

Example of Machine Name

Machine ID	Machine name
MC001	air conditioning
MC002	Projector
MC003	Monitor
MC004	Wifi
MC005	Computer
MC006	A printer
MC007	

Table 3

Examples of Machine Maintenance Guards

Schedule ID	Division ID	Machine ID	Status
SC001	DV008	MC001	Waiting
SC002	DV008	MC002	Open
SC003	DV008	MC003	Closed
SC004	DV008	MC004	Open

Table 4

Engine Repair Example

Repair ID	Machine ID	Technician ID	Status
TC001	MC002	US003	Open
TC002	MC001	US003	Waiting
TC003	MC004	US003	Closed

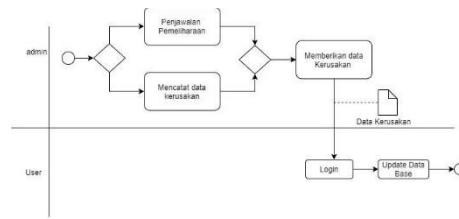


Fig 3. Diagram of Asset Inventory Damage Recording

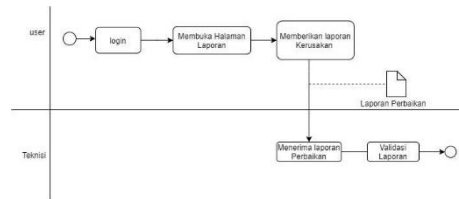


Fig 4. Asset Inventory Damage Reporting Diagram

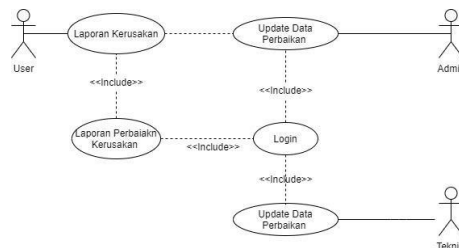


Fig 5. Use case Maintenance Management Diagram

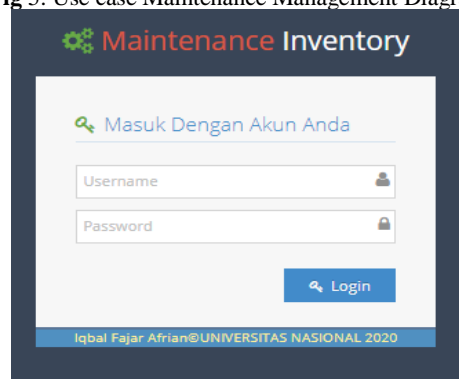


Fig 6. Display Login Page

The earliest appearance that we encounter when opening an application that is used by admin, user, technician

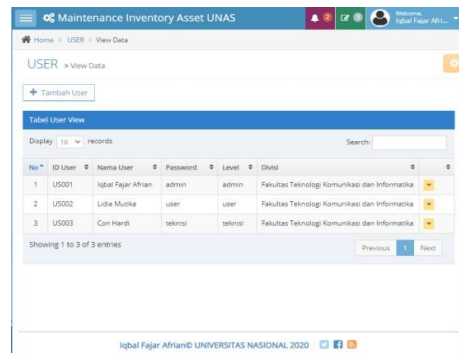


Fig 7. User Data Display

The results of user input is based on the id number in sequence F1, F2 FN

No	ID mesin	Nama mesin	Merk Mesin	Kapasitas	Divisi	Tahun Pembelian	Periode Pakai
1	MC001	AC Cassette	Panasonic Cassette Type Air Conditioner CS-F24DB4ES (CU-J24DBPS)	memiliki sumber daya 220 - 240 volt, dengan input daya sebesar 2,58 kW, dan kapasitas pendinginan 6,60 kW, selang pembuangan depan dinoskan 750 mm, disarankan pembarikan setiap 1,5 bulan.	Fakultas Teknologi Komunikasi dan Informatika	06/03/2020	1,5 Tahun
2	MC002	Printer	Epson L4150	A4 5760 x 1440 dpi Up to 33 ppm Print Black/White Up to 15 ppm Print Colour 1200 x 600 dpi	Fakultas Teknologi Komunikasi dan Informatika	06/03/2020	2 Tahun

Fig 8. Display Inventory assets Contains inventory of assets that are owned and will be carried out maintenance

No	ID Divisi	Nama Divisi
1	DV001	Fakultas Ilmu Sosial dan Ilmu Politik
2	DV002	Fakultas Hukum
3	DV003	Fakultas Bahasa dan Sastra
4	DV004	Fakultas Ekonomi dan Bisnis
5	DV005	Fakultas Teknik dan Sains
6	DV006	Fakultas Biologi
7	DV007	Fakultas Pertanian
8	DV008	Fakultas Teknologi Komunikasi dan Informatika

Fig 9. Display Division Display in the form of faculties at the National University to be carried out maintenance of assets

No	ID Jadwal	Tanggal	Nama Divisi	Nama Mesin	Point Check	Tanggal Jadwal	Status
1	SC001	2020-06-02	Fakultas Teknologi Komunikasi dan Informatika	AC Cassette	Service	2020-06-03	Waiting
2	SC002	2020-06-02	Fakultas Teknologi Komunikasi dan Informatika	Printer	Cleaning	2020-06-03	Open
3	SC003	2020-06-02	Fakultas Teknologi Komunikasi dan Informatika	Monitor	Replace	2020-06-03	Close
4	SC004	2020-06-02	Fakultas Teknologi Komunikasi dan Informatika	Akses Point	Setting	2020-06-03	Open
5	SC005	2020-06-02	Fakultas Teknologi Komunikasi dan Informatika	Akses Point	Setting	2020-06-25	Open

Fig 10. Display Scheduling Display that displays the user's scheduling in the form of dates and assets that will be maintained.

No	ID perbaikan	Tanggal	Nama User	Nama Mesin	Judul	Keterangan	Status
1	TC002	2020-06-02	Iqbal Fajar Afrian	AC Cassette	Perlu Diperbaiki	Ruang 4.404 perlu di perbaiki karena tidak dapat bekerja secara maksimal dan AC bersih namun tak bekerja maksimal	Waiting
2	TC003	2020-06-02	Lidia Mukta	Akses Point	perlu di setting ulang	Ruang 4.403 kondisi wifi tidak aktif dan perlu di setting ulang	Close
3	TC004	2020-06-02	Lidia Mukta	AC Cassette	ac rusak	di ruangan 4.402 ac rusak perlu diganti	Close
4	TC005	2020-06-02	Iqbal Fajar	Monitor	Monitor rusak	Ruang 4.409 monitor perlu di service	Open

Fig 11. Repair Display that shows the assets that have been repaired, being repaired and waiting for approval.

LAPORAN DATA PERMAIKAN
Range Date : s/d

No perbaikan	Tanggal	Nama user	Nama Mesin	Judul	Keterangan	Status
1	2020-06-02	Iqbal Fiaz Afrian	AC Cassette	perlu diperbaiki	Ruang 4.404 perlu di perbaiki karena tidak dapat bekerja secara normal, dan AC berisik namun tak bekerja maksimal	Waiting
2	2020-06-02	Lidia Nurika	Akses Point	perlu di setting ulang	Ruang 4.403 kondisi wifi tidak aktif dan perlu di setting ulang	Closed
3	2020-06-02	Lidia Nurika	AC Cassette	ac rusak	di ruangan 4.402 ac rusak perlu diganti	Closed
4	2020-06-02	Fiaz Afrian	Monitor	Monitor tidak berfungsi	Ruang 4.403 monitor perlu di service	Open

Fig 12. Repair data report The final display of repairs is a combination of users and technicians

LAPORAN DATA PERAWATAN
Range Date : 2020-06-02 s/d 2020-06-03

No Jadwal	Tanggal	Nama Divisi	Nama Mesin	Point Check	Tanggal Jadwal	Status
1	2020-06-02	Fakultas Teknologi Komunikasi dan Informatika	AC Cassette	Service	2020-06-03	Waiting
2	2020-06-02	Fakultas Teknologi Komunikasi dan Informatika	Printer	Cleaning	2020-06-03	Open
3	2020-06-02	Fakultas Teknologi Komunikasi dan Informatika	Monitor	Replace	2020-06-03	Closed
4	2020-06-02	Fakultas Teknologi Komunikasi dan Informatika	Akses Point	Setting	2020-06-03	Open
5	2020-06-02	Fakultas Teknologi Komunikasi dan Informatika	Akses Point	Setting	2020-06-25	Open

Fig 13. Maintenance Data Report Final report in the form of data that is repaired, replaced, up-graded and overhauled

4. Conclusion

This research produces data from assets owned by the National University. From research conducted with genetic algorithms, many assets were repaired. So that by knowing the maintenance pattern, the asset management at the National University can predict the asset needs in the future. From the results of this study also asset scheduling is more structured and assets that are maintained can last a long time according to the useful life and are expected to facilitate asset management at the National University.

5. Reference

- [1] Y. V. Pavan Kumar, "Overview On Role Asset Management Systems For Smart Microgrids", IJSTR. Vol 8 Issue 11. 2019.
- [2] Noor Ahmad dan Lukman Hidayat, " Pengaruh Manajemen Aset terhadap Kinerja perusahaan" JIMKES, Vol 1, No 1, 2013.
- [3] Kristanto, Andri. 2011. Perancangan Sistem Informasi Dan Aplikasinya. Yogyakarta: Gava Media.
- [4] Arinda Lestari, John Roni Coyanda, Dasrial. "Sistem informasi pevelangan barang secara online pada PT pegadaian (PERSERO) unit pelayanan cabang pasar 26 ilir Palembang". Jurnal Informatika Global. Vol 6 No 1 . 2015.
- [5] Hasim Saputra. " Sistem penunjang keputusan seleksi penerimaan siswa baru di SMPN 1 pagelaran dengan metode SAW". KMSI. Vol 4 No 1 . 2016.
- [6] Huston, S.J. "Measuring Financial Literacy" journal of consumer affairs. Vol 44 No 2 . 2010.
- [7] Wayan Firdaus Mahmudy. Algoritma Evolusi. Program Teknologi Informasi dan Ilmu Komputer (PTIIK) Universitas Brawijaya September 2013.
- [8] Jahromi A.A, Parvania M, Bouffard F, Firuzabad M.F, "A two-stage framework for power transformer asset maintenance management-part I: models and formulations," IEEE Trans. Power Systems, Vol. 28, No. 2, pp. 1395-1403, 2013.
- [9] Jahromi A.A, Parvania M, Bouffard F, Firuzabad M.F, "A two-stage framework for power transformer asset maintenance management-part II: validation results," IEEE Trans Power Systems, Vol. 28, No. 2, pp. 1404-1414, 2013.
- [10] Maxime Gilliaux, Florent Lemenager, Thierry Coste, "Improving asset knowledge using system management based on IEC-61850," IET CIRED, 2017, Vol. 2017, No. 1, pp. 2366-2369, 2017.

