WEB-BASED RESEARCH FACILITIES INFORMATION SYSTEM DESIGN USING LINEAR SEQUENTIAL METHOD

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Abstract

This research was aimed at knowing the current information system of research facilities at LIPI Bandung Geotechnology Research Center, to find out the problems facing, and to know how to cope these problems. Based on the research results, it turns out that the problems of these systems are processing research facilities data at LIPI Bandung Geotechnology Research Center is still not efficient, where data processing is still manuals. To resolve these problems, therefore, a new research facilities information system design with an integrated database was needed to simplify the process of managing data that can be accessed anytime and anywhere, so that the report needed to be faster, complete, and precise. The method of this information system design was using the object oriented with the UML (Unified Modeling Language) and implemented to Web Programming language and MySQL as databases. linear Sequential was used as for the software development. The suggestions given: 1) organizing training on the procedures for the use of the new system, and 2) performing regular maintenance so as not to damage.

Keywords: Analysis and Design Systems, Object Oriented, UML, Linear Sequential, Research Facilities

Introduction

LIPI Geotechnology Research Center is an institution under the auspices of the Indonesian Science Council and the National Research Affairs Council which is tasked with conducting research in the field of geotechnology and becoming a trusted research institution that plays a role in providing solutions to problems in the field of geotechnology.

Technology is currently developing very rapidly and can provide convenience for users in the process of information management, technology will be very helpful in processing data, getting information easily and quickly in making decisions.

Management of research facilities at the LIPI Geotechnology Research Center is currently still running manually, as a step in problem solving and providing research facilities services including the use and borrowing of research equipment or laboratories at the LIPI Geotechnology Research Center and implementing ISO Certification No:103-059-9-13 from the National Accreditation Committee, required a new research facilities information system design with an integrated database was needed to simplify the process of managing data that can be accessed anytime and anywhere, so that the report needed to be faster, complete, and precise.

Main Problem

Based on the author's observation, there are still data management problems which happen in LIPI Bandung, including:

1. Research facilities management system that is currently running at the LIPI Bandung Geotechnology Research Center is still done manually using paperbase for the various form fields.
2. Management of research facilities data has not been integrated with the database causing difficulty in finding data, prone to redundancies, loss and inconsistency of data.
3. Verification of research facilities submissions are very dependent on the leader who must be there.
4. Preparation of reports on research facilities is still not effective.

Objective Study

The purpose of this research is to analyze, design and build a Research Facilities Information System including data management of research and laboratory equipment at the LIPI Bandung Geotechnology Research Center, as a solution to problems in the existing system, so that the system can be more optimal, and improve the quality of research facility management

Literature Review

1. General Approach

2.2.1 Information System Design

Design is an effort to construct a system, so the requirement specifications can be fulfilled either explicitly or implicit [1]. System Design, is a process of understanding the system then designing a computer-based information system, where the result will be in the form of a computerized system. The purpose of system development is to organize a new information system so that it can overcome various problems that occur in an organization, as well as provide an understanding of a form of system that exists in an organization and management tricks related to computer-based management information systems [2]. Information system is a set of interconnected components whose function is to collect and store data and process it into information that can be used in the decision-making process [3].

2.1.2 Research Facilities

Research Facilities are equipment and materials used to conduct scientific experiments, research, learning practices, testing activities, calibration, and/or production of certain materials.

2. Special Approach

1. Method Oriented object

Object-oriented approach in systems development is seamless transition from the external world to software objects. After identifying the objects, then providing the functionality that the system should provide. The goal of Object Oriented Design is designing the classes which identified during the analysis stage and between user interfaces.

2. *Unified Modeling language* (UML)

UML stands for ***Unified Modeling Language*** which means language modeling standard. UML is applied for a specific purpose, usually for design purposes, among other things device soft, means communication between device soft with process business, describe the system in detail for analysis and find out what is needed system, and document system which there is along processes and the organization [4]. UML consists of:

1. ***Use case,*** describe interaction between system and actor, also can describe type interaction between user with the system [5].
2. ***Activity diagrams,*** is a diagram that is used to describe the process flow of the system as a whole, as well as only the parts of the system process that you want to describe in detail [6].
3. ***Sequences diagrams,*** used to describe interactions between objects in successive time [7].
4. ***Class diagrams,*** is a model that describes the structure and class description and can connect between other classes [8].
5. ***Collaboration diagrams,*** describe interaction between object like *sequences diagrams,* but more emphasize on respective roles object [9].
6. ***Diagram Statechart,*** illustrating transition and change of circumstances (from one *state* to *another)* an object in the system because of stimulation which accepted.
7. ***Component diagrams,*** describe structure and connection between software components, including dependency
8. ***Deployment diagrams*** describe how components are *deployed* with in   system infrastructure, where the components will be located (on machines, *servers,* or what hardware), what are the network capabilities at that location, specification *servers* and stuff other which is physical.

Methodology

The research method used by the author is a qualitative research method, of an invention nature and carried out under natural conditions, with the aim of providing understanding in a manner deeper to something problem which studied. Writer use Collection Techniques Observation Data, Interview and Studies References [10].

In the device development information system, using *Linear Models Sequential* which do approach on development information system in a manner systematic and sequential, which means activities on this model is done sequentially based on process guidance starting from communication to *client* or customer arrives with activities until ordering after the problem is fully understood and running stable until finished. Stages in *linear Sequential* is as following:
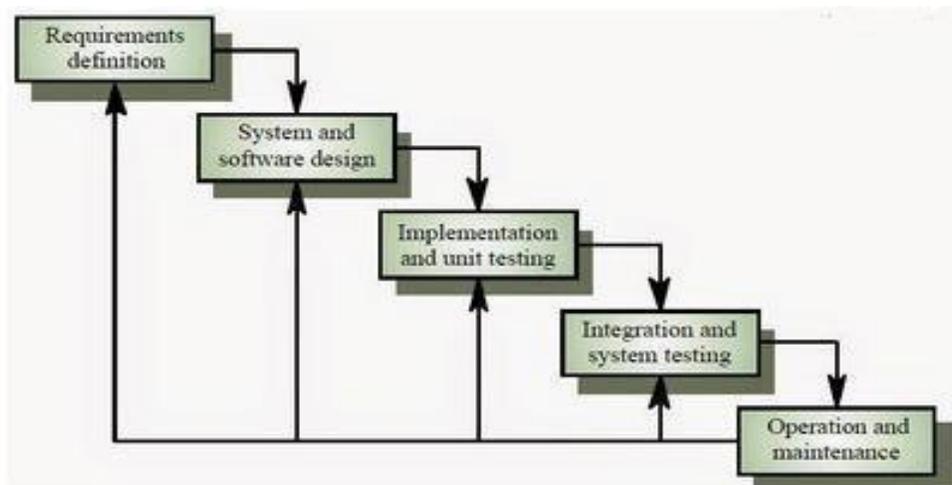

Figure 3.1. *linear Sequential Method* **According to Somerville**

1. *Requirements analysis and definitions:* Collect system requirements in complete, then be analyzed and defined according to the program to be built.
2. *System and software design:* The design is carried out after the requirements have been completely collected.
3. *Implementation and unit testing:* The program design is translated into codes using a predetermined programming language, then the designed program is directly tested.
4. *Integration and system testing:* The unification of program units is then tested as a whole.
5. *Operation and maintenance:* Operate programs in their environment and carry out maintenance, such as adjustments or changes due to adaptation to the actual situation.

Results and Discussions

1. **Analysis System**

Information system analysis of research facilities at the LIPI Bandung Geotechnology Research Center, the authors describe as follows:
1. Carrying out research facilities management activities including use and borrowing of research and/or laboratory equipment is still carried out manually using a paper base for various form fillings.

2. Research Facility Information System at the LIPI Bandung Geotechnology Research Center has been design with characteristics system as follows: The application is built with used *Frameworks Programming* Web covers **HTML 5** *(HyperText markup language 5),* **CSS 3** *(Cascading styles Sheets 3),* **XML** *(Extensible Markup Language),* **Javascript,** **PHP** *(PHP: Hypertext Preprocessor),* **Codeigniter & Bootstrap** and **MySQL** *as database.*

3. *The Management Access level* in the application is divided into 4 levels, with descriptions as following:
    a) ***Super Administrators,*** have authority access all system.
    b) ***Head Facilities Subdivision and General,*** have access to read which message sent by visitors through website.
    c) ***Officers,*** have access to view *user* data information on State Property (BMN), lab data, as well as updating data profile from Officer That Alone
    d) ***Petitioner,*** own right access for make loan, and fill in Form Satisfaction Service Public (FKPP) after tool/ goods finished borrowed.

2. **System Design**

4.2.1 Input Design

Table 4.1 Input Design of Research Facilities Information System

No	Input Name	Function	Attribute
1.	Goods Data	For know data Goods Owned by Country (BMN) or tool study Which there is in Center Study Geotechnology LIPI Bandung	Photo, Code Goods, Name Goods, Specification, and Information
2.	Inventory Data	To know inventory from each respectively goods/ tool	Code Inventory, Name Goods (Code Goods), Information, And Status
3.	Head of Subdivision Data	For know data from Head of Subdivision active	Nip Kasubag, *Password,* Name, Type Sex, Date Born, Address, telephone, *Email, Other contact*, Profile (Photo), and Status
4.	Laboratory Data	For know data the laboratory there is in Center Study Geotechnology LIPI City Bandung	Code, Lab Name, Status, Information, and Photo
5.	Attachment Data	For know data attachment from application certain	No, Application No, Specification, Information, and Files
6.	Service Data	For know data services that are in every laboratory	Code Service, Laboratory (Code labs), Name Service, Information, and Status
7.	LHP data (including Data Details Results Test)	For know data report results service and data details of test results after request/ task finished done	LHP No, Application No, No Details, Type Example, Location, description, and Date Making Details
8.	*Logs book* Data	For know data *logs book* from every application	No *Logs book,* no plea, NIP Officer, Day, Date Fill, Description Activity, O'clock Start, O'clock Finished, Notes
9.	Applicant Data	For know data from Applicant Which registered in *databases*	Applicant ID, KTP, *Password,* Name, institution, Work, Type Sex, Date Born, Address, telephone, *E-mail, Other Contact,* and Profile (Photo)
10.	Assignment Data	For give task to Officer Which There is in laboratory certain	No Task (No Letter Task), No Application, Activity Description, Information, and Date Assignment
11.	Super Administrator Message Data	For send message to Super Administrator	Name Sender, Institution Sender, *E-mail* Sender, Address Sender, Message, Day, Date Message, O'clock Message, NIP Superadmin, and Status

No	Input Name	Function	Attribute
12.	Subdivision Head Message Data	For send message to the Head of Sub Part Means and General	Name Sender, Institution Sender, *E-mail* Sender, Address Sender, Message, Day, Date Message, O'clock Message, NIP Head of sub-division, and Status
13.	Officer Data	For know data from the Officers in *databases*	NIP Officer, Code labs, *passwords,* Name, Title, Gender, Date Born, Address, telephone, *Email, Other contact,* Profile (Photo), and Status
14.	Super Administrator Data	For enter the system as super admin	NIP Super Administrator, Name, *passwords,* Type Sex, Date Born, Address, telephone, *E-mail, Other contact,* Profile (Photo), and Status
15.	Data Loan	To create data loan	No Loan, Inventory Code, ID Petitioner, Officer NIP, Head of Subdivision NIP, Loan Date, Date Must Return, Day Return, Date
16.	Application Data (including FKPP application)	To create data application	No plea, ID Applicant, NIP Head of Sub-Division NIP Officer, Code labs, Financing, Title Activity, Day plea, Date plea, O'clock plea, Day Finished plea, Date Finished Application, Time of Completion of Application, Status, Reason for *Reject,* Value 1, Value 2, Mark 3, Mark 4, Mark 5, Mark 6, Mark 7, Mark 8, and Suggestion

4.2.2 Output Design

Table 4.2 Output Design of Research Facilities Information System

No	Name Output	Function	Attribute
1.	Officer Data Report	As data for give information about researcher which active in Center Study Geotechnology LIPI City Bandung	NIP, Name, Laboratory, telephone, *E-mail,* and Status
2.	Applicant Data Report	As data for give information about applicant which registered in website	ID Applicant, Name, institution, Address, telephone, *E-mail*
3.	Inventory Goods/ Tool Data Report	As data for give information about inventory tool/ goods which there is	No, Code Inventory, Tool Name, Goods Information, and Status
4.	Service Laboratory Data Report	As data for give information regarding service laboratory Which There is	No, Laboratory, Code Service, Name Service, Information, and Status
5.	Loan Report	As data for give information about all data Loan	Borrowing No, Inventory Code, Tool Name, Applicant Name, Officer Name, Loan date, And Status
6.	Loan Report By date	As data for give information regarding data loan by date certain	Borrowing No, Inventory Code, Tool Name, Applicant Name, Officer Name, Loan date, and Status

No	Name Output	Function	Attribute
7.	Loan Report by month	As data for give information regarding data loan per month certain on year certain	Borrowing No, Inventory Code, Tool Name, Applicant Name, Officer Name, Loan date, and Status
8.	Loan Report by year	As data for give information regarding data loan on year certain	Borrowing No, Inventory Code, Tool Name, Applicant Name, Officer Name, Loan date, and Status
9.	Loan Report by petitioner	As data for give information regarding data the borrowing done by each each applicant	Borrowing No, Inventory Code, Tool Name, Applicant Name, Officer Name, Loan date, and Status
10.	Loan Report by Officer	As data for give information regarding data loan per officer	Borrowing No, Inventory Code, Tool Name, Applicant Name, Officer Name, Loan date, And Status
11.	Loan Report by inventory	As data for give information regarding data loan based on tool certain	Borrowing No, Inventory Code, Tool Name, Applicant Name, Officer Name, Loan date, And Status
12.	Application Report	As data for give information about all data application	No plea, Laboratory, Applicant Name, Financing, Status, Date plea, And Title Activity
13.	Application Report By date	As data for give information regarding data application by date certain	No plea, Laboratory, Applicant Name, Financing, Status, Date plea, and Title Activity
14.	Application Report by month	As data for give information regarding data application per month certain on year certain	No plea, Laboratory, Applicant Name, Financing, Status, Date plea, And Title Activity
15.	Application Report by year	As data for give information regarding data application on year certain	No plea, Laboratory, Applicant Name, Financing, Status, Date plea, and Title Activity
16.	Application Report by Petitioner	As data for give information regarding data that application done by each. respectively applicant	No plea, Laboratory, Applicant Name, Financing, Status, Date plea, and Title Activity
17.	Loan Report by laboratory	As data for give information regarding data application laboratory	No plea, Laboratory, Applicant Name, Financing, Status, Date plea, and Title Activity
18.	Form Loan BMN	Print documents recording quality form Form Loan BMN which contains data from *databases*	Request No (Loan No), Name Borrower (Applicant Name), Institution/ Agency/ Field (Institution), Telephone/ HP, Tool Name, No Inventory, Objective loan, Loan date, Loan Note, Name Person responsible (Officer), Name Head of Subdivision, Condition of Equipment After, Notes Return and Date Return
19.	FKPP (Form Satisfaction Service Public) Loan	Print documents recording quality form FKPP (Satisfaction Form Service Public) Which containing data from *databases*	Mark suitability results, mark time Wait service administration, mark ease of getting information, value friendliness service officer, mark smoothness and convenience in service administration, mark accuracy report time, response value to complaint customer, and mark service in a manner whole

No	Name Output	Function	Attribute
20.	Form Service	Print documents recording quality form Service Which containing data from *databases*	No Request (No Application), Name Lab Person in Charge (Officer), Name (Applicant Name), Agency/ Field (Institution Applicant), Address (Address Petitioner), Telephone/ HP (Telephone/ HP Applicant), Activity/ Financing, Type Service (Laboratory), Activity Title, Name Head of Sub-Division NIP Head of Sub-Division ID Applicant, and Application Date
21.	Form Attachment Service	Print documents quality record in the form of Attachment Form Service Which containing data from *databases*	No Request (No application), Name files, Specification, Information, Date plea, Name Person responsible Lab (Officer Name), NIP Officer, Name Petitioner, and ID Applicant
22.	Letter Formats Assignment Service	Print documents recording quality form Format Letter Assignment Services that contain data from *databases*	Letter of Assignment Number, Name of Head of Subdivision, NIP Head of Sub-Division No Request (No application), Name (Officer Name), NIP (Nip Officer), Position (Job Officer), Description (Description Task), Information and Date Making Letter.
23.	*Log* Formats *book* Laboratory	Print documents recording quality form Format *Logs book* Laboratory Which containing data from *databases*	Day/ Date (Day/ Date contents), Person responsible (Officer Name), Financing, Description Activity, Time Start, Time Finished, Notes, And Column Initials
24.	FKPP (Form Quality Service Public) Application	Print documents recording quality form FKPP (Satisfaction Form Service Public) Which containing data from *databases*	Mark suitability results, mark time Wait service administration, mark ease of getting information, value friendliness service officer, mark smoothness and convenience in service administration, mark accuracy report time, response value to complaint customer, And mark service in a manner whole
25.	Form Results Report Service	Print documents recording quality form Form Report Results Services that contain data from *databases*	Received Date (Date Application), Completion Date (Date Finished application), No LHP No Request (No application), Title Activity, Name (Applicant Name), agency (Institution Applicant), Address (Address Applicant), Telephone/ MOBILE PHONE (Applicant), Name Head of Sub-Division NIP Head of Sub-Division No Details Results Test, Type Example, Location, Description and Date Making Details

3. **Functional Design**

Use case Diagram

From analysis system Which writer do, so *use case* system information on research facilities at the LIPI Bandung Geotechnology Research Center can depicted as following:
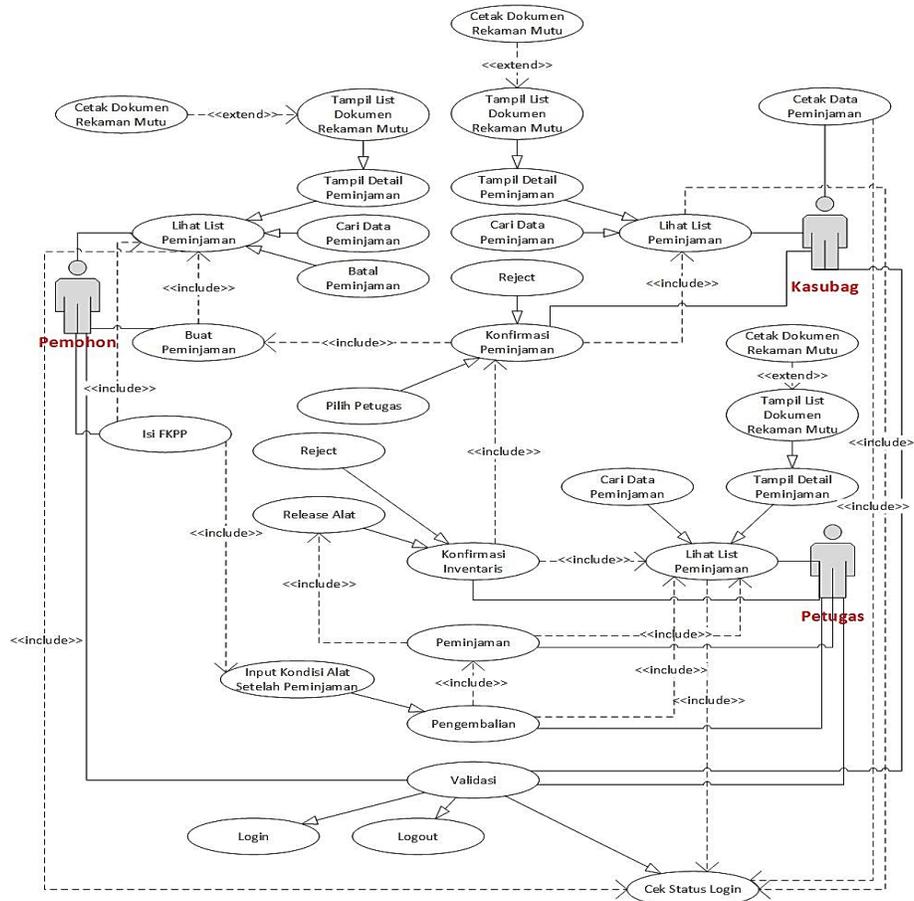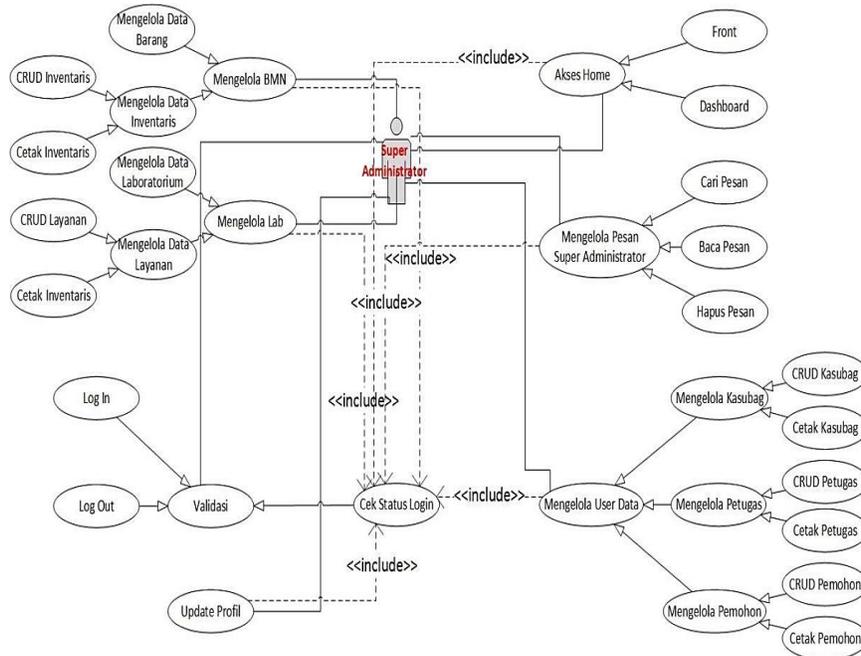
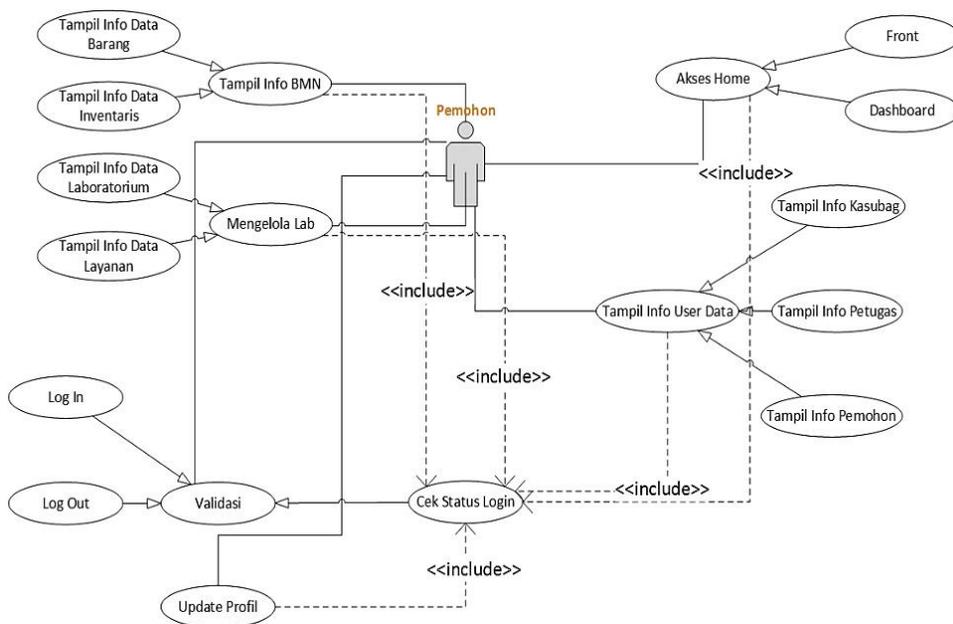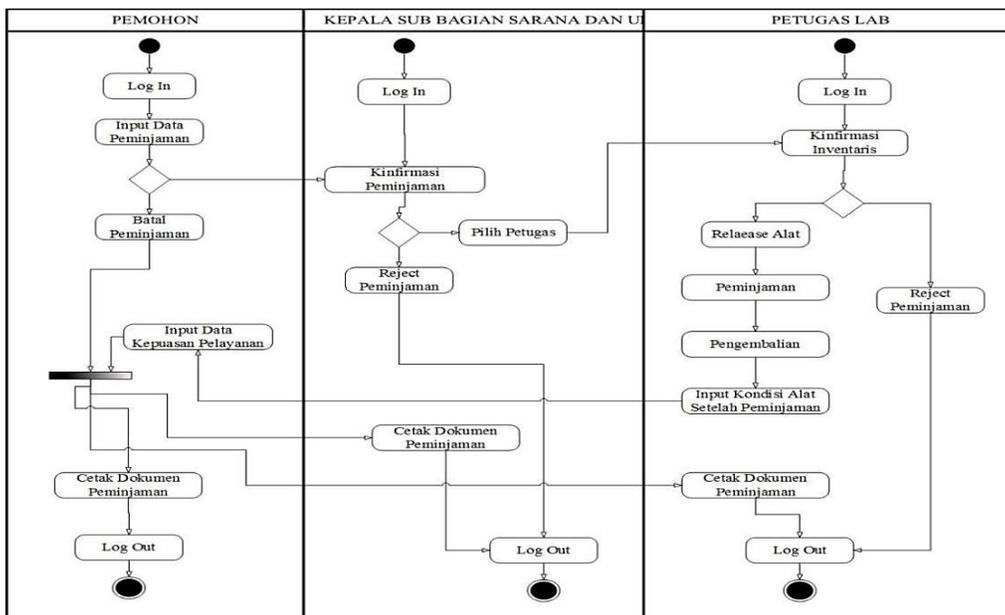**Figure 4.1** *Uses case Diagram* **Loan Research Facilities**

Figure 4.2 *Use case* **Manage** *Charts Master's Data* **By Super Administrator & Petitioner**

B. *Activity Diagram*

Picture 4.3 *Activity Diagram* **Of Research Facilities Information System**
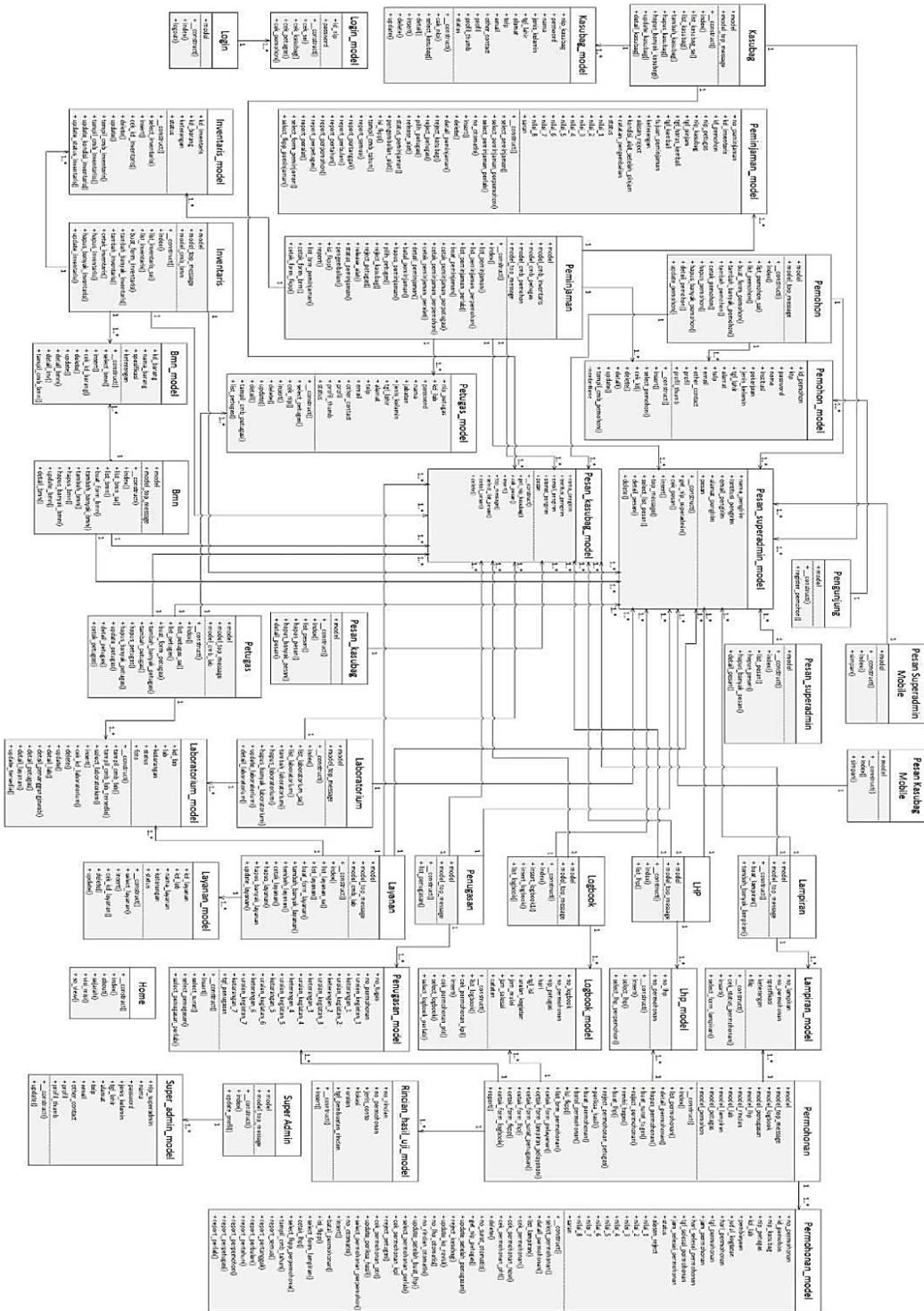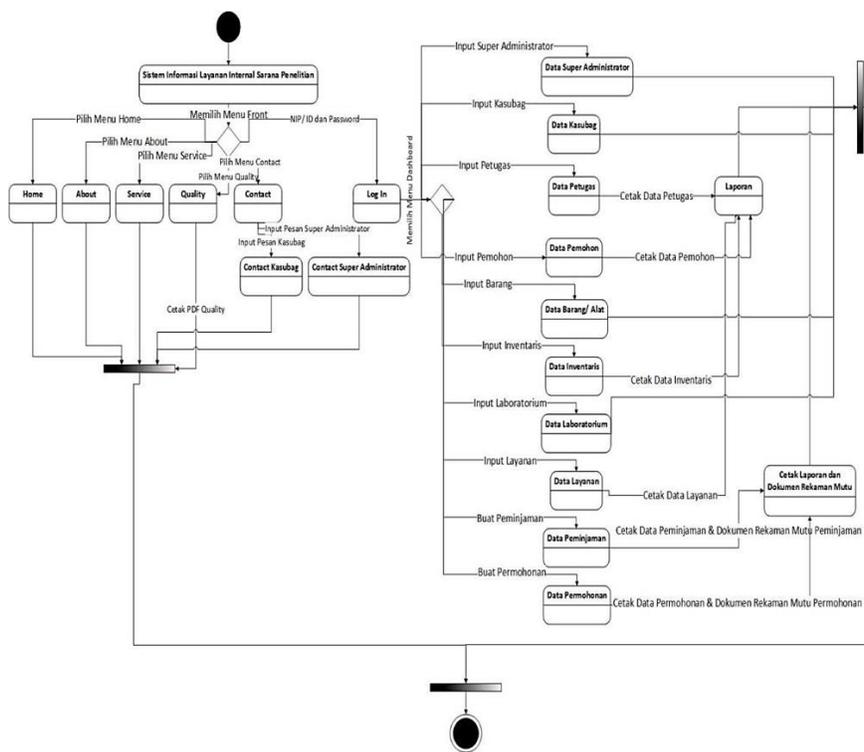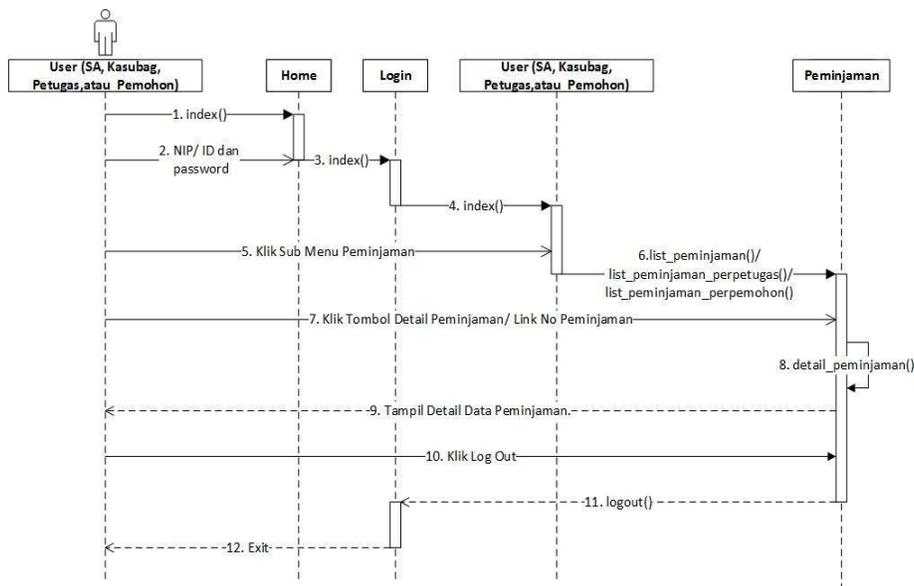
C.   *Class Diagram*

Figure 4.4 *Classes Diagram* **Of Research Facilities Information System**

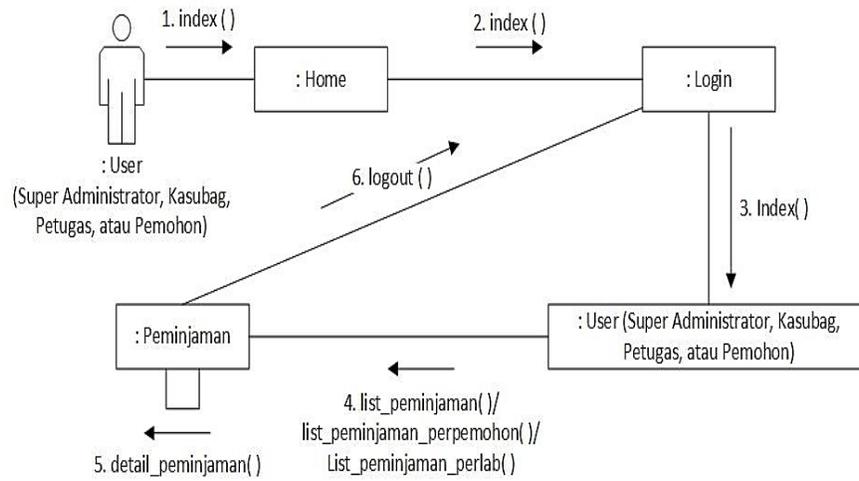**D.** *Statemachine Diagram*

Figure 4.5 *Statemachine Diagram* **Of Research Facilities Information System**
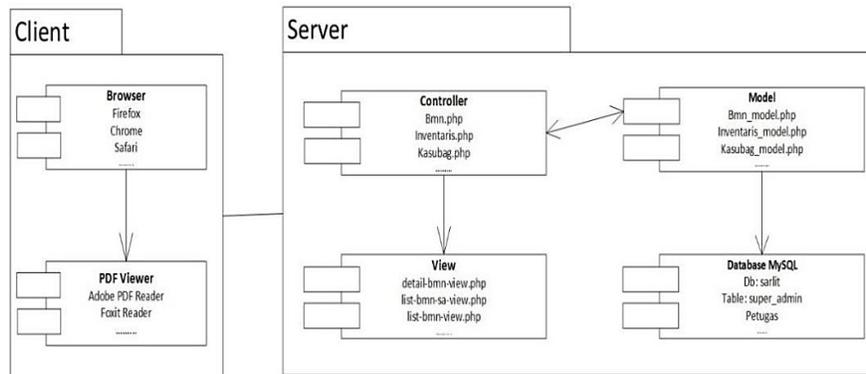
E. *Sequences Diagram*

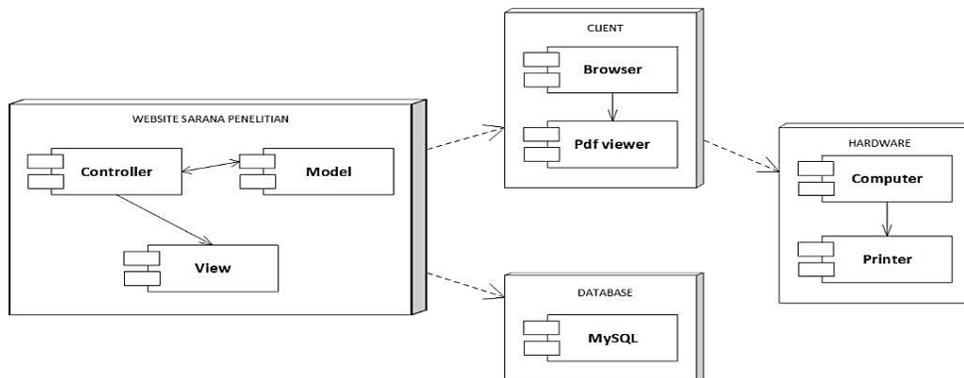**Figure 4.6** *Sequences Diagram* **Details Loan Research Facilities**

F. *Collaboration Diagram*

Figure 4.7 *Collaboration Diagram* **Details Loan Research Facilities**

G. *Components Diagram*

Figure 4.8 *Components Diagram* **Of Research Facilities Information System**

H. *Deployments Diagram*

Figure 4.9 *Deployments Diagram* **Of Research Facilities Information System**

4.2.4 *Interface* Design
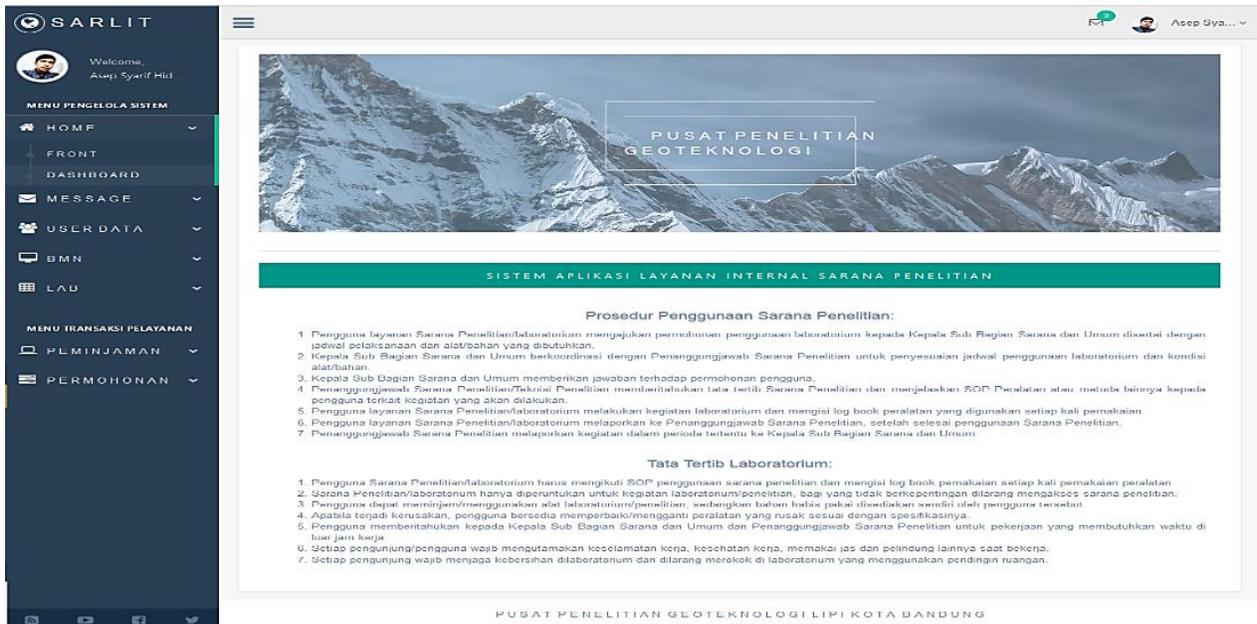
A.   Page *Dashboards*

Figure 4.11 Appearance page *Dashboards*
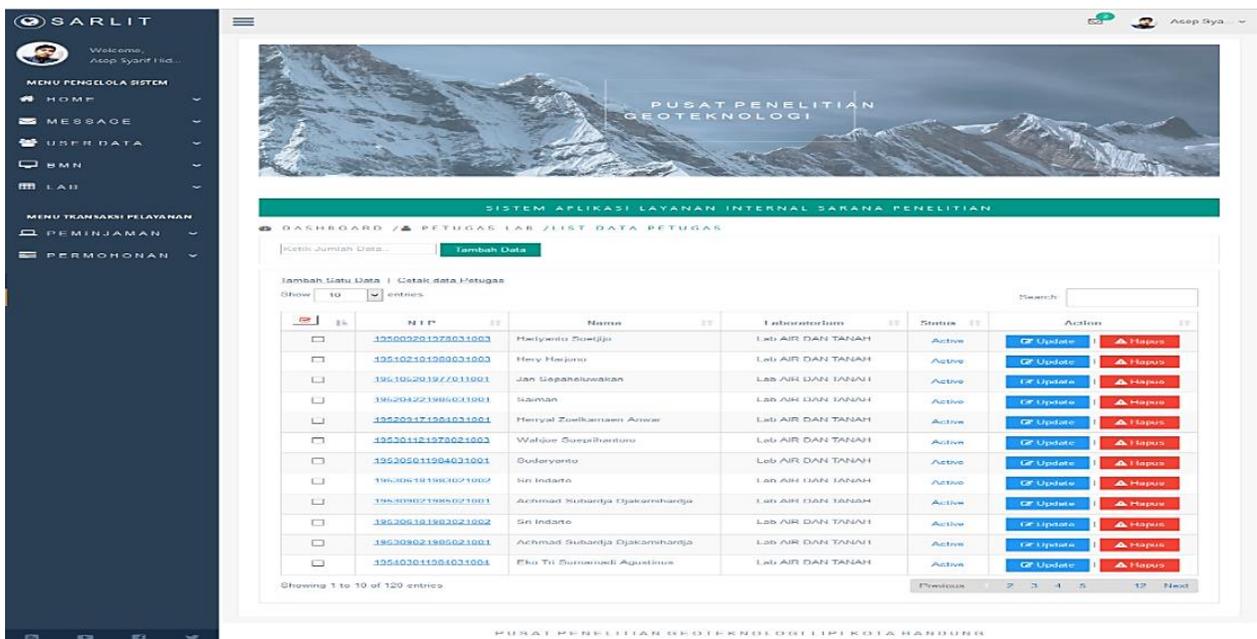
B.   Appearance *List* page Inventory Data

Figure 4.12 Appearance *List* page Inventory Data

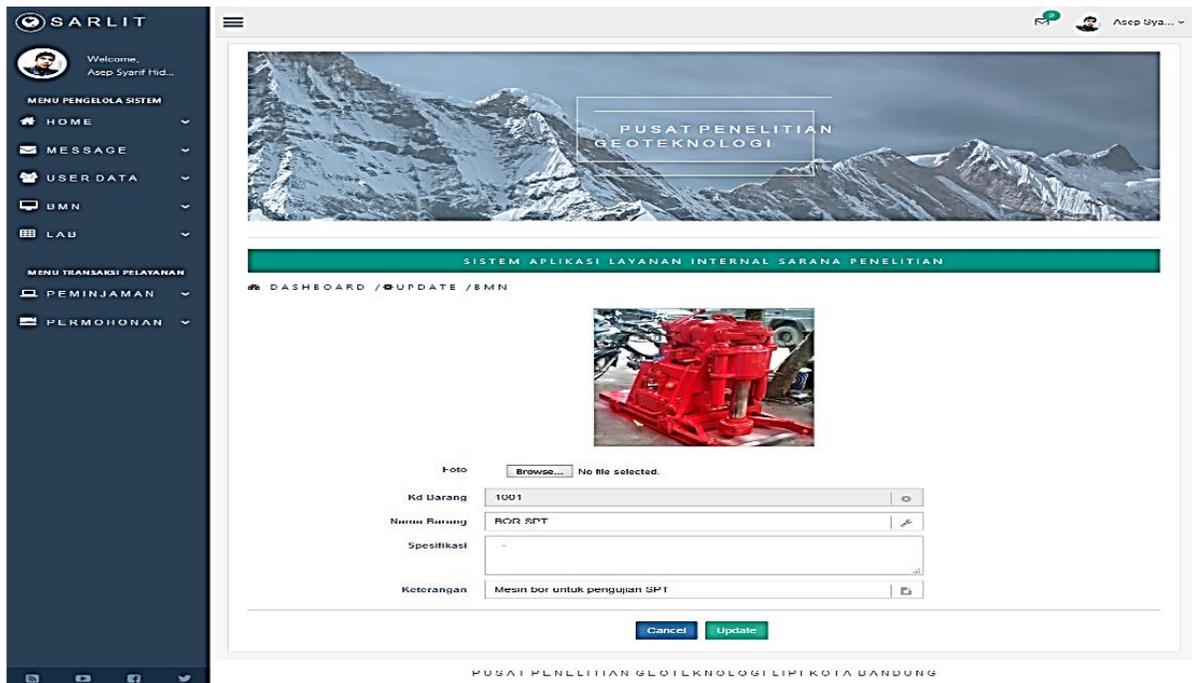**C. Appearance Details Page of Goods Data**

Figure 4.13 Display Details Page of Goods Data
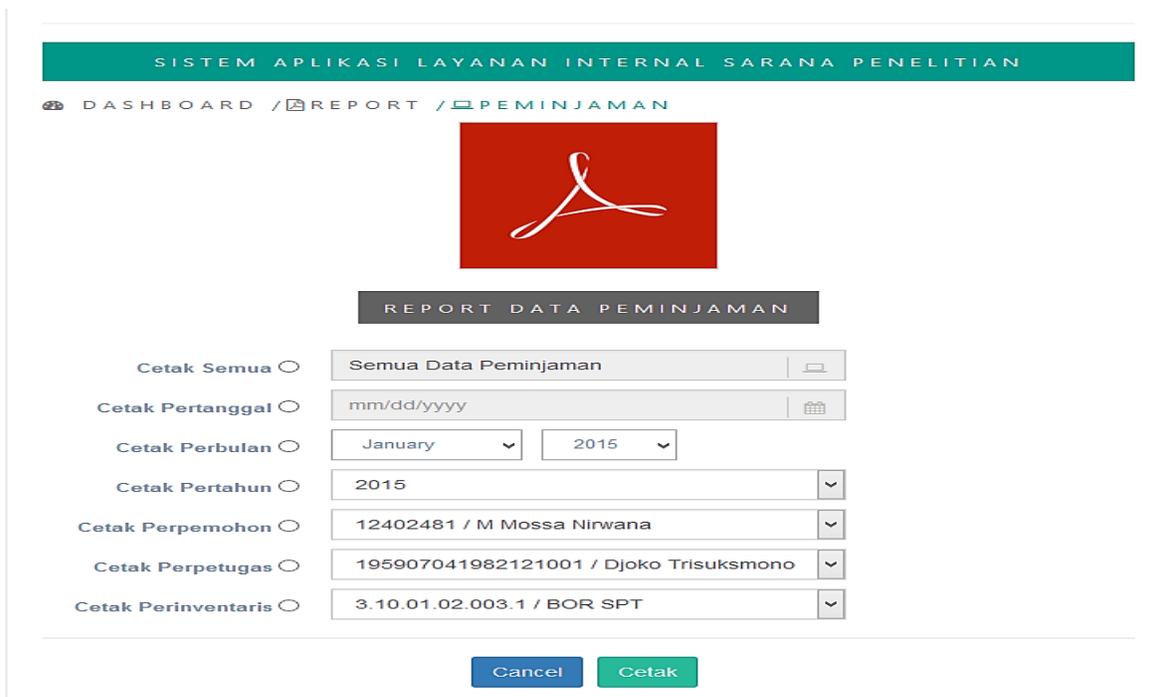
D. Appearance Display Page Loan *Reports*

Figure 4.14 Display Page Loan *Report*

E. **Appearance Loan Report**

				PUSAT PENELITIAN GEOTEKNOLOGI LEMBAGA ILMU PENGETAHUAN INDONESIA Kantor: Komplek LIPI Gd. 70 Jl. Sangkuriang, Bandung, 40135 Telp: (022) 250 3654 Fax: (022) 250 4593 Website: www.geotek.lipi.go.id			IQA CERT KAN LSSM–040–IDN CERT NO : 103–059–9–13	
LIPI				Laporan Data Peminjaman				
No. Dokumen P2G-FR-TU-120		No. Revisi 01		Halaman 1 dari 4			Tanggal Terbit 1 April 2014	

NO	NO PEMINJAMAN	KODE INVENTARIS	NAMA ALAT	NAMA PEMOHON	NAMA PETUGAS	TANGGAL PEMINJAMAN	STATUS	BIAYA
1.	038/IPK-P2G/FP/2016	3.10.01.02.003.8	SEISMOMETER	Erwin Nugraha	Djoko Trisuksmono	07 Juni 2016	Closed >> Isi FKPP	20000000
2.	037/IPK-P2G/FP/2016	3.10.01.02.003.6	HAND AUGER	Ridwan Purnama	Sukaca	07 Juni 2016	Peminjaman	15000000
3.	036/IPK-P2G/FP/2016	3.10.01.02.003.1	BOR SPT	M Mossa Nirwana	Sukaca	07 Juni 2016	Reject	20000000
4.	035/IPK-P2G/FP/2016	3.10.01.02.003.71	KAMERA DIGITAL	Karyr	Sukaca	11 Oktober 2016	Release Alat	10000000
5.	034/IPK-P2G/FP/2016	3.10.01.02.003.1	BOR SPT	Saepul		15 September 2016	Reject	15000000
6.	033/IPK-P2G/FP/2016	3.10.01.02.003.1	BOR SPT	Prigel Apriyanto	Adde Tatang	17 Agustus 2016	Konfirmasi Petugas	10000000
7.	032/IPK-P2G/FP/2016	3.10.01.02.003.4	GPS RECEIVER	M Sani Nugraha		07 Juni 2016	New (ACC KASUBAG)	20000000
8.	031/IPK-P2G/FP/2015	3.10.01.02.003.1	BOR SPT	M Mossa Nirwana	Djoko Trisuksmono	08 Januari 2015	Closed	15000000
9.	030/IPK-P2G/FP/2016	3.10.01.02.003.1	BOR SPT	M Mossa Nirwana	Adde Tatang	04 Oktober 2016	Closed	10000000
10.	029/IPK-P2G/FP/2016	3.10.01.02.003.1	BOR SPT	Hanif	Adde Tatang	04 Oktober 2016	Closed	15000000
11.	028/IPK-P2G/FP/2016	3.10.01.02.003.4	GPS RECEIVER	M Mossa Nirwana	Adde Tatang	03 Oktober 2016	Closed	20000000

PUSAT PENELITIAN GEOTEKNOLOGI LIPI KOTA BANDUNG

Figure 4.15 Appearance Loan Report

Conclusions

Based on the results of the research and identification of problems as well as discussion of the system being analyzed and designed, several conclusions can be drawn as follows:

1. Management of research facilities at the LIPI Geotechnology Research Center in Bandung City still does not utilize information technology, causing the system to run not optimally.
2. The problems encountered in processing lending data for research facilities in the current running system are the length of time the data processing is due because it is not yet integrated with the database, still using paperbase, it is difficult to get information on service availability, the length of the application submission process, the Head of Subdivision has difficulty monitoring the execution of tasks by the officer because the log book data of the Head of Subdivision was not integrated with the officer's log book data.
3. It is necessary to solve this problem built a *web-* based Research Facilities Information System that is integrated *database* so that management data more fast, safe and easy used

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