SYSTEM DESIGN WITH ANDROID AS GROUND WATER MONITORING TOOL (CASE STUDY : GROUNDWATER RESOURCE CENTER AND ENVIRONMENTAL GEOLOGY (PAG) BANDUNG)

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ABSTRACT

Ground water resources is one important source of drinking water in Indonesia. Soil water conservation is an effort to protect and preserve the existence, groundwater conditions and environment in order to maintain the sustainability or continuity in the availability of adequate quantity and quality, for the sake of continuity of functions and public health to meet the needs of living things, both the present and the generations that will datang.Dalam monitoring of groundwater resources groundwater resource Center and Environmental Geology (PAG) with the current system is a tool that is used to transmit data from the sensor devices into the server is RTU (Remote Terminal Unit). RTU is a system that has been marketed by a company. RTU tool included in expensive equipment. Seeing the problems it is dibentuklan an application that could replace the task RTU. Application Monitor wells, which is a system designed to monitor directly in monitoring wells. Apliakasi will show the data of the current water depth and supporting data lainnya.Dengan by combining arduino microcontroller and application on android. With the construction of this system, to make it easy for observers monitoring wells to monitor in accordance with the desired time and anywhere.
Keywords: Well Monitor, Arduino, Altitude Water

1. PRELIMINARY

Centre for Water Resources Soil and Environmental Geology (PAG) is one unit under the Geological Agency of the Ministry of Energy and Mineral Resources. Soil water conservation is an effort to protect and preserve the existence, condition and environment of groundwater in order to maintain the sustainability or sustainability of its availability in quantity and quality sufficient for the continuation of the functions and usefulness to meet the needs of living things, both the present and the future generations. [1]

In the monitoring of groundwater resources Groundwater Resource Center and Environmental Geology (PAG) with the current system is a tool that is used to transmit data from the sensor devices into the server is RTU (Remote Terminal Unit).

Of these problems required a new system application that can monitor in real time and replace the role of RTU to send the data that has been converted into a server. The system works by using arduino microcontroller connected to the sensor and microcontroller arduino will mengkoversi signal transmitted by a sensor in the form of analog signals into digital signals .. In monitoring could also use SMS (Sort Massage Service) to send certain codes, observers can obtain elevation data in real time.

1.1 Arduino

Arduino is an electronic prototyping platform that is opensource hardware is based on hardware and software that is flexible and easy digunakan.Arduino was originally developed in Ivrea , Italy . The platform consists of arduino board arduino , shield , arduino programming language and development environment arduino . Arduino board usually have a basic chip Atmel AVR microcontroller ATmega8 berikutt urunannya . Arduino programming language is a programming language that is commonly used to make the software embedded in arduino board . Arduino programming language similar to C ++ programming language

1.2 Ultrasonic Sensor

Ultrasonic sensor is a sensor that converts physical quantities (sound) into electrical quantities . In this sensor ultrasonic wave generated by an object called piezoelectric . This will produce a piezoelectric ultrasonic waves with a frequency of 40 kHz when an oscillator is applied to the object. Ultrasonic sensors commonly used for such a disclosure does not touch as diverse as distance measuring applications . This tool is generally emits ultrasonic sound waves toward a target behind the reflecting wave towards sensor.Kemudian system measures the time required for transmitting the

waves until it returns to the sensors and calculates the target range by using the speed of sound in the medium . The circuit constituent ultrasonic sensor consists of a transmitter , reiceiver , and a comparator. In addition, the ultrasonic waves generated by a piezoelectric crystal is thin

1.3 RTU

NTN - CS 108 Remote Terminal Unit is a device or system that serves to organize the retrieval of data from multiple parameters support meteorology and climatology digitally that ultimately generate the data in tables and graphs of each of these parameters , the system Full Remote distance far or called telemetry .

1.4 Android

Android is an operating system on mobile phones that is open and based on the Linux operating system . Android can be used by anyone who wants to use it on their devices . Android provides an open platform for developers to create their own applications that will be used for a variety of mobile devices.

1.5 JSON

JavaScript Object Notation (JSON) is a lightweight data interchange format , readable and writable by humans , as well as easily translated and made (generated) by the computer . JSON is a text format that is independent of any programming language because it uses a style that is commonly used by programmers family of C including C , C ++ , C # , Java , JavaScript , Perl , Python etc . Because of these properties , making it ideal as a language exchange JSON - data.

1.6 Eclipse

Eclipse is an IDE (Integrated Development Environment) to develop the software and can be run on all platforms (platform-independent). The following are the properties of Eclipse:

1. Multi-platform: Eclipse target operating system is Microsoft Windows, Linux, Solaris, AIX, HP-UX and Mac OS X.
2. Multi-language: Eclipse was developed with the Java programming language, but Eclipse-based application development support other programming languages, such as C / C ++, Cobol, Python, Perl, PHP, and others.

Multi-role: In addition to being an IDE for application development, Eclipse can be used for activities in the development cycle perangkat.lunak, such as documentation, test software, web development, and so forth.

Eclipse at the moment is one of the favorite IDE due to the free and open source, meaning anyone can view the programming code of the software. In addition, the advantages of Eclipse that makes it popular is its ability to be developed by the user with components called plug-ins.

1.7 PHP

PHP (Hypertext Prepocessor), a programming language widely used for handling the creation and development of a website and can be used in conjunction with HTML. PHP was created by Rasmus Lerdorf first time in 1994. At first PHP stands for "Personal Home Page Tools". Subsequently changed to FI ("Forms Interpreter"). Since version 3.0, the name of the language was changed to "PHP: Hypertext Prepocessor" by the acronym "PHP". PHP version is the latest version of all five. Based on the Netcraft survey in December 1999, more than a million sites use PHP, among which are NASA, Mitsubishi, and RedHat.

PHP is a programming language server-side designed for web development, but also can be used as a common programming languages (wikipedia). PHP was first developed in 1995 by Rasmus Lerdorf, but is now managed by The PHP Group. The official website is located at http://www.php.net PHP. At first PHP stands for Personal Home Page, but for the development of PHP is not only used to create personal web pages, PHP is now an abbreviation of PHP: Hypertext Preprocessor, an extension recursive, which is a word game which stands for lists also stands for itself.

1.8 HTML

HyperText Markup Language (HTML) is a markup language used to create a web page, displaying a variety of information in an Internet web browser and a simple formatting hypertext written in ASCII format file in order to produce a display form that terintegerasi. In other words, a file created in a word processing software and stored in a normal ASCII format so that a web page with HTML commands. Starting from a previously widely used language in the world of publishing and printing called SGML (Standard Generalized Markup Language), HTML is a standard that is widely used to display web pages. HTML is now an Internet standard defined and controlled use by the World Wide Web Consortium (W3C). HTML created by TIM Caillau collaboration with Berners-Lee Robert when they are working at CERN in 1989 (CERN is the high-energy physics research institute in Geneva).

HTML documents are similar to regular paper document, only in this document is an article can contain instructions that are marked with the code or better known as the particular TAG. For example if you want to make writing appear become thick like: Appear THICK, then the writing is done by: <b> Appear THICK </ b>. The <b> is used to activate the bold print instruction, followed by the text you want bold, and ends with a </ b> to disable the bold print.

1.9 Web Service

Web service is the application of a set of data (databases) , software (software) or a piece of software that can be accessed remotely by various devices with a particular intermediary . In general , the web service can be identified by using a URL such as only the web in general . But what distinguishes web service with the web in general is the interaction provided by the web service . In contrast with the URL of the web in general , the URL of the web service just menggandung collection of information , commands , configuration or syntax that is useful to build a certain functions of the application [4].

Web services can be interpreted also a method to exchange data, regardless of where sebuahdatabase implanted , created in what language an application that consume the data , and on a platform of what the data is consumed . Web service capable of supporting interoperability . So that the web service is able to be a bridge between the various existing systems .

1.10 MYSQL

MySQL is a software SQL database management system (English: a database management system) or DBMSyangmultithread, multi-user, with about 6 million installations worldwide. MySQL MySQL ABmembuat available as software gratisdibawah lisensiGNUGeneral Public License (GPL), but they also sell under a commercial license for cases where use is incompatible with penggunaanGPL.

The reliability of a database system (DBMS) can be known of the workings of its optimizer to process SQL commands created by the user or application programs that use it. As a servant database, MySQL database operations support transactional and non-transactional database operations. In the non-transactional mode of operation, MySQL can be said to be superior in terms of performance compared to software database servant competitors. But in non-transactional mode there is no guarantee on the reliability of the stored data, therefore non-transactional mode is only suitable for the types of applications that do not require the reliability of data such as web-based blogging application, CMS, and the like. For system requirements are aimed at businesses are strongly advised to use a transactional database mode, it's just that as a consequence the performance of MySQL in transactional mode is not as fast as the performance of the non-transactional mode [5].

1.11 Java Script

JavaScript is a scripting language that is popular on the internet and can work in most popular web browsers such as Internet Explorer (IE), Mozilla Firefox, Netscape and Opera. JavaScript code can be inserted into a web page using the tag SCRIPT.JavaScript is the language (programming) a great, difficult and less understood in the field of computer programming languages. However, the core capabilities possessed by JavaScript to create applications that make use of a change of perspective on the Internet this decade. One good example of such application is Google Maps [7]. Excellence JavaScript, which is also known as ECMAScript, present on all web browsers, so having the ability to produce the same output on all platforms supported by the browser. As already mentioned above, Google Maps, which can run on Linux, Windows and Mac OS. With the growth of the library (library) javascript recently, which makes it easy to navigate a document, select DOM elements, create animations, handle events, and develop Ajax applications. Another well different technologies driven by commercial interests, JavaScript truly cross-platform technology, client-side programming language which is free (and free to be modified of course) and universally adopted.

1.12 Data

Conceptually, the data is a description of things, events, activities and transactions, which have no meaning or no direct impact to the user. Data is often referred to as a raw material information.

Here is an excerpt sense data from different viewpoints:

1. According to the English-Indonesian dictionary, data is interpreted as a term derived from the word "datum" means facts or informative materials.
2. From a business standpoint, there is a sense of business data as follows: "the Business Data is an organization's description of things (resources) and events (transactions) that it faces". So the data, in this case referred to as business data, a description of the organization about something (resource) and events (transactions) that occur.
3. According Jogiyanto, the data is the plural of datum (the fact) that the form of facts, figures, pictures can be drawn conclusions.

4. Gordon B. Davis in his book Management Informations System: Conceptual Foundations, Structure, and Development called the data as a raw material of the information, which is defined as a group of symbols that indicate the number is not random or action or other things.

Of the four above understanding, it can be concluded that the data is the raw material information, defined as an organized group of symbols that represent quantities, actions, objects, and so on. Data formed from characters, can be either alphabet, numbers, and special symbols like *, $, and /. Data compiled for processing in the form of data structure, file structure, and data bases [11].

1.13 Information

Information is data that has been processed into a form that has meaning for the recipient and may be a fact, a useful value . So there is a process of transforming data into an information (input - process - output) .

common definition for information in the information system according to Jogiyanto H.M (1990; 11): "Information is a form of data that can be processed more useful and meaningful for those who receive". According to Robert G. MUNIK (1973; 12): "Information is data that has been processed into a form that is meaningful to the recipient and useful in decision making at this time or mendatang.Berikut understanding of information from various sources:

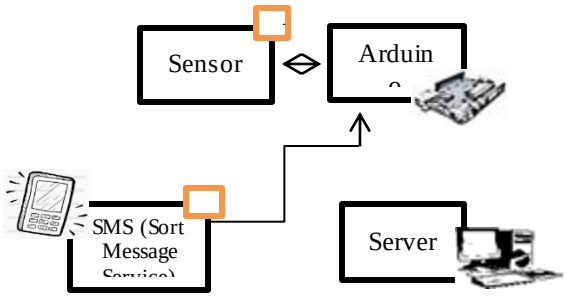
1. According to Gordon B. Davis in his book "Management Informations System: Conceptual Foundations, Structures and Development, called the information as data that has been processed into a form that is useful for the recipient and real, a value that can be understood in the present and future decisions.
2. According to Berry E. Cushing in his book "Accounting Information System and Business Organization" said that information is something that shows the results of data processing which is organized and useful to the person who receives it.
3. According to Robert N. Anthony and John Dearden in his book "Managemet Control Systems", calling the information as a matter of fact, data, item, yangmenambah knowledge for its users.
4. According to Stephan A. Moscove and Mark G. Simkin dalambukunya "Accounting Information Systems: Concepts and Practices" says the information as fact or useful forms that can be used for business decision-making.

Of the four sense as mentioned above it can be concluded that the information on the results of data processing menjadibentuk more useful for those who accept that describes a real events and can be used as a tool for making a decision.

2. RESEARCH CONTENTS

2.1 Analysis of the current system

System architecture that runs is the system that is currently used in PAG . Here is a system that is running Explanation



Picture 2. 1 Analysis of the current system

Stages groove running system is as follows:

1. The sensor will read water level monitoring wells and issuing an analog signal.
2. RTU equipment will capture and convert analog signals into digital signals and process them to be sent into the server.
3. Data transmission is done on a regular basis which is 3 times a day during the hours tertemtu that have been set.
4. Data will be stored in the server.
5. Supervisors who are far away from the location of the monitoring wells can send SMS (Sort Massage Service) with a specific code to control the RTU.
6. Officers berugas to monitor the monitoring wells are officers of the Ministry of Energy and Mineral Resources from the Central Ground Water Resources and Environmental Geology.
7. The clerk in the office can check the state of existing monitoring wells on the server that continuously monitor monitoring wells.
8. 2 of The clerk on duty to check every day either via sms or through the server.
9. Officers will be reporting each month to see the state of water in monitoring wells.
10. Each monitoring wells will produce a report and would submit their reports within a single unit and these reports will be combined into a single report.

2.2 Analysis of system built architecture

Physical architecture consists of a system built application components fronted and backend applications . Applications fronted a user interface with monitoring application monitoring wells were applied to Android . Application is a web service backend (backend) that provides service - service to the frontend application as well as a media liaison input data from the application process fronted into the database .

2.2.1 Arduino and Sensor

Ultrasonic sensor is a sensor that can read the waves. The working principle of a sensor module that detects objects ultasonik by sending waves pantulam ultasonik and then receive the wave. Sendor ultasonik will only transmit ultrasonic waves when there is a voltage (pulse) trigger pulses from the microcontroller that is equal to high for 10 microseconds / µS. Ultrasonic waves with a frequency of 40 KHz to be emitted during 200µS. These waves will propagate in the air at a speed of 344 424 m / sec (or 1 cm each 29.034µS), on the object for later reflected back to the sensor.

While waiting for a bounce, ultasonik sensor will generate a pulse. These pulses will stop (low) when the reflected wave terdekteksi by the sensor. Therefore, the pulse width can be presented to the distance between the sensor with the object. Furthermore, the microcontroller enough to measure the pulse width danmengkonversinya in the form of beer was calculated as follows:

distance = (width /29.034µS) / 2 (cm)

or

distance = (width x 0.034442) / 2 (cm)

Pin configuration that existed at arduino used can be seen in the table below:

Table 2. 1 Configuration Pin

NO	Pin	Informantion
1	D0	Rx Arduino
2	D1	Tx Arduino
3	D2	Rx GSM Shiled
4	D3	Tx GSM Shiled
5	D10	Trigger Ultrasonik
6	D11	Echo Ultrasonik
7	D12	LED Kuning
8	D13	LED Hijau

2.2.2 Analysis of android

In fronted applications which display the user interface on the monitoring application monitoring wells where the user should the monitoring wells PAG monitors Bandung. With this application will be able to monitor the officer monitoring wells faster and more automated. The application will also display the water level was statistically easier to see water levels. In android connects with the database data used web services technology. Web service is also a connecting line between the microcontroller with Webservice android app is divided in three components:

1. Simple Object Access Protocol (SOAP), which is responsible for pertukuran protocol information in a distributed network environment.
2. Web Service Definition Language (WSDL), standard documents that are written in XML format, and the presence mendifinikasan web service in a network.
3. Universal description, Discovery and Inttegration (UDDI), which is a directory location that beriskan service (service) and are free platform (platform independent), written based on XML.

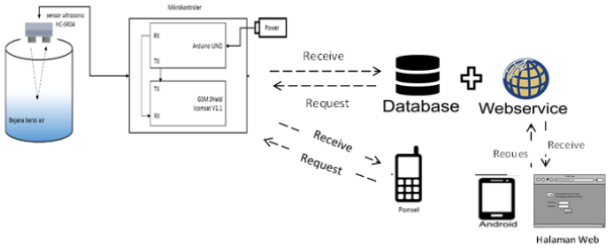
In the construction of SOAP-based web service with JSON-based data exchange, web development service built into 2 parts webservice for android devices and web services for perangakat arduino, the web service will be connected on a single database. It also acts as a webservice datayaitu communication data will be taken by the arduino and android devices and then mereturn or return back to the device with JSON format.

2.2.3 Analysis of backend

Backend application serves as a liaison between the frontend application with the database server. On the backend application , there are three parts : web administrator , webservice and database server . Web administrator functions to process data that is operated by admin . Database server is used to store data - data that has been processed . Management of the data used in this application is MySQL . User backend application (web) is a special officer . In this admin backend application process a variety of data that is data of water levels , the data sms , and processing the data user .

2.2.4 Analysis of system

The overall architecture can be seen in the figure below

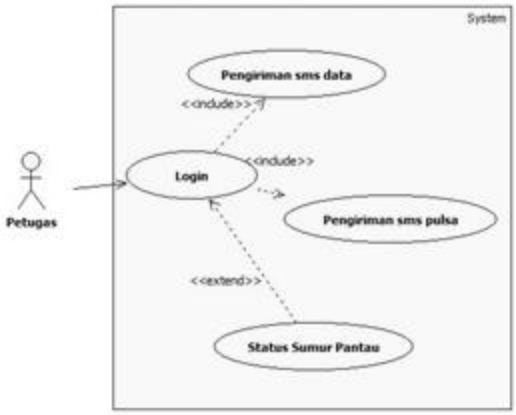


Picture 2. 2 Over all system

2.3 Analysis Functional requirement

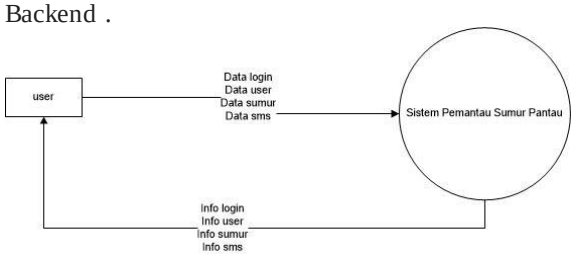
Analysis of functional requirements describe the process frontend activities that will be implemented in the system and explain the necessary requirements for the system to learn well and in accordance with the needs of the system. Analysis conducted modeled using UML (Unified Modeling Language) . Here is the Use Case Diagram for android apps

.



Picture 2. 3 Use Case Diagram

Here is a context diagram for the application Backend .



Picture 2. 4 Diagram Konteks

2.4 System Planning

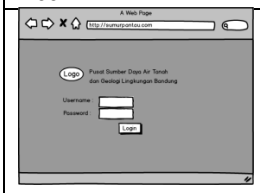
The design phase of the development of this software includes the design and pengambaran which includes several elements present. The design created a design of the interface . Here is a android design to be built .

Table 2. 2 System Planning

T001	
	a. Click the text field "username " to enter a username b. Click the text field "password " for the password c. Click the login button to login and go to the main page and enter the interface T002
Screen size following the resolution of the device Font : Arial Background Theme of JqueryMobile	

Here is the backend design to be built .

Table 2. 3 System Backend

T001	
	a. Enter your username and password. b. Click login to continue the program and enter into the home (T002)
Screen size following the resolution of the device Font : Arial Background Theme of JqueryMobile Halaman webpage	

2.5 System Impementation

2.5.1 Implementation Hardware

The hardware used to implement the system can be seen in the table below .

Table 2. 4 Implementation hardware

No	Hardware	Spesification
1	Prosessor	AMD APU 8
2	Memory	Memory DDR3 4 GB
3	Hardisk	Minimum 160 GB
4	Mikrokontroler	Arduino Uno R3
5	Sensor	Sensor Ultrasonik HY-SRF05
6	GSM Shield	GSM Shield

2.5.2 Implementation Software

The software used to implement the system can be seen in the table below

Table 2. 5 Implementation Software

No	Perangkat Lunak	Spesification
1	Operating System	Windows 7
2	Web service	Notepad ++
3	Arduino	Arduino
4	Database	Php MyAdmin
5	Android	Eclipse Juno

2.6 System examinataion

2.6.1 System examination of Arduino

Application testing scenarios can be seen in the table below.

Table 2. 6 Testing Scenario Arduino

No	Test Class	Test Item	Type Testing
1	Sms Data	Receive sms data	[√] succeed [ ] unsucceed
		Sending data is already taken	[√] succeed [ ] unsucceed
2	Sms Pulse	Receive sms pulse	[√] succeed [ ] unsucceed
		Sending data is already taken	[√] succeed [ ] unsucceed
3	Sends data to the server	Sends data to the server	[√] succeed [ ] unsucceed

2.6.2 System examintation of Android

Application testing scenarios can be seen in the table below.

Table 2. 7 System Testing of Android

No	Test Class	Test Item	Type Testing
1	Login	Requirements for entry into the system	[√] succeed [ ] unsucceed
2	SMS Data	Sms sending the data to ascertain the depth of the well	[√] succeed [ ] unsucceed
3	SMS Pulse	Sms sending pulses to see the pulse on the appliance	[√] succeed [ ] unsucceed
4	Well Status Monitor	Showing charts every day	[√]succeed [ ] unsucceed

2.6.3 System examination of Backend

Application testing scenarios can be seen in the table below.

Table 2. 8 Testing Scenario Backend

No	Test Class	Test Item	Type Testing
1	Login	Requirements for entry into the system	[√] succeed [ ] unsucceed
		change the password	[√] succeed [ ] unsucceed
		change the question	[√] succeed [ ] unsucceed
2	Data management officer	Adding the data admin	[√] succeed [ ] unsucceed
		Deleting data admin	
		Changing the data admin	[√] succeed [ ] unsucceed
3	Well Data	Displays station data overall	[√] succeed [ ] unsucceed
4	Data SMS	Displays sms data overall	[√] succeed [ ] unsucceed

3 Conclusion

Based on the results obtained from studies conducted in the preparation of the final project refers to the purpose of research, it can be concluded .

1. The tool is built to replace the RTU in the monitoring of the depth of water in monitoring wells under the supervision of PAG Bandung .
2. Applications built can help in monitoring the daily monitoring wells.

DAFTAR PUSTAKA

[1] Sejarah Sumber Daya Air Tanah dan Geologi Lingkungan.http://pag.bgl.esdm.go.id/?q=content/sejarah-pusat-sumber-daya-air-tanah-dan-geologi-lingkungan(Diakses pada tanggal 30 agustus 2015)

[2] Khadir, Abdul. 2013. Panduan Praktis Mempelajari Aplikasi Mikrokontroler dan Pemrogramannya Menggunakan Arduino. Andi Publisher, Yogyakarta.

[3] U. M. Arief, "Pengujian Sensor Ultrasonik PING untuk Pengukuran Level Ketinggian," *Elektrikal Enjiniring*, p. 73, 2011.

[4] Sutanta, Edhy. (2013). *Sistem Basis Data*, Graha Ilmu Yogyakarta, Yogyakarta.

[5] Wibisono, Gunawan dan Gunadi Dwi Hantoro.(2008) *Mobile BroadBand*, Informatika.

[6] Safaat H.,M.T, Nazruddin.(2013). *Aplikasi Berbasis Android*, Informatika.

[7] http://cordova.apache.org/diakses pada tanggal 22September 2015 pukul 20.00 WIB.

[8] www.ijimt.org/papers/354-D10307.pdfdiakses pada tanggal 24 September 2015 pukul 21.00 WIB.

[9] Komputer, Wahana. (2014). *Membuat Sendiri Aplikasi Web Mobile Menggunakan jQuery Mobile*, Andi Publisher, Indonesia.

[10] Komputer, Wahana. (2012). *Berlajar Javascript Menggunakan JQuery*, Andi Publisher, Indonesia.

[11] Kadir, Abdul. (2009). *Mudah Menjadi Programmer PHP*, Andi Publisher, Indonesia.

[12] www.sersc.org/journals/IJSH/vol7_no4_2013/20.pdfdiakses pada tanggal 24 September 2015 pukul 21.00 WIB.