

DESIGN SMART MINE EXERCISE POSITIONING USING GLOBAL POSITIONING SYSTEM (GPS)

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ABSTRACT

Marine mines are one of the supporters in securing the marine region of NKRI. In relation to marine mines, the Navy has mapped mines to the territorial waters. The importance of mine site mapping information aims to prevent landmines from being a feeding weapon for the NAVY's Alutsista. In realizing a mine-site mapping and location system that can provide geo-location information for mines using Arduino devices. Build your exercise Smart mine positioning using Global Positioning System (GPS) Neo-M6. A study in providing latitude and longitude location information is packaged using a GPS module that is connected to the Arduino processing device to obtain the location coordinates of the latitude and longitude mines. Test results of GPS-based location tracking devices are obtained by the results of location data in latitude and longitude formats. Smart Mine location identification, can be applied using GPS based on the results of the design and creation of the system that has been done. Location displacement speed calculations can be obtained by calculating the starting location with the updated location in a time span and converting to a unit of distance. Based on the results of the speed test can be obtained even if the device's location position is unchanged, this is due to the GPS data always changing due to the level of position accuracy obtained from satellites. The use of the Neo-M6 GPS can be applied to the latitude and longitude location identification systems acquired a relatively small error value with an average satellite number obtained by as much as 8 satellites. The use of the Neo-M6 GPS, to get GPS data from satellites is a long time, the problem of GPS gets satellite data due to the less supportive weather conditions.

Keyword: GPS Neo-m6, Arduino Mega 2560, weather.

1. INTRODUCTION

Implementation of sea territorial security is the main task of TNI AL. In carrying out fundamental tasks to preserve the sovereignty of the waters of the HOMELAND, the NAVY must always be ready in the operation of security safeguards quickly and precisely. With the extent of the territorial waters of the NKRI, this region is the main point in relation to the aggression of militarily other countries. Therefore, in keeping the territorial waters, the Navy must be equipped with adequate supporting facilities and infrastructures.

One of the supporting means of securing the navy in keeping the waters of NKRI is sea mines, which is the explosive equipment placed in the water area. Mines serve to blow up the enemy ship or alutsista if mines are approached. So this can also be called an aggressive mine. Mine, is one of the defence equipment of the NAVY, which is placed in a location that is prone to infiltrated the enemy and scattered according to military strategy of the Navy. With the number of marine mines spread over the waters, the

mine site points must be It is known for sure not to backfire for the Navy forces. Mine location information is defined in earth coordinates.

In relation to marine mines, the Navy has mapped mines to the territorial waters. The importance of mine site mapping information aims to prevent landmines from being a feeding weapon for the NAVY's Alutsista. Mine locations must be known for certainty and be monitored in real-time. To obtain mine locations, a GPS device and communication device is installed. The GPS device is used as a device that can indicate the location of mines within the longitude latitude. The GPS system consists of three parts, namely satellite in the space, the controlling station on Earth, and the receiver as a GPS satellite receiver device attached to the mine device. When satellites are orbiting, emit signals are captured by GPS receivers on Earth. The receiver will calculate the distance with the satellite by calculating the time interval required to receive the signal from each satellite. Distance information used to determine the position of the GPS receiver.

In realizing the mine site mapping and tracking system that can provide information on Geo mine location using Arduino devices, the author tries to lift it into a research theme with the research title of design Build Determination Smart Mine Exercise position using Global Positioning System (GPS). A study in providing the latitude of longitude location information is packaged using a GPS module that is connected to the Arduino processing device to obtain the location position of latitude and longitude mines.

The GPS module generates a standard set of information on the National Marine Electronics Association (NMEA) protocol. Information data in the NMEA protocol standard need to be done encoding process to be obtained original data of latitude and longitude coordinates. This process is performed on the Arduino device and the GPS module is connected to the Arduino device via serial communication.

In this research need to be formulated problems in the design build position determination Smart Mine using Global Positioning System (GPS).

Some of these problems are:

- a. How do I identify my Smart Mine location?
- b. How do I get the Smart Mine location change speed?

The benefits of this design build research are:

- a. As the application of Geo location system using GPS module.
- b. As an application of Arduino programming material.
- c. As one way to get speed based on GPS data.

2. RESEARCH METHODS

2.1 Design Research

This type of research on the final task is the design research system build, namely a design of the mine site identification system using GPS devices and Arduino devices consisting of several steps in designing the Embody a capable device to obtain location data using a GPS device with the process unit using the Arduino.

2.2 Research procedure

To implement the research well, the preparation of steps to find the data source as well as conducting a research on the device positioning the Exercise Smart Mine system using Global Positioning System (GPS) in the Exercise Smart Mine Includes research

instruments, basic data, supporting data, and the validity and reliability testing of data.

2.2.1 Research procedure

Tools and materials to support this process of research and application of systems.

Table 3.1 Tools and materials research

1. 1 unit GPS NEO-6M
2. 1 unit Arduino Mega
3. Komputer (PC) 32/64 bit architecture processor, 4 GB Random Access Memmory RAM, sistem Operasi windows 7
4. Arduino IDE 1.8.0
5. 1 set toolset
6. 1 AVometer
7. 1 unit solder

2.2.2 Research draft

Research draft of design build position determination Smart Mine using Global Positioning System (GPS) Implement the research stages, as follows:

- a. Flowchart Research

To explain the steps of designing a research Exercise Smart Mine positioning using Global Positioning System (GPS) can be made flow diagram so that the process or steps of the design build can be defined clearly and Structured.

- b. Block diagrams

Designing will be easier in the realization of equipment with hardware diagram blocks. In designing it is expected to clarify what systems and hardware devices are used in this research.

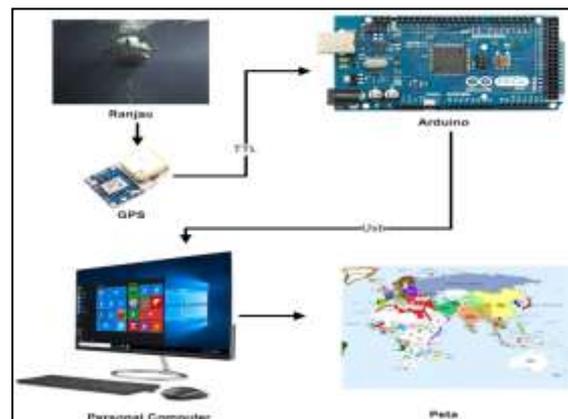


Figure 2.1 Images System block Diagram
(Source: self-processed result)

GPS is accessible via a serial communication channel, as shown in the flowchart image.

2.2.3 Data Collection

At the research on design of Exercise position determination Smart Mine using Global Positioning System (GPS) authors do the study by collecting data. The method of research data collection design establish position determination Smart Mine using the Global Positioning System (GPS) that the author will do, namely:

a. Interview

Is a question and answer method of the competent party regarding GPS.

b. Observation,

Is a method of research directly in the field.

c. Documentation

It is a way of collecting data from books, records, and research outcomes in GPS-related agencies.

2.2.4 Data processing

Data processing is a process by which authors have taken some information collected in the data collection process. The Data obtained will be conducted and become reference to the design and system design analysis process.

3. DESIGNING, IMPLEMENTING AND TESTING THE SYSTEM

3.1 Design of mine site position

In the design of mine site position systems, can be described in Figure 4.1 of the system block diagram. The configuration of the GPS connection, consisting of the use of Arduino Mega pin 2560 compatible with the needs, connect the TX GPS pin with the Arduino RX pin, the GPS power supply pin with Arduino power supply pin. Interconnection process.

Figure 3.1 The following diagram is a system design block position positioning using the GPS Neo-6M and the Arduino Mega microcontroller 2560.

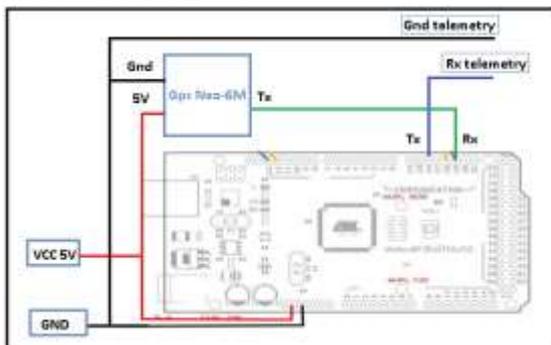


Figure 3.1 Image Wiring Diagram mine position system (Source: self-processed result)

3.1.1 Implementation

At the stage of implementation conducted by researchers on mine site positioning devices, researchers can describe the steps in implementing the mine site positioning system, as follows:

a. Setting up a Neo M6 GPS device and Arduino Mega 2560 device.

b. Connecting the GPS to the Arduino, TX GPS pins are connected to the Arduino Mega RX1 pin 2560, ground GPS with the ground Arduino and VCC GPS to the resource pin 3.3 Vdc.

c. Set up the code of the program written using the C++ language on the Arduino idea 1.8.5 and perform a reading test on the terminal monitor Arduino idea.

d. Set up a program code to get NMEA data GPS and transmit data via serial communication.

e. Set up the program code to parse NMEA GPS data data and transmit latitude, longitude, speed, number of satellites via serial communication.

3.1.2 Testing

Testing was conducted to find out that the modules and the overall use in the design to determine the position of Smart mine using GPS can function properly.

3.1.3 Test GPS NEO 6M

Global Positioning System (GPS) is a satellite-based navigation system consisting of at least 24 satellites. GPS can work 24 hours a day.

The GPS receiver uses this information and the trilateration to calculate the user's exact location. Essentially, the GPS receiver calculates the distance to each of the satellites with the amount of time it takes to receive the transmitted signal. By calculating the distance from multiple satellites again, the receiver can determine the user's position and display it.

To calculate the 2-D location position (latitude and longitude) and the trajectory movement, the GPS receiver must be locked at a signal of at least 3 satellites. With 4 or more satellites in view, the receiver can define your 3-D position (latitude, longitude and altitude). Generally, the GPS receiver will track 8 or more satellites, but it depends on the time and location being on the Earth.

To conduct testing GPS module Neo-6M need to connect the GPS with Arduino devices like wiring diagram Figure 3.2 follows.

3. Satellite data is the number of satellites received by the GPS receiver. The number of satellites presents the accuracy or accuracy of identified locations. The number of satellite signals received less than 4 satellites is not able to prenupe the location in coordinates in 3 dimensions. As it is known that 3 satellites can be used to get the location in 3dfix, 1 satellite for time synchronization. In Test figure 3.7 The following is shown that the number of satellites received is 5 satellites. Thus location is obtained in 3d dimensions.

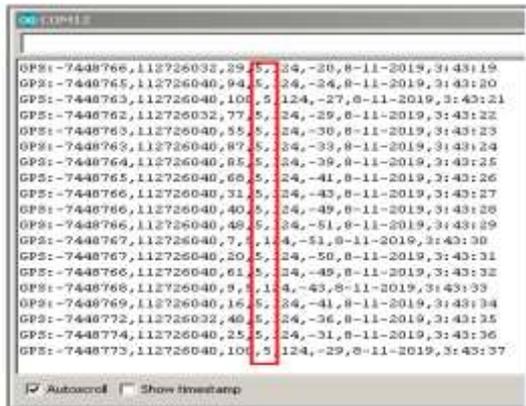


Figure 3.1 Data testing Satellites (Source: Self-processed results)

4 Hdop Data, Hdop is a horizontal location accuracy. The HDOP variable shows the error value of the location in horizontal. The larger the value shown on the test the error value indicated will be greater. The value of Hdop approaching a value of 0 indicates a smaller error value. This relates to the number of satellites received, energy much of the number of satellites received the smaller HDOP value is generated. Hdop Data is formed in an integer format by multiplying the value of HDOP with a value of 100, it is done to negate the character format ', ' or character '.', so that the data needs to be multiplied by 100. Thus on the process to display the data need to be done division with the variable 100.

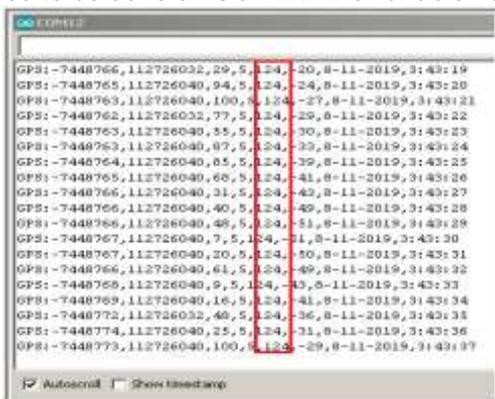


Figure 3.8 HDOP Data testing (Source: Self-processed results)

3.2.1 System Interface Testing

The system interface created by the authors on the design build of the mine-position GPS system, using the C# programming language in the Visual Studio 2012 editor. The system interface is built to visualize GPS data in numbers and visualize images in the form of electronic maps. On the interface made by the authors using serial communication feature that has been integrated in it, to communicate with the GPS device of mine determination position. Setting serial communications on the system is determined by the BaudRate value on the GPS device, which is 9600. Setting the BaudRate value on the built-in GPS system interface can be viewed in the 4.9 Image Test System interface program running using the Visual Studio 2012 editor program. The test image explains step-by-step testing steps for testing to be performed correctly and to get results according to the expected objectives.



Figure 3.9 Baudrate Serial communication setting (Source: self-processed result)

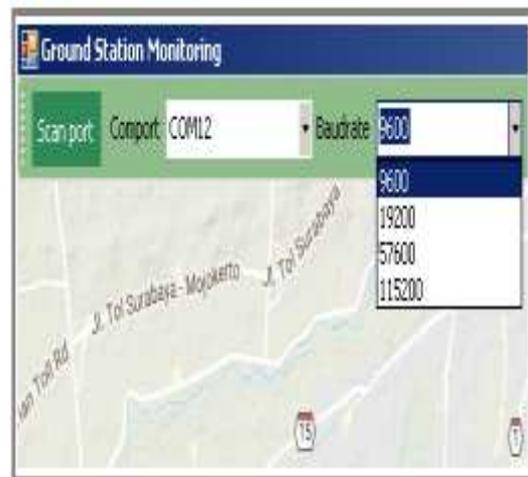


Figure 3.10 Baudrate Serial Communication selection (Source: self-processed result)

After connection to the device then the data transmitted by the GPS device will be

received on the interface of the monitoring system, as shown in Figure 3.11 below.

```

GPS:-7448872,112725952,50,8,98,327,8-11-2019,4:16:58
GPS:-7448874,112725952,55,8,98,332,8-11-2019,4:16:59
GPS:-7448876,112725952,94,8,98,338,8-11-2019,4:17:0
GPS:-7448873,112725944,100,7,101,342,8-11-2019,4:17:1
GPS:-7448874,112725944,131,7,101,345,8-11-2019,4:17:2
GPS:-7448874,112725936,90,7,101,348,8-11-2019,4:17:3
GPS:-7448872,112725944,109,7,101,350,8-11-2019,4:17:4
GPS:-7448872,112725944,92,8,101,353,8-11-2019,4:17:5
GPS:-7448873,112725936,62,7,101,357,8-11-2019,4:17:6
GPS:-7448872,112725936,40,7,101,359,8-11-2019,4:17:7
GPS:-7448871,112725936,14,7,101,359,8-11-2019,4:17:8
GPS:-7448869,112725936,55,7,101,358,8-11-2019,4:17:9
GPS:-7448869,112725936,37,7,101,352,8-11-2019,4:17:10
GPS:-7448869,112725936,5,7,101,348,8-11-2019,4:17:11
GPS:-7448867,112725928,12,8,101,345,8-11-2019,4:17:12
GPS:-7448865,112725928,27,8,101,345,8-11-2019,4:17:13
GPS:-7448865,112725936,37,8,101,342,8-11-2019,4:17:14
GPS:-7448864,112725936,18,8,101,343,8-11-2019,4:17:15

```

3.11 Image Testing Data on Monitoring systems (Source: self-processed results)

Data received on the monitoring system will be done parse or sorting data based on needs. Sorting data by character ',' as an indication of 1 data variable. By sorting data by character ',', it is obtained by data as much as 8 data. Data with index to 0 is latitude data, index to 1 is data longitude, index to 2 is data speed, index to 4 is data Hdop, index to 5 is data altitude, index 6 is the data of the UTC and index time 7 is UTC clock data.

The following test drawings result in data separation on the GPS monitoring system.

Gps data	
Latitude	-7.448804
Longitude	112.72604
Speed	0.8
Satellite	8
Hdop	0.9
Altitude	1.5
Tanggal	8-11-2019
Jam	4:32:12

Figure 3.12 Sorting Data testing (Source: Self-processed results)

Once the data separation is done and displayed in the form of values or figures on the interface, then the data associated with the location variables can be displayed into the electronic map. The Electronic map used in testing is the library of Gmap.net programs. Libraries can be used in c# programming by adding the program libraries in the application, the library extension is the compiler program. DLL, by adding in the reference program monitoring system then the program library can be called each function. Figure 3.13 The following is a test result to display location data on an electronic map.



Figure 3.13 Images of electronic map display (Source: self-processed)

By moving the device location to a different location, a different location monitoring system can be generated. Below are the test pictures of different locations. The testing site was conducted in the city of Sidoarjo, Temple District, Kelurahan Prohibition. The tests performed were done in the same steps as in the first test by running a GPS device and a Visual Studio 2012 interface program. The test is done by connecting the GPS device and the Arduino mega 2560 to the laptop device via USB communication channels. To run this test on the interface the program performed should settings and serial baudrate communications as shown in Figure 3.14 below.



3.14 Image Comport Settings (source: Self-processed result)



3.15 Image Baudrate Settings (source: Self-processed result)

After connection settings are performed, serial communication. By pressing the

Connect button, the system can be run to get data from the GPS device. Figure 3.16 The following views of data acceptance testing results in the Visual Studio 2012 program interface.

```

10.53.36 GPS:-7469834,112720768,61,8,102,2140,29-10-2019,3:53:35
10.53.37 GPS:-7469837,112720760,109,0,102,2240,29-10-2019,3:53:3
10.53.38 GPS:-7469836,112720760,148,8,102,2060,29-10-2019,3:53:3
10.53.39 GPS:-7469835,112720776,90,8,122,2020,29-10-2019,3:53:38
10.53.40 GPS:-7469837,112720776,66,10,122,2060,29-10-2019,3:53:3
10.53.41 GPS:-7469838,112720776,53,10,122,2060,29-10-2019,3:53:4
10.53.42 GPS:-7469840,112720784,48,10,122,2040,29-10-2019,3:53:4
10.53.43 GPS:-7469841,112720784,33,10,102,2010,29-10-2019,3:53:4
10.53.44 GPS:-7469842,112720784,140,10,102,1960,29-10-2019,3:53:
10.53.45 GPS:-7469843,112720792,105,10,102,1850,29-10-2019,3:53:
10.53.46 GPS:-7469844,112720800,175,9,102,1740,29-10-2019,3:53:4
10.53.47 GPS:-7469842,112720808,74,9,102,1629,29-10-2019,3:53:46
10.53.48 GPS:-7469844,112720808,53,9,102,1640,29-10-2019,3:53:47
10.53.49 GPS:-7469844,112720808,9,9,102,1560,29-10-2019,3:53:48
10.53.50 GPS:-7469842,112720816,48,9,102,1470,29-10-2019,3:53:49
10.53.51 GPS:-7469836,112720824,144,9,102,1210,29-10-2019,3:53:5
10.53.52 GPS:-7469835,112720832,27,8,122,1100,29-10-2019,3:53:52
10.53.53 GPS:-7469834,112720832,77,7,122,1120,29-10-2019,3:53:53
10.53.54 GPS:-7469836,112720832,42,7,122,1060,29-10-2019,3:53:54
10.53.55 GPS:-7469835,112720832,77,7,122,1070,29-10-2019,3:53:55
10.53.56 GPS:-7469835,112720832,124,7,122,950,29-10-2019,3:53:56
10.53.57 GPS:-7469836,112720832,72,9,122,970,29-10-2019,3:53:57
10.53.58 GPS:-7469837,112720832,42,10,122,989,29-10-2019,3:53:58
10.53.59 GPS:-7469839,112720824,46,7,122,1010,29-10-2019,3:53:59
10.54.0 GPS:-7469841,112720824,11,8,122,1080,29-10-2019,3:54:0
10.54.1 GPS:-7469839,112720824,129,8,122,1120,29-10-2019,3:54:1
10.54.2 GPS:-7469836,112720816,237,7,122,1120,29-10-2019,3:54:2
10.54.3 GPS:-7469829,112720808,264,8,122,1090,29-10-2019,3:54:3
10.54.4 GPS:-7469832,112720808,179,8,122,1000,29-10-2019,3:54:4

```

Figure 3.16 Images of Data acceptance display on Program interface (source: self-processed results)

The data obtained by the process of splitting the data to obtain the information contained in the data, separating the data to be done parsing process, based on the comma character. After the process of splitting the data or parsing, it can be obtained each information data displayed in the program Interface 3.17.

Gps data	
Latitude	-7,469832
Longitude	112,720808
Speed	1,8
Satelite	8
Hdop	1,2
Altitude	10
Tanggal	29-10-2019
Jam	10:54:04

Figure 3.17 Data separation Program interfaces (source: self-processed results)

In addition to be able to display the results of splitting of data on a program interface in the form of GPS variable values, the resulting data can be displayed in the form of an interface electronic map program Figure 3.18 Below is a display of the map settings In the form of Google Map terrain.

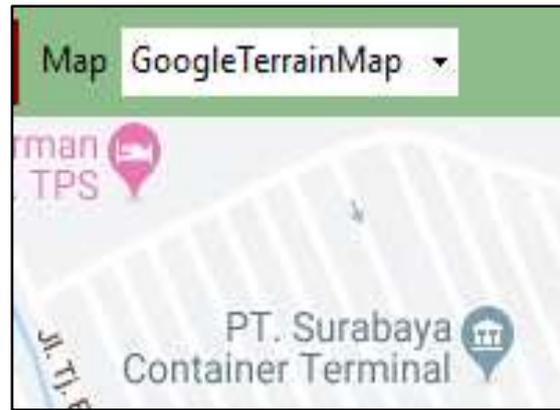


Figure 3.18 Electronic map settings for Google map Terain (Source: self-processed result)

To set the display of electronic map in hybrid form then can be done settings as in Figure 3.19 below.



Figure 3.19 Google Map Hybrid electronic maps settings (Source: Self-processed results)

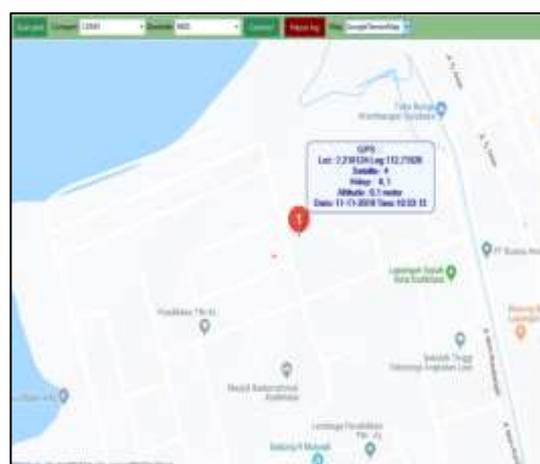


Figure 3.20 images display electronic maps using Terain Google map (Source: Self-processed results)



Figure 3.21 Pictures of electronic map display using Google map Hybrid (Source: self-processed result)

Below are the test pictures of different locations. The test site was conducted in the city of Surabaya, Kodiklatat football field Morokrembangan District. The tests performed were done in the same steps as in the first test by running a GPS device and a Visual Studio 2012 interface program. The test is done by connecting the GPS device and the Arduino mega 2560 to the laptop device via USB communication channels. To run this test on the interface the program performed should settings and serial baudrate communications as shown in Figure 3.22 below.

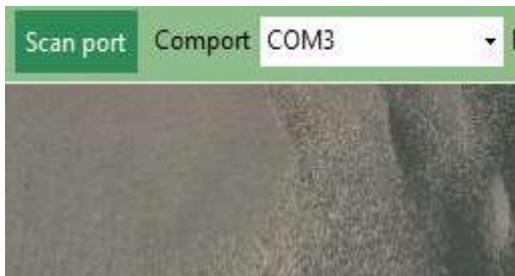


Figure 3.22 Comport settings (source: Self-processed result)



Figure 3.23 Baudrate settings (source: Self-processed result)

After connection settings are performed, serial communication. By pressing the Connect button, the system can be run to get data from the GPS device. Figure 3.24 The

following views of data acceptance testing results in the Visual Studio 2012 program interface.

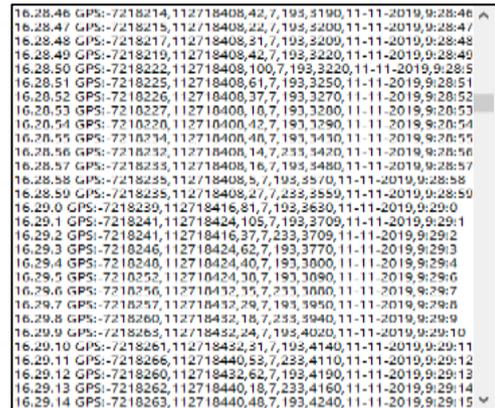


Figure 3.24 Data acceptance display on Program interface

Data obtained is done the process of splitting the data to get the data information contained in the separating data need to be done parsing process by based on the comma character. After the process of splitting the data or parsing, it can be obtained each information data displayed in the program interface 3.25. Data obtained is done the process of splitting the data to get the data information contained in the separating data need to be done parsing process by based on the comma character. After the process of splitting the data or parsing, it can be obtained each information data displayed in the program interface.

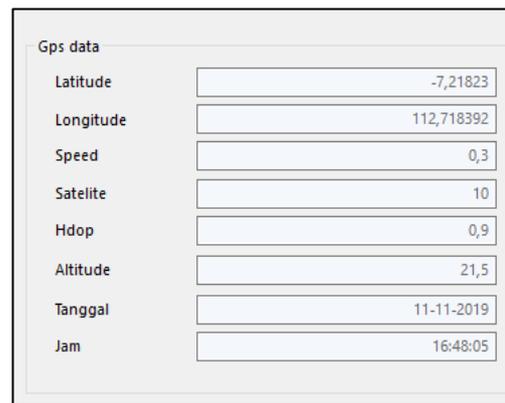


Figure 3.25 Data separation Program interfaces (source: self-processed results)

In addition to be able to display the results of splitting of data on a program interface in the form of GPS variable values, the resulting data can be displayed in the form of an interface electronic map program Figure 3.26 Below is a display of the map settings Electronic in the form of Google Map terrain

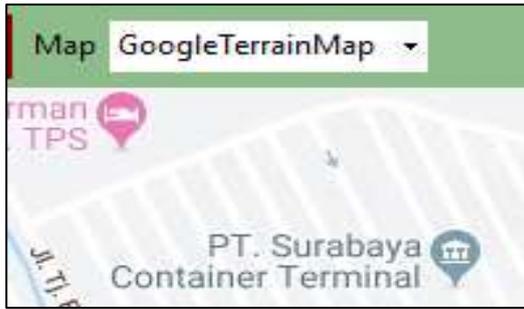


Figure 3.26 Electronic map settings for Google map Terrain (Source: self-processed result)

To set the display of electronic map in hybrid form then can be done settings as in the following figure 3.27.

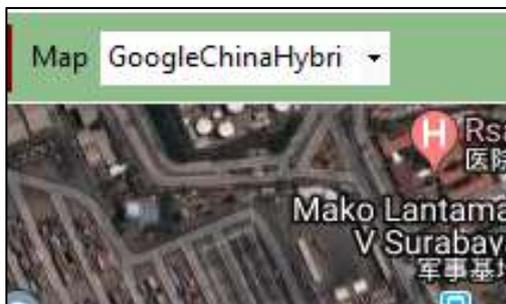


Figure 3.27 Google Map Hybrid electronic maps settings (Source: Self-processed results)



Figure 3.28 Display electronic maps using Terrain Google map

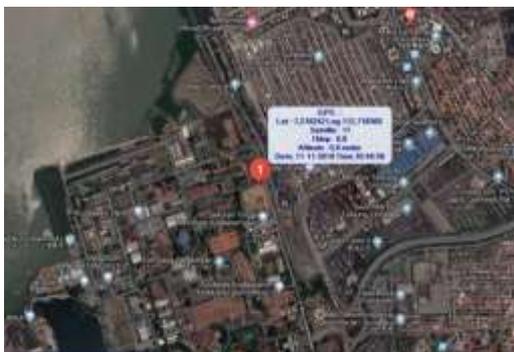


Figure 3.29 Electronic map display using Google map Hybrid

In the tests shown in the system interface, the authors test the Kodiklatal football field can be obtained with GPS location readings according to the actual location. Error reading location obtained a small error value is evidenced by the location data retrieval site According to the satellite imagery displayed on the program interface. The location shown in the program interface is displayed in the form of an electronic map by adding the location data and adding a marker icon to the map. Electronic maps that the authors used on this test used the electronic map of Gmap.net.

Location Data is obtained from the GPS device connected to the application through a serial communication via the USB port. Data obtained through USB port is sorting data to get latitude, longitude, Hdop, speed and altitude data. The test was obtained error data in the location readings in the longitude or called Hdop of 0.9. The error value of 0.9 is a relatively small location error value, with the signal from a more satellite, the HDOP error value will be smaller. Hdop is a reversed comparison with the number of satellites. In the test acquired location 3d fix with the number of satellite signals received as much as 11 satellites, the maximum number of satellites is 15 satellite according to the number of satellites outside the Earth.

4. CONCLUSION

Conclusions obtained from the testing of systems that have been made can be mentioned, namely:

- a. Identify the Smart Mine location, can be applied using GPS based on the results of the design and creation of the system.
- b. The location displacement speed calculation can be obtained by calculating the starting location with the updated location in a time span and converting to a unit of distance. Based on speed test results can be obtained even if the location of the device is unchanged, this is because the GPS data is always changing due to the level of positioning accuracy obtained from satellites.
- c. Developing a location tracking system using a GPS device with a higher level of sensitivity, it aims to get satellite signal more quickly and accurately than using the GPS Neo 6M.
- d. To get a faster and better satellites on a GPS device so as to plus a cable antenna or stick antenna on the GPS Neo 6M.

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