ISSN No:-2456-2165

Utilizing Web-Based Technology for Speed Bump Mapping

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Abstract:- A speed bump is a mound made across the road to limit vehicle speed and function to maintain order traffic and keep drivers from limiting their speed. However, there are still violations of the use of speed bump not standard with Minister of Transportation Regulation no. 14 of 2021 which can cause traffic accidents and damage vehicles, especially on spring and shock absorber parts. However, unfortunately there is still no technology in the form of a website that can be accessed remotely and real time to provide information on detection results from the detection tool which will be displayed in the form of speed bump mapping. Therefore the author proposes a Web-Based Speed Bump Mapping System. In this system the website will display several features such as results speed bump mapping in the form of pin points on the Google Maps API, then speed bump data containing image data, speed bump coordinates, the height, width and description of the speed bump are standard or non-standard. Apart from that, the website will have a report printing feature availablecan be downloaded in (.pdf) format, then there is a speed bump guide feature, and the last feature is upload speed bump. On the website It has been able to map speed bumps with a data sending and receiving speed of 1.2 seconds per data and sensor accuracy error GPS when compared to Google Maps is 4 meters.

Keywords:- *Speedbump, Web , Mapping.*

I. INTRODUCTION

Traffic accidents are difficult events predicted when and where it will happen, involves motor vehicle colliding with another object, thus causing damage and may result injuries and fatalities, both humans and animals [1]. Based on data from the National Police Traffic Corps (Korlantas), there are 94 thousand cases of traffic accidents until September 2022. This number increases by 34.6% compared to the year 2021. Of these accident cases resulted in 19,054 fatalities or an increase of 3.7% compared to 2021 [2]. Material losses due to traffic accidents up to in February 2022 it has reached more than 47 billion rupiah [3]. One of the causes of traffic accidents caused by a non-standard speed bump, this is proven by 30 accident cases every day [4]. Then it is reinforced with a journal containing a questionnaire The negative effects of speed bumps include accidents resulting from them wrong overtaking, increased polluting exhaust emissions environment, and cause noise and damage on vehicles [5]. Many complaints have been experienced by road users regarding non-standard speed bumps, These include colors that are similar to the road body, and materials making non-standard speed bumps, so endanger road users [6].

Based on cases of traffic accidents due to speed lumps that occur every year, efforts need to be made overcome this problem. Therefore it is There are several innovations regarding speed bump identification [7], [8], but have not been able to differentiate or do so classification of standard or standard types of speed bumps not standard. Furthermore, there are innovations in 2018 [9], [10], but unfortunately they have not been able to show results The data is in the form of photos and there is no website that can be accessed reading results in real time and remotely. A number of The innovation carried out is also still a simulation using a computer device, so it is not portable [11], [12], [13]. Then there is innovation

regarding the system information [14], but the system is still focused on road damage, not to mention speed bumps, especially those that don't standard and requires an operator in the data input process.

Based on background and problems contained in previous research, the authors propose Title "Web Based Speed Bump Mapping System". System will use Arduino Uno as a microcontroller Run the program that will become a feature of the GPS, including receiving latitude and longitude coordinates to the satellite, then send it back using POST method with HTTP protocol to the database server. The database can be accessed via the existing website displays pin points on the map. The map will be monitored in real time using the website it contains There is a picture of the speed bump pin point along with the width measurement and height and location. The hope is the results of this research can make it easier for related agencies in the detection process speed bump equipped with height, width and capacity map it. So there will be a speed bump endangering road users will be reduced and can reduce the number of traffic accidents due to problems.

II. PROPOSED METHODS

This section will explain the method, block diagram, speed bump mapping system flowchart Iot-based.

A. Proposed System

In Figure 2.1 a block diagram of Web-based speed bump mapping system.

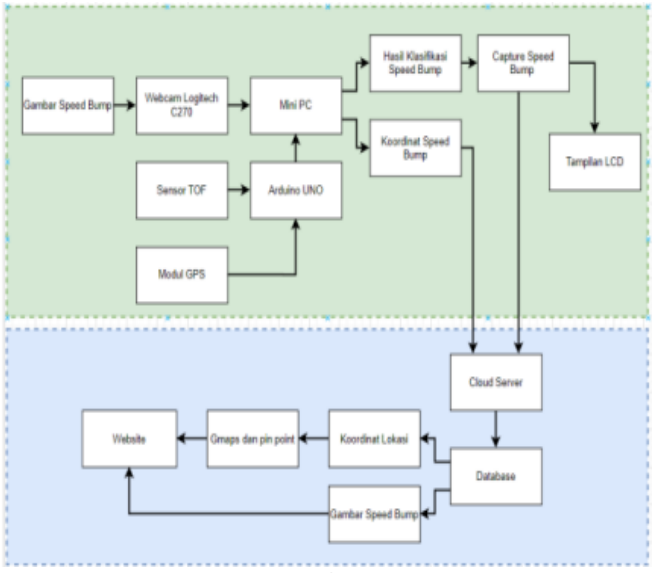

Fig. 1. Mapping System Diagram

Figure 1 is a system diagram of this research, in Figure 1 which is a system diagram consisting of speed bump detection and speed bump mapping system. Author working on the mapping system, explanation of Figure 1 is divided into two parts, namely:

On the hardware side, the GPS Module input functions as a GPS signal receiver that will be converted on Arduino Uno which produces speed location coordinates bump. The output in the form of location coordinates will be saved in a database containing speed bump images. Next, the location coordinates obtained from the database will be converted into pin points which according to Google Maps location coordinates. After that, web will contain pin points and Google Maps API. Then all pin point positions will be displayed on Google Maps and speed bump images from database will be displayed when the pin point is pressed.

In the software section, system input starts with Enter your account in the login form, if you don't have one yet account, you are required to fill out the registration form first. Once the account has been registered, it will Enter the maps display on the loading website several pin points showing locations and images speed bumps. Pint points on maps are obtained from database as a place to store result data GPS signal conversion by Arduino Uno in the form of speed bump locations and pictures.

In Figures 2 to 3 there is how the system works web-based speed bump mapping.

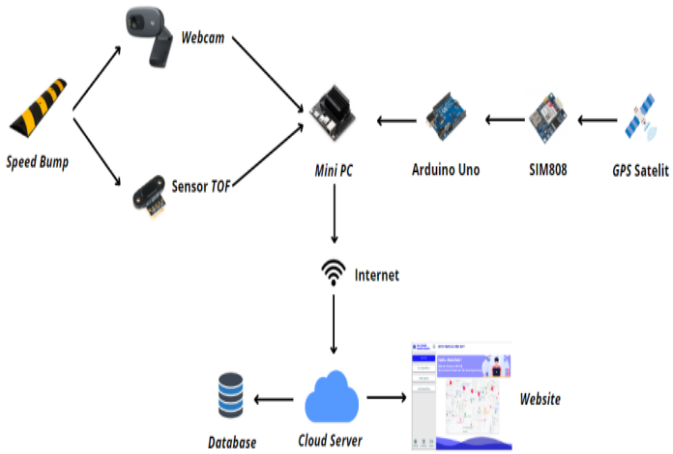

Fig. 2. System design

In Figure 2 there is an explanation regarding speed bump mapping system starts with webcam and TOF sensor that will capture images, height and the width of the speed bump that the data will then be processed on mini PC will also be sent to a cloud server if available internet network, at the same time when there is a speed bump detected, the GPS satellite will transmit a signal to SIM808 which will then generate coordinates latitude and longitude that will be recorded and processed on Arduino Uno. Then the results of the data that have been processed are in The Arduino Uno will ship on mini PCs via serial communication and if there is an internet network it will send to the cloud server and will be stored on database and displayed on the website in the form of pin points and complete speed bump data such as photos, height, width and information on whether the speed bump is in standard condition or not standards in accordance with Minister of Transportation Regulation no. 14 of 2021.

ISSN No:-2456-2165

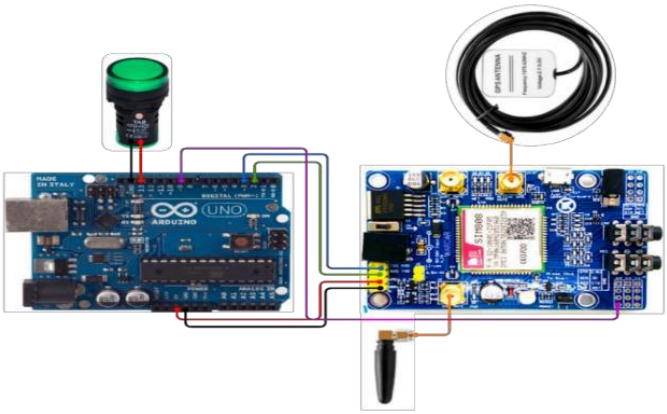

Fig. 3. SIM808 series

In Figure 3 is a series used to connect SIM808 with Arduino UNO. This circuit connects several components with SIM808, including the Arduino UNO as a microcontroller, a green indicator light is used for the GPS on indicator, the GPS antenna for detection the presence of speed bumps, and GSM antennas. This series will be later will be connected to the Nvidia Jetson Nano via serial communication and will map if there is speed bump.

Figure 4 is a system flowchart used in creating a speed bump mapping system web-based or can be called the SIPANEL website.

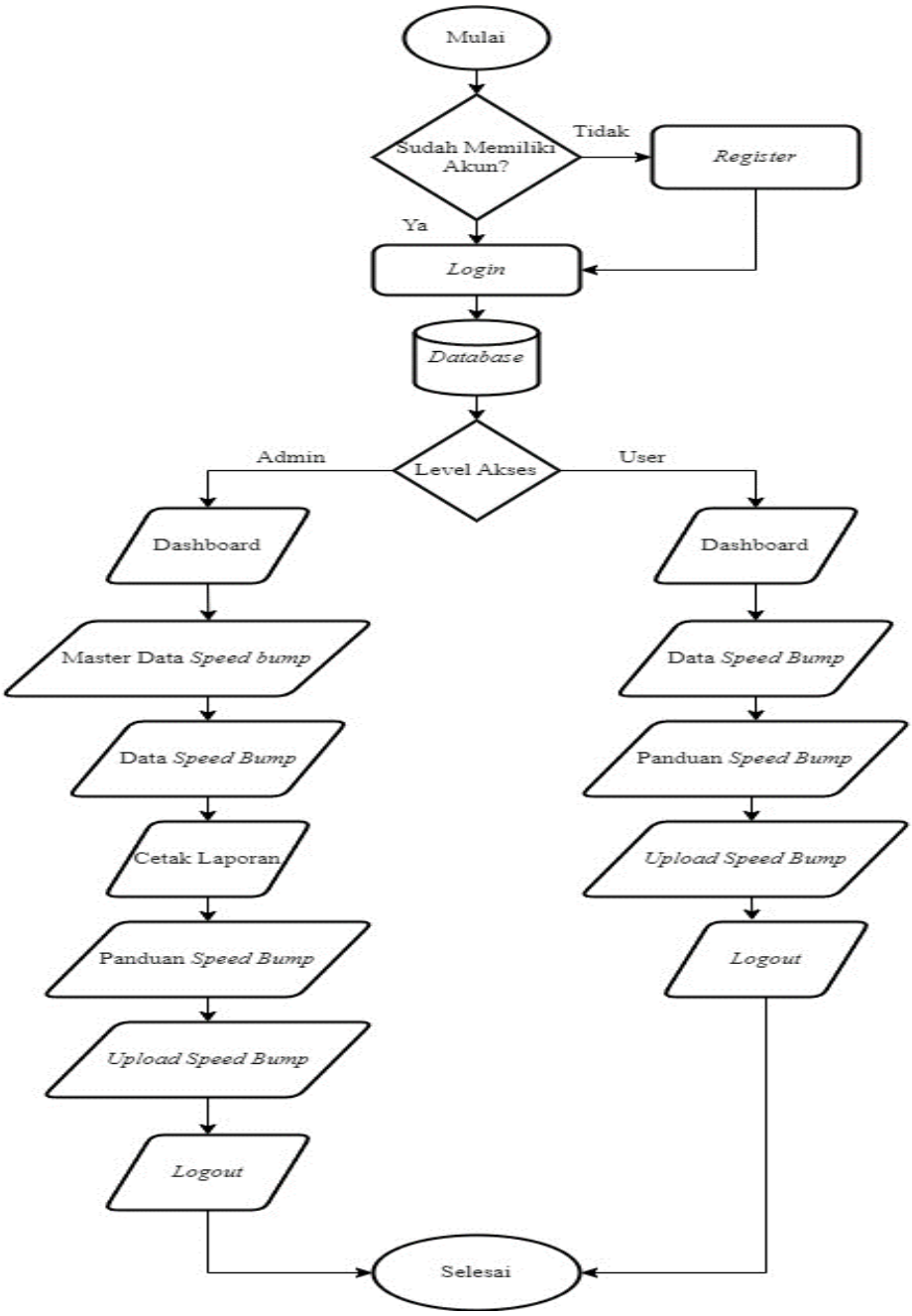

Fig. 4. Flowchart Based Speed Bump MappingWeb

ISSN No:-2456-2165

III. EXPERIMENTAL RESULTS

This stage is tool testing carried out on creation of a "Web Based Speed Bump Mapping System". The results of this test are to determine the results of planning, analyzing system weaknesses, compare the accuracy and results of the test with thoseplanned. The tests carried out are as follows:

A. Data Delivery Speed Testing

This test is carried out to determine speed shipping data originating from speed bump detection tools go to the database server. The test method is carried out by compare the data transmission times that are on terminal detection tool with reception time from database servers. Scheme and Results of delivery speed testing data can be seen in Figure 5 and Table 1.

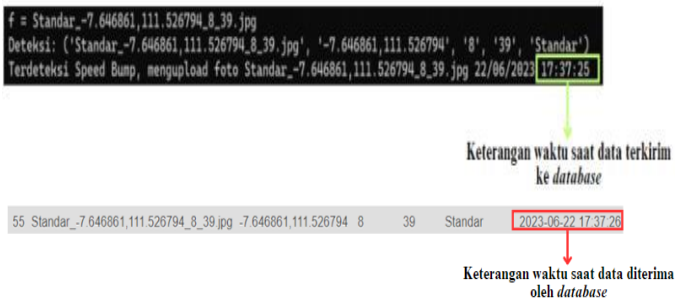

Fig. 5. Data Delivery Speed Testing Scheme

TABLE I. DATA DELIVERY SPEED TEST RESULTS

No	Data sending time detection tool	Time received server database	Delay (second)
1	22/06/2023 17:37:25	2023-06-22 17:37:26	1
2	22/06/2023 17:38:15	2023-06-22 17:38:16	1
3	22/06/2023 17:39:01	2023-06-22 17:39:02	1
4	22/06/2023 17:42:23	2023-06-22 17:42:24	1
5	22/06/2023 17:43:32	2023-06-22 17:43:34	2
6	22/06/2023 17:44:14	2023-06-22 17:44:15	1
7	22/06/2023 17:45:12	2023-06-22 17:45:13	1
8	22/06/2023 17:45:46	2023-06-22 17:45:48	2
9	22/06/2023 17:46:14	2023-06-22 17:46:15	1
10	22/06/2023 17:46:47	2023-06-22 17:46:48	1
Average			1,2

The results of the speed and reception of data produce different time ranges, starting from 1 second and no later than 2 seconds. This depends on connectivity internet network in the area. There was a delay by 1.2 seconds from 10 trials.

B. GPS Accuracy Testing with Google Maps

This test is carried out to see the accuracy of the sensor GPS when compared to Google Maps API. Testing This is done by comparing the resulting coordinates sensors with those generated by the Google Maps API. Scheme and The test results can be seen in Figure 6 and Table 2.

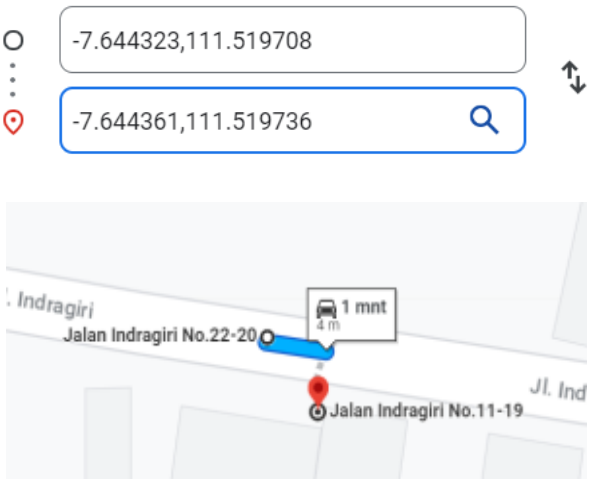

Fig. 6. GPS Accuracy Testing Scheme

TABLE II. GPS ACCURACY TEST RESULTS

Location	Raw	coordinat	Difference Coordinate
Ciliwung V	GPS	-7.646873,111.526863	10
	Google Maps	-7.647017,111.526925	1
Jl. Serayu	GPS	-7.647423,111.525712	3
	Google Maps	-7.647502,111.525697	2
Premiere Residence Madiun	GPS	-7.646627,111.525740	4
	Google Maps	-7.646605,111.525773	0
Jl Rokan	GPS	-7.645617,111.522002	0
	Google Maps	-7.645604,111.522028	10
Indragiri	GPS	-7.644323,111.519708	10
	Google Maps	-7.644361,111.519736	10
Condong Campur	GPS	-7.656991,111.521366	10
	Google Maps	-7.657010,111.521322	10
Sutoyo	GPS	-7.668921,111.528659	10
	Google Maps	-7.668912,111.528640	10
Average			5

GPS accuracy testing results produce differences accuracy at different ranges, starting from 1 meter up to 10 meters. Of the 10 testing sites different results in an average error or difference of 5 meters

C. User Interface, Database and Entire System Testings

This test is carried out to ensure the user interface, The database and the entire system are running accordingly planned. Schemes and test results can be viewed in Figures 7 to 8 and Tables 3 to Table 4.

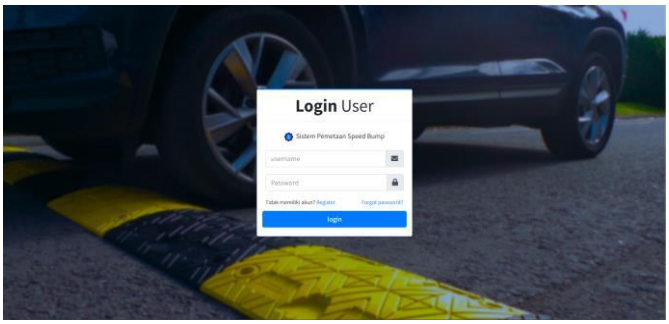

Fig. 7. Website User Interface Display

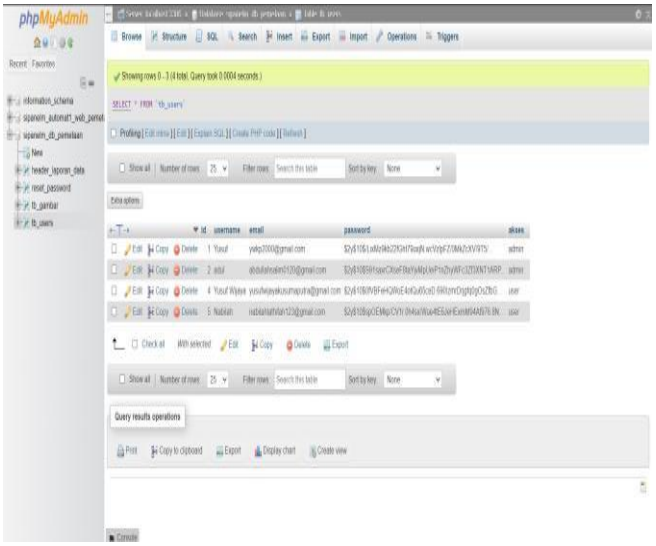

Fig. 8. Database Server

TABLE III. USER INTERFACE TEST RESULTS THAT HAVE BEEN CONNECTED TO THE DATABASE

No	*Input Data*	*Data pada Database*	*Result*
1	Yusuf, ywkp2000@gmail.com, yusuf2000, yusuf2000	Yusuf, ywkp2000@gmail.com, $2y$10$/LixMz9 kb22fGht79uxjN. wcVzlpFZ/0MkZ cXV/9T5/p6gc4h dG.6	appropirate
2	adul, abdullahsalim0120@gmail.com, 1234, 1234	adul, abdullahsalim0120@gmail.com, $2y$10$S91saxrC XseF8taYjvMpUe iP1nZhyWFc3Zf3	appropirate

		XNT1ARPHlqOz QS5da	
3	Yusuf Wijaya, yusufwijayakusumaputra@gmail.com, 1234, 1234	Yusuf Wijaya, yusufwijayakusumaputra@gmail.com, $2y$10$0fVBFe HQWoE4otQu65 ceD.690IzmrDrjgf q0gOsZfbG4b00i Ox6lK	appropirate
4	Nabilah, nabilahlathifah123@gmail.com, 778899, 778899	Nabilah, nabilahlathifah123@gmail.com, $2y$10$spOEMk p/CV1r.0h4sx/Wu e4tE6JeHExmM9 4Af976.8NrsRvlN NnWu	appropirate

TABLE IV. OVERALL SYSTEM TEST RESULTS

No	*Testing*	*F*	*N*
1	Sending dummy data to server database	√	
2	Retrieving data from the database displayed on the website	√	
3	Sending data from the website upload feature to the server database	√	
4	Login page	√	
5	Register page	√	
6	Dashboard page	√	
7	Speed bump data page	√	
8	Print report page and download	√	
9	Speed bump guide page and download	√	
10	Upload Speed bump page	√	
11	Logout	√	

F means works , N means no works. Based on this test, the website is ready runs the user interface well and is connected on the database. Then the data received by the database with the data entered by the user is appropriate and does not exist differences as well as on testing the entire system, throughout The features contained in this research can already be implemented well and functioning.

IV. CONCLUSIONS

After doing an in-depth study of several things like testing each feature on the website then based on the background and mapping data speed bump that has been carried out in the manufacture of this tool So it can be concluded from this scientific article, including:

Media tracking or speed bump mapping usesSIM808 sensor module connected to Arduino Uno to capture latitude and longitude coordinates speed bump in real time which is then sent via serial communication to the Nvidia Jetson Nano. Results The tracking is stored in the database as well displayed in the form of Google Maps API mapping with an average sensor reading error difference of 4 meters from five different testing sites. Can It is concluded that the website can do it speed bump mapping on Google Maps API with the difference in sensor readings is 4 meters.

The conversion results will be displayed in the form of a pin point which, if previewed, will display window info data speed bump detection results. Can concluded that the speed bump mapping website is in place can display the location of speed bumps on Google Maps API from the SIM808 sensor module found in the dashboard feature.

In sending the speed bump coordinates start with SIM808 sensor module captures satellite signals and detecting coordinates, the results of these coordinates are processed Arduino Uno and sent via serial communication to Nvidia Jetson Nano and finally saved on The database server uses File Transfer Protocol (FTP). Results of the speed of sending detection data is 1.2 seconds with 10 tests. It can be concluded that from the results of delivery testing speed bump coordinates are acceptable at database server with an average delay of 1.2 seconds out of 10 testing times, for data transmission speed depends on internet network connectivity on that area

The features on the website are working properly with a plan. Then the data on the website will continue updated if there is internet. So with there are several additional features such as printing reports and speed bump data that can be accessed in real time can complement the weaknesses of some studies previously which also discussed detection tools speed bump or information and mapping system. It can be

concluded that the website has been able to do it runs all the features in it, such as print report feature, upload speed bump, speed guide bump, mapping in the form of Google Maps API, and speed bump data table

.

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