APPLICATION OF GPS TRACKER SYSTEM ON BUSCITY WITH SUPPORTING SENSORS BASED ON INTERNET OF THING

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Abstract-City buses are one of the modes of public transporta-tion used by the public. In its use, city buses still have shortcomings, one of which is the uncertainty of the schedule of bus traffic to the available bus stops. This can cause prospective passengers who are at bus stops to get bored waiting for the bus, and can even switch to other modes of transportation that are more flexible and utilize technology already in use. So that transportation can be estimated when the time of arrival. The lack of utilization of the GPS tracker system technology which is integrated with smartphones on city buses, makes the mode of transportation can lag behind other modes of transportation in conducting public services in driving. Therefore, the use of GPS tracker system technology should also be applied to city buses, so that potential passengers can estimate the arrival of the bus to the bus stop where they are waiting. This system was built using the Arduino Uno microcontroller which is equipped with a GPS module that serves to get coordinates, also equipped with an ultrasonic sensor that can calculate the number of passengers. The data is sent to the broker who will later be saved to the database through a web service. The data can be sent to the broker, by using one more module that is integrated into the microcontroller, the wifi module which bridges the communication between the microcontroller and the broker through the internet network. After that the application made on an android smartphone will display a map and the location existence of each available bus.

Keyword-Android, Arduino, broker, City Bus, GPS tracker

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1. INTRODUCTION

GPS tracker system is a tracking system that is widely applied in various fields, one of which is transportation. GPS tracker system has various functions in its application depending on what field the system is applied, the general function of the GPS tracker system itself is to find out the existence of an object [1]. GPS tracker systems are currently widely applied in public transportation modes based on online, while public transportation modes that are not based online have not used it much as city buses.

In the current urban conditions, which often experience congestion on many roads, could be one of the factors disrupting the bus arrival schedule to the bus stop. The effect of bus delays coming to the bus stop will make prospective passengers waiting at the bus stop feel bored. The use of the GPS tracker system is deemed necessary to apply to public bus transportation in the city in order to keep abreast of technological developments, so that bus arrivals to stop can be monitored and can be predicted by prospective passengers who will use the bus, by using an application on an integrated android smartphone.

2. LITELATURE

2.1 Global Positioning System (GPS) Tracking

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GPS tracking is a method of knowing exactly where an object is. This GPS tracking can be placed in a vehicle, on a cellphone or on a special GPS device in the form of a fixed or portable unit. GPS tracking can track the movement of vehicles, goods or people for example, can be used to monitor routes, deliver goods and the location of human objects [2].

2.2 City Bus

A city bus is a public transportation mode that moves from one place to another within an urban area and is bound in a fixed and regular transportation route. City bus has become one of the public transportation used as a solution to overcome congestion, of course supported by improving bus services such as providing special bus lanes, engineering cheap bus fares even free at certain times and scheduling bus arrivals to bus stops available [3].

2.3 Arduino Uno

Arduino Uno is an ATmega328 based microcontroller board. Arduino Uno has 14 digital input / output pins (of which 6 pins can be used as PWM outputs), 6 analog inputs, 16 MHz crystal oscillators, USB connections, power jacks, ICSP headers and reset buttons. These pins contain everything needed to support a microcontroller. Besides hardware Arduino also has software, Arduino IDE (Integrated Development Environment) which is Arduino microcontroller programming software [4].

Figure 1: Arduino Uno Rev ATmega 328

2.4 Global Positioning System (GPS)

GPS is a device that can determine the location of an object on the surface of the earth with the help of synchronizing satellite signals. This system uses 24 satellites that send microwave signals to the earth. This signal is received by the GPS module on the surface of the earth, and is used to determine location, speed, direction, and time [5].

Figure 2: Module U-blox NEO-M8N

2.5 Android

Android is a linux-based operating system designed for touch screen mobile devices such as smartphones and tablets. The Android user interface is based on direct manipulation, using touch input that is similar to actions in the real world, such as swiping, tapping, and pinching, to manipulate objects on the screen. Android applications are developed in the Java programming language by using an Android software development kit (SDK). In general, Android is an open source platform for developers to create their own applications that are used by various devices [6].

2.6 Message Queing Telemetry Transport

Message Queing Telemetry Transport (MQTT) is a simple and lightweight communication protocol based on publish / subscribe that is designed for devices with low bandwidth or unreliable networks. MQTT's own design principle is to

minimize network bandwidth and the need for resources used by the device, while on the other hand it also ensures its reliability in sending data. This principle also makes an ideal protocol for machine-to-machine communication (M2M) or the Internet of Things originating from connected devices [7].

2.7 Internet of Thing (IoT)

IoT is a communication concept in which various objects in everyday life have the ability to transfer data to each other by becoming part of the way of internet access. With the main goal principle of IoT as a means to facilitate the supervision and control of an object, the IoT is very possible to be used almost in various fields, such as private homes, factories, health, agriculture and transportation [8].

3. ARCHITECTURE AND DESIGN

3.1 System Architecture

This GPS tracker system operates by having 5 interconnected components that must be met. The components can be seen in the system architecture below.
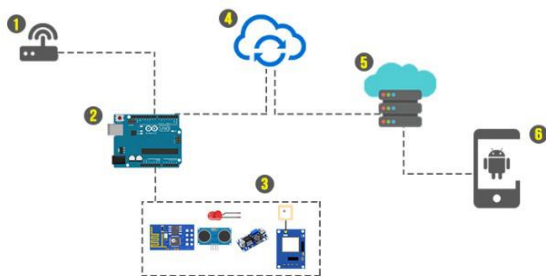

Figure 3: System Architecture

1. A wireless transmitter that makes the microcontroller can be connected to the internet so that it can be connected to other system architecture components via a WiFi module.
2. Microcontroller, a device that functions to control other electronic devices that are connected to the microcontroller and process data to be sent to the broker. Connected devices include a wifi module device that functions to connect a microcontroller to the internet, a gps module that functions to read coordinate data, an ultrasonic sensor that functions to count the number of passengers, a converter module that functions to change the voltage level, and LED lights that function as a marker of a connected system. with wifi and MQTT broker.
3. MQTT broker, a communication protocol that connects the microcontroller with a web service.
4. Web service serves as a bridge to connect the broker with the database so that data sent to the broker can be updated to the database.
5. Client / front-end in the form of a mobile application that will request to the web service for data stored in the database and then displayed on the smartphone screen
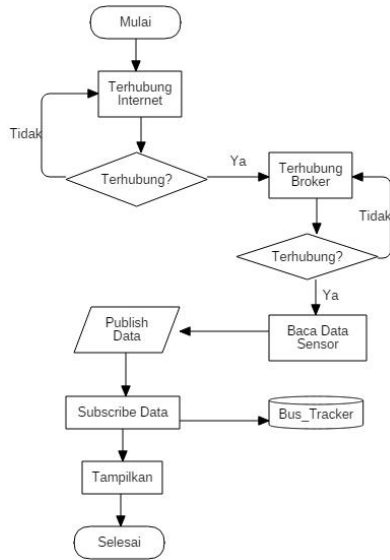
3.2 System Work

Figure 4: System Work Flowchart

The system must be connected to the internet first, both in terms of the GPS tracker circuit and the user side of the application. Before GPS can send data to the user's screen, the system will go through two checks, check that it is connected to the internet and MQTT or not. If one of them fails to connect, the information bus will not reach the application user. But if it is connected then the system can send information on the current bus location and number of passengers to the Android smartphone user screen

3.3 Hardware Design

In the development of the GPS tracker bus system, it has several hardware components needed to connect to each other, while the components are as follows:
1. Mikrontroller Arduino R3
2. Modul ESP8266-01
3. Modul GPS Ublox-Neo M8N
4. Modul Ultrasonik HCSR-04
5. Modul konverter DC ke DC
6. Mini Lampu LED
7. Kabel Jumper
8. Mini *Breadboard*

The series of hardware that has been assembled and connected to each other is then implemented in a simulation in the form of a toy bus as shown below.
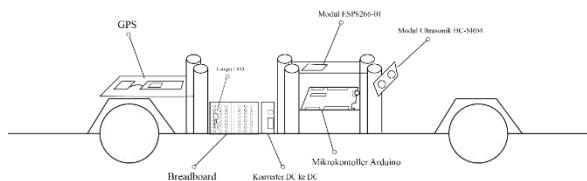

Figure 5: Hardware Implementation Design

4. IMPLEMENTATION

The process of implementing the system is divided into 2 parts, namely the hardware and software parts in the form of an android mobile application.

4.1 Hardware Implementation

The GPS tracker system hardware that has been assembled requires uploading a program to the microcontroller to be able to perform the functions of each connected component and send information data obtained to be displayed to application users.
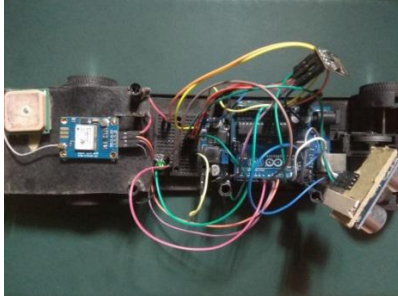

Figure 6: Hardware Implementation

4.2 Software Implementation

The software is built using the Javascript programming language framework, namely React Native. In displaying the main information that is monitoring the location of the bus and the number of passengers at this time, this system uses the Google Maps API in its manufacture. In addition, it also requires MQTT broker protocol and database server to be able to send and display data on the android smartphone application.

The main interface display on the android smartphone application can be seen in the image below.
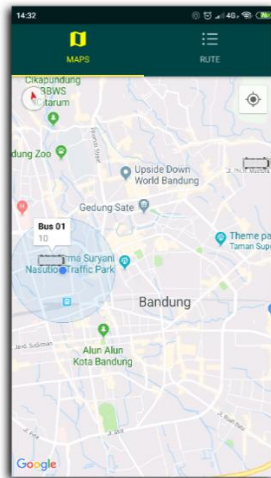

Figure 7: Display the GPS tracker application interface

5.   CONCLUSION

1. The GPS tracker system on this city bus has been able to display the location or whereabouts of the bus at this time in real time, so that potential passengers can find out the current bus traffic location and can better estimate the arrival of the bus to the bus stop.
2. GPS tracker system on city buses has been able to provide additional information for prospective passengers, in the form of information on the number of passengers on the bus, so that prospective passengers will not find a bus that is full of seats, because they can first see the number of passengers when it's on the bus.

3. The GPS tracker system on this city bus has been integrated with Android-based smartphones. So that the bus stop location going to the bus stop can be monitored via smartphone from prospective passengers.

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