PROTOTYPE MONITORING AND TRACKING DUMPTRUCK SYSTEM BASED ON IOT (INTERNET OF THINGS) IN BADAN PENGELOLAAN PAJAK DAERAH KUNINGAN

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ABSTRACT

The purpose of this study is to help facilitate the activities of sand tax recording activities at the Badan Pengelolaan Pajak Daerah Kuningan (Bappenda Kuningan) by implementing IOT (Internet of Things) technology to monitor the activities of sand tax recording activities in realtime for the Bappenda Kuningan. In this research, sand tax monitoring is carried out using a NodeMCU microcontroller, BLE (Bluetooth Low Energy) sensor and GPS Antenna Module placed in a dumptruck car carrying sand with conditions passing through the Raspberry Pi as a monitoring device placed at the registrar's desk and which will receive and sending data to the website in realtime. In addition, the system can generate sand tax report data on a daily basis. Weaknesses in the system built are sending data longitude and latitude still have a long time delay. This is because the GPS Module used is not good. In general, based on the results of performance and functionality testing in this study, the system that was built was successful in collecting sand tax data using the BLE (Bluetooth Low Energy) sensor and can assist the Kuningan Bappenda office in monitoring sand tax activity activities and can report tax data daily on a daily basis. realtime through the website that was created.
Keyword : *Sistem Monitoring , Tracking , Bluetooth Low Energy , GPS , Internet of Things*

1. PRELIMINARY

Badan Pengelolaan Pajak Daerah Kuningan (Bappenda Kuningan) which is engaged to manage taxation in the Kuningan region of West Java specifically its sand tax section. Every day officers from the Bappenda Kuningan office are tasked with recording every truck that carries sand from the mining site to a particular company. The holding of this recording program is to optimize and accelerate tax collection and ensure legal certainty in the implementation of MBLB tax collection..

Based on the results of an interview with Mr. Nono Sumartono as head of sub division. Field of Analysis and Determination that all sand extraction activities still use the method of recording on form paper issued by the Data Collection Section. This resulted in the length of the process in taking form paper because the distance between the department and the recording location was 13 km by the registrar to the Data Collection Section.

Another problem obtained from the interview is that there has been an error in recording activities that have occurred almost every day or in a month there was a recording error. This results in a lot of invalid data because the recording still uses paper form and it is known that the officer has difficulty due to conditions at the recording location where the officer has to record the sand dumptruck from each different company when passing through the recording post which can be a mistake when recording.

In addition, it is also known from the results of the interview that the head of the department wants officers to report the recording data directly on a daily basis, but the officer cannot report the recording data directly because the recording data must also be recapitulated by the officer before reporting the data to the head of department. This results in the recording officer must be able to more quickly recap and report the recording data that already exists.

From the problems that occur, the writer wants to help solve the existing problems and the author intends to build a prototype system based on the Internet of Things (IOT) which can help facilitate the Bappenda Kuningan office in recording and reporting sand truck data more effectively and can send it to the server as a realtime so that the head of the office or head of the Bappenda Kuningan office can see the data directly through the website that will be created in the form of a final project entitled "Prototype Monitoring and Tracking System Based on IOT (Internet of Things) at the Kuningan Regional Tax Management Agency".

2. BASIS THEORY

2.1 Internet of Things

Internet of Things is all activities that the actors interact with and do using the internet.[1].

The Internet of Things makes things easier, in the field of education IoT is very necessary to carry out all activities using the system and orderly and filing systems that are right.

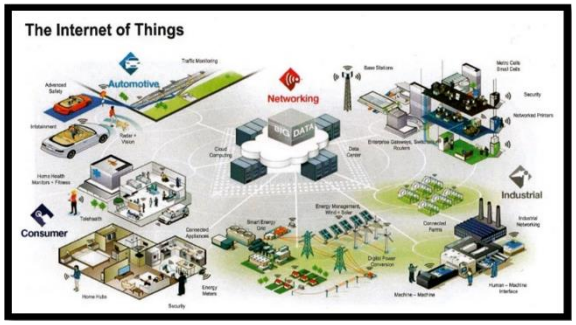

Figure 1. Internet of Things

2.2 Monitoring System

Monitoring system is a process for collecting data from various sources. Usually the data collected is real-time data [2]. Broadly speaking, the stages in a monitoring system are divided into 3 processes:

1. Process in collecting monitoring data.
2. Process in monitoring data analysis.
3. The process of displaying data monitoring results.

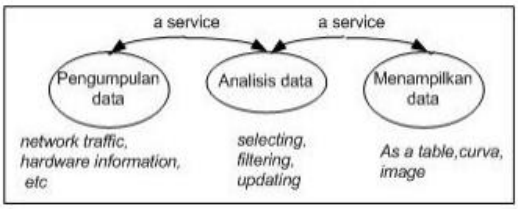

Figure 2. Monitoring System

The technique used in data collection is descriptive research, the data collection method used in this research is to use the interview method, literature study and observation[3].

2.3 Tracking

Tracking literally means following the path, or in the sense of being free is an activity to follow in the footsteps of an object[4].

Tracking in this case is an activity to monitor the presence of a vehicle based on the position obtained from the equipment or vehicle.

2.4 Dumptruck

A dumptruck is a truck whose contents can be emptied. Dumptruck is commonly used to transport goods such as sand, gravel and soil for construction purposes [5].

In general, the dumptruck is equipped with an open body that is operated with assistance such as hydraulics, the front of the tub can be lifted up so as to allow the transported sand to sag down to where desired. The following is an example of a dumptruck figure operating at a sand collection location:

Figure 3. Dumptruck

2.4 NodeMcu

NodeMCU is an electronic board based on ESP8266 chip with the ability to run microcontroller functions and also an internet connection (WiFi). There are a number of I / O pins so they can be developed into a monitoring and controlling application on the IoT project.

The physical form of the NodeMCU ESP 8266, there is a USB port (mini USB) so that it will facilitate the programming [6].

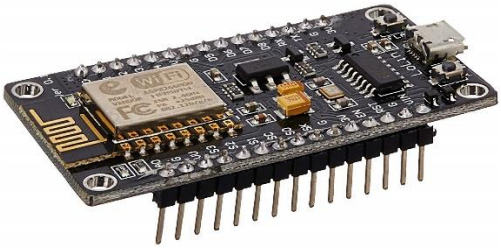

Figure 4. NodeMcu

2.5 BLE (Bluetooth Low Energy)

Bluetooth Low Energy (BLE) works by using radio signals with GFSK modulation on the 2.4 GHz frequency band. Bluetooth Low Energy (BLE) works with 2 MHz wide channels using the principle of Frequency Hopping Spread Spectrum (FHSS)[7].

Bluetooth Low Energy has several advantages compared to other technologies, such as communication that is not affected by solid objects such as walls, fast communication, wide signal coverage, low power consumption, and relatively inexpensive.

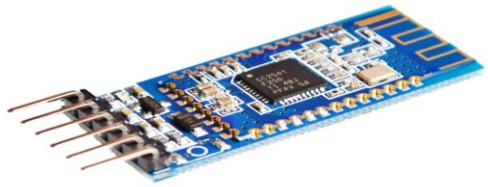

Figure 5. Module BLE

2.6 Module GPS

Global Positioning System is a satellite-based radio navigation system. GPS receivers use satellite signals to triangulate the position to be determined by measuring the length of time the signal is sent by the satellite[8].

Figure 6. Module GPS Antenna

2.7 Arduino

Arduino is an electronic platform that is open source and easy to use. This is shown so that anyone can make interactive projects easily and interestingly [9]

2.8 Raspberry

Raspberry is a fruit figure that looks like a grape and red has become one of the latest electronic product brands that is somewhat innovative. Accompanied by one of the highly poisonous "snake" figures, Python, the name is Raspberry Pi (Pi = Python). Then why Python? Because Raspberry Pi uses Python as its official programming language. Of course it is also possible to use other languages to program RasPi (a familiar call for Raspberry Pi) as needed[10].

3. The Design Of The System

3.1 Communication

Communication is the stage where the problems are explained in detail and data collection is carried out to support the development of a prototype monitoring system and dumptruck tracking.

3.1.1 System Analysis

The current system procedure is a system figure that has been implemented by the Kuningan Bappenda office to be able to analyze the workings of the system that has been implemented so that problems can be identified.

The procedures of the system analysis that runs consists of:

1. Sand Monitoring Procedure
2. Sand Recording Procedure
3. Sand Reporting Procedure
4. Procedure of Grabbing Permit

3.1.2 Non Fungsional Analysis

Non-functional analysis aims to analyze the requirements or specifications needed to build a system.

3.1.3 Client Hardware Analysis

Based on interviews with the Data Collection Section, the computer specifications used by the office. The following are the client hardware specifications used by the Bappenda Kuningan office:

Table 1. Client Computer Specifications

Hardware	Details
Processor	Core i-5
RAM	4 GB
Harddisk	500 GB
VGA	On-Board

3.1.4 Analysis of User Needs

Analysis of user needs is to find out who the user can access the system along with the access rights and their level of expertise. Here is an analysis of users who can access the system:

Table 2. User Requirements Table

No	User	Description	experience
1	Officer	People who enter data trucks that are just operating, monitoring dumptruck data and reporting	Able to master the computer and input the required data
2	Head of Division	People who receive report data	Able to master computers and understand report data

			in the form of tables and charts
3	The Company	People who receive report data	Able to master computers and understand report data in the form of tables and charts
4	Data Collection	People who enter company data and manage existing user accounts	Able to master computers and understand report data in the form of tables and charts

3.2 Quick Plan

This stage is carried out system design using a prototype method that is tailored to the system that has been previously defined and in accordance with existing problems.

3.2.1 System Architecture Analysis

System architecture analysis is a process to configure the system to be built as a whole. Sensor devices (Bluetooth Low Energy) will later be applied to Dumptruck for detection by a monitoring device (Raspberry).

Web platform is a system as an office party media for monitoring. Next is the Figure architectural system that will be built later.

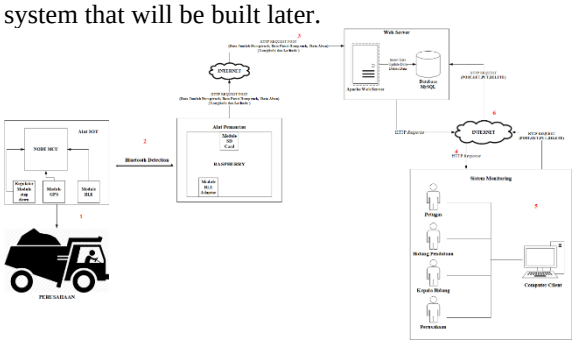

Figure 1. System Architecture

The following is an explanation of the architecture of the IoT-based Dumptruck monitoring system based on the Figure system above:

1. The IoT tool will be placed inside a Dumptruck that carries sand.
2. IoT devices consisting of Arduino Nano microcontrollers, Regulators, Wifi Module (GPS), and Module BLE (Bluetooth Low Energy) sensors send sand truck data to the Monitoring Equipment.
3. A monitoring device consisting of a Raspberry, Micro SD, and Bluetooth Adapter to capture signals from the IoT Tool and will send sand truck data to the web server.
4. The web server will immediately send the data trucks that already exist in the Database to the website.
5. The user will receive sand truck data in realtime when the Dumptruck installed by the IoT Tool passes through the Monitoring Tool.
6. Users have the right to manipulate data online related to truck sand data and account data

3.2.2 IOT Tool Workflow Analysis

The IoT workflow analysis tool aims to configure how the system can work as figured in the form of a flowchart. Following is the workflow of the IoT tool that will be built:

1. IoT (Microcontroller) tool that has been installed and turned on goes through the Receiver
2. The monitoring tool captures the bluetooth signal from the IoT Tool.
3. The monitoring tool will check whether there is a connection to the inter
4. If there is no internet connection, the sand truck data will be temporarily stored in the SD Card Module.
5. If there is an internet connection then the data will be sent to the Web Server

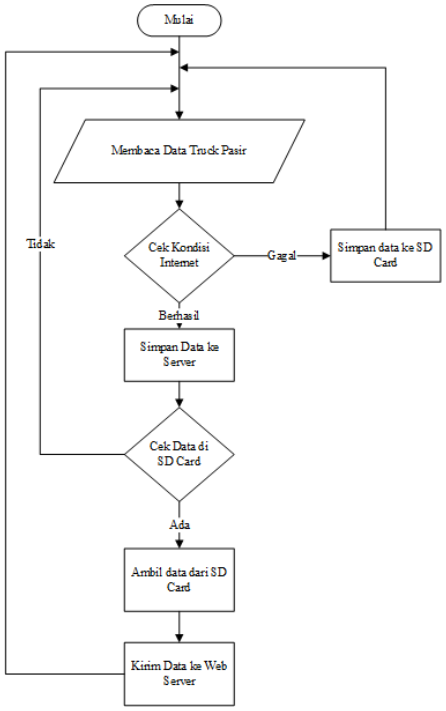

Figure 2. IOT Tool Workflow Analysis

3.2.3 Bluetooth Low Energy Distance Analysis

Bluetooth Low Energy (BLE) works by using radio signals with GFSK modulation on the 2.4 GHz frequency band. Here is the Bluetooth Low Energy Distance Analysis Table:

Table 3. Bluetooth Low Energy Distance Table

Name	value
Data Transfer	1 Mbps
Frequency	2.4 GHz
Latency	3 milisekon
Range	10 - 100 meter
Robustness	24 Bit CRC
Security Force	enkripsi Full AES-128 CCM

From the results of research observations on Bluetooth Low Energy Distance Analysis is Bluetooth Low Energy can be used in this study as a sensor for the dumptruck monitoring system in the Kuningan Bappenda office.

3.3 Modeling Design

the following stages the modeling of system protoype is adjusted to the system design created.

3.3.1 Fungsional Analysis

Functional analysis aims to configure the processes that occur in the system that will be applied in accordance with the needs needed so that the system can run well in accordance with needs.

3.3.1.1 Use Case Diagram

Use case diagrams from the dumptruck monitoring and tracking system can be seen in the following Figure.

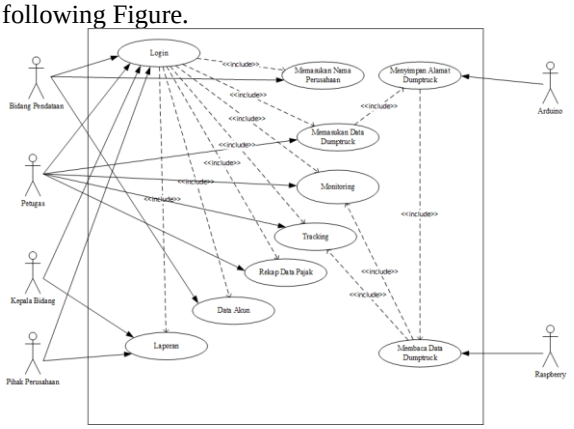

Figure 3. Use case diagram

3.3.1.2 ERD

Entity Relationship Diagram is aimed at structuring relationships between tables to clarify the relationships between tables.

The following is the ERD of the Internet of Things Based Dumptruck Monitoring and Tracking System which will explain the key attributes and relationship relationships between each entity.

Figure 4. Entity Relationship Diagram

3.3.2 Database Analysis

Database analysis is an analysis to determine a set of interconnected data from one data to another.

3.3.2.1 Relation Scheme

Relation scheme is the relationship between two or more tables in a database system. Following is the relation schema Figure from the system database:

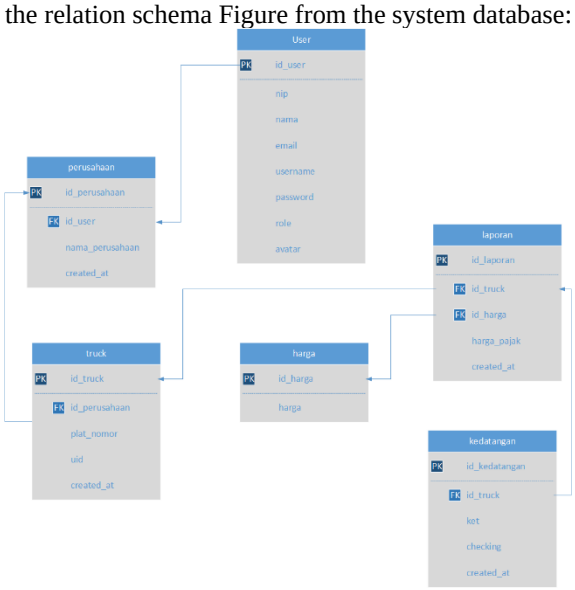

Figure 5. Relation Scheme

4. Implementation and Testing

4.1 Construction of Prototype

After the design stage is done, the next stage is the implementation and design stages.

4.1.1 Implementasi Perangkat Keras

In the hardware implementation section, it will be explained what devices are implemented for system development needs.

4.1.1.1 Implementasi Perangkat Keras Client

This section discusses the hardware from the client side that is used to run the IOT-Based Dumptruck Monitoring and Tracking System at Bappenda Kuningan. Details of the hardware used can be seen in the Table below.

Table 1. Client Hardware Implementation

Hardware	Details

Processor	Core i-5
RAM	4 GB
Harddisk	500 GB
VGA	On-Board

The following is a client computer specification table used to use the monitoring and tracking system of Bappenda Kuningan sand dumptruck

4.1.1.2 Hardware Monitoring Tool Implementation

Monitoring tool is a device consisting of a series of microcontrollers, sensors and modules.

Table 2. Hardware Monitoring Tool Implementation

Hardware	Details
Arduino Nano	ATMega328
Module Wifi	ESP8266
Antena Luar GPS	Car Antenna Receiver Aerial Adapter Auto
Nodemcu	Amica Lua Wifi V3 4mb 32mbits Flash Esp8266 Esp12 Cp2102
Module BLE (Bluetooth Low Energy)	Serial Bluetooth 4.0
Module SD Card	Sandisk Micro SD 32GB
USB Bluetooth Adapter	Dongle USB Bluetooth Adapter 4.0
Raspberry	Raspberry Pi 3 Model B

4.1.2 Architecture System Implementation

The implementation of system architecture is the implementation of the system architecture in the Quick Plan section. The implementation of the system architecture can be seen as follows:

1. Sensor / mikrokontroller

   Consisting of Node Mcu microcontroller, GPS Module, GPS Antenna and BLE (Bluetooth Low Energy) placed in a dumptruck that will send dumptruck data as well as longitude and latitude, the following is the IoT tool Figure can be seen in the Figure below

Figure 1. IOT things Implementation

2. Monitoring / Receiver

   Consists of Raspberry, Micro SD, and Bluetooth Adapter as receivers and will send data to the web server, the following is the monitoring / receiver Figure can be seen in the Figure below

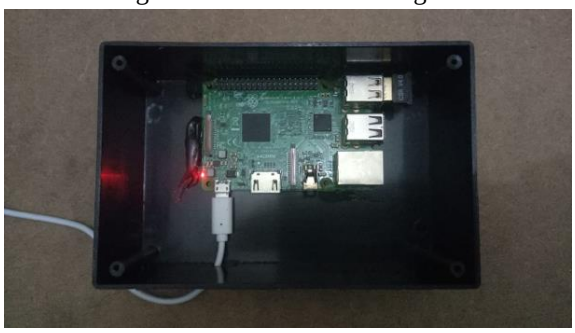

Figure 2. Implementasi Alat Pemantau

3. Database

   As a data receiver, storing dumptruck data, company data, account data, longitude and latitude.

Figure 3. Database Implementation

4. Website

   As an interface to control data and provide requests or commands to the web server, Website Implementation can be seen in the Figure below

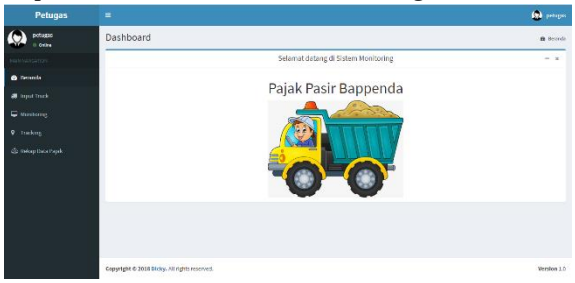

Figure 4. Website Implementation

5. User

As a user of the Dumptruck Monitoring and Tracking System website at Bappenda Kuningan.

Table 3. User Implementation

User	Description
Data Collection	Enter company input, manage account data
Officer	Input dumptruck, monitor, track and recap tax data
Head of Division	Receive Report Data
The Company	Receive Report Data

4.2 Deployment Delivery and Feedback

System testing is a part that must be done to see the results of research that has been built in the Kuningan Bappenda office.

4.2.1 Bluetooth Low Energy Distance Sensor Testing

Bluetooth Low Energy Sensor Distance Testing aims to determine how far the range of Bluetooth that has been used for dumptruck monitoring applications in Bappenda Kuningan. Following is the Bluetooth distance testing Table:

Table 4. Bluetooth Low Energy Distance Sensor Testing

Bluetooth Distance	Testing Result	Execution Time (seconds)
1meters	smoothly receive a signal	1
2meters	smoothly receive a signal	1
3meters	smoothly receive a signal	1
4meters	smoothly receive a signal	1
5meters	smoothly receive a signal	1
6meters	smoothly receive a signal	1
7meters	smoothly receive a signal	1
8meters	slow to receive a signal	3
9meters	slow to receive a signal	3
10meters	signal disconnected	-

5. CONCLUSION

5.1 Conclusion

Based on the results of research for half a month conducted at the Kuningan Bappenda office, to compile the final project that refers to the original purpose of the study the authors can conclude:

1. Application of monitoring and tracking system for dumptruck using BLE (Bluetooth Low Energy) sensor has succeeded in collecting sand tax data with Bluetooth sensor condition in the dumptruck car and a distance of 1 to 10 meters from the receiver, but for the GPS sensor it still has a time delay to get the dumptruck location information .
2. The dumptruck monitoring and tracking system successfully reports sand tax data in realtime.

5.2 Suggestion

For this Dumptruck Monitoring and Tracking System to run well, the system still needs to be developed so that the system is perfect and can run as desired. The suggestions for developing a system that is built are as follows:

1. The application is expected to make an Android version so that this application is easier to use wherever and whenever.
2. Because the data transmission still has a time delay to get the longitude and latitude data from the GPS Module, it is expected to use a better GPS Module.

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