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Applications of Ultrasonic Sensor Early Warning System Crash Due to landslide On Train

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Abstract

Transportation accidents on the railways to the attention of all elements of the government, the public because it could memaka soul as occurred in Greater Jakarta, West Java, Central Java, East Java, for example, the incidence of railroad traffic. The cause of the accident because of the location of heavy rain and soil in the landslide. The purpose of this study was to design an early warning ultrasonic sensors on the railway line and test the early warning valiadasi accelerometer sensor on the railway. Methods used in realtime with data acquisition Ardino microcontroller connected to the ultrasonic sensor (PING) as a tool to measure the distance of the object level altitude avalanche order to be more effective. It can be concluded that the early warning system (early warning system) works digitally, realtime, and effective response to the reading of less than 1 second, the average error penbacaan ultrasonic sensor is 0 to 0.68%.

Keywords: ultrasonic sensors, early warning, landslides, train

Introduction

Disasters can be caused by natural events (natural disaster) or an act of man (man-made disaster). Factors that could cause disasters: natural hazards (natural hazards) and danger caused by man (man-made hazards), which according to the United Nations International Strategy for Disaster Reduction (UN-ISDR) can be grouped into geological hazard, hazard hydrometeorological, biological hazards, the danger of technology (technological hazards), and environmental degradation vulnerability, high of communities, infrastructure and elements in the city / area at risk disaster low capacity of the various elements within the community

Geographically, Indonesia is an archipelago located in the juncture of four tectonic plates, the Asian Plate, Australian Plate, plate Indian Ocean and the Pacific Ocean. In the southern and eastern parts of Indonesia are volcanic belt (volcanic arc) that extends from the island of Java, Sumatra, Java - Nusa Tenggara, Sulawesi, which sides old volcanic mountains and lowlands partly dominated by swamps. The condition is a high potential and prone to disasters such as floods and landslides. Such climatic conditions coupled with the surface topography and rock are relatively diverse, both physically and chemically, generating fertile soil conditions. Instead, it may cause some bad consequences for humans such as hydro-meteorological disasters such as floods, landslides, forest fires and drought. Along with time and growing human activity, environmental degradation tends to get worse and lead to increasing the number of events and intensity of hydro-meteorological disasters (floods, landslides and drought), which occurs in turns in many regions in Indonesia. In 2006 alone occurred landslides and flash floods in Jember, Banjarnegara, Manado, Terri and some other areas. Although development in Indonesia has been designed and are designed with minimal environmental impact, the development process nevertheless caused damage to the environment and ecosystem. On the other hand the rate of development

resulting in increased public access to science and technology. However, due to lack of precise policy on the application of technology, technological failure with often fatal accidents such as rail transport. With the above considerations it would need for tools that can detect landslides. By using the early warning system is expected symptoms naturally arising in connection with natural disasters such as landslides can be detected as early as possible. Thus the possibility of casualties due to landslides can be avoided.

The State of the art or previous studies are related research is Prawiroredjo K 2008 produces an ultrasonic sensor module PIN distance of 2 m with either of the objects, Iswanto 2009 discusses landslide sensor with a pulse generator, Dandun 2015 Widhiantoro detect ground movement discussed the potential landslide with ultarsonik sensor with a distance 0-768 cm and a distance of 1 cm 2 cm of data unreadable. M Andayani et al 2016 discuss, Azzam Firdaus in 2016, discusses the function of ultrasonic sensors SRF-04 to detect the arrival of the train mengaftifkan time count, Dhimas IS et al 2016 about an ultrasonic sensor as a distance measuring device perdeitk so it can know the speed of the train, James Barshinger et al, 2016 to work for manual ultrasonic and radiographic widely used to measure the integrity of the assets to relegation-thick walls.

The Objective it is ultrasonic sensors Designing an early warning system for railway accidents, both to test the sensors ultarsonik for an early warning system in the train crash.

Research methodology

Application design in a landslide early warning system there are several stages, namely:

1. Designing an early warning system crash due to a landslide on the railway.
2. To assess the effectiveness of early warning system software at railroad crossings through testing - testing that has been prepared.

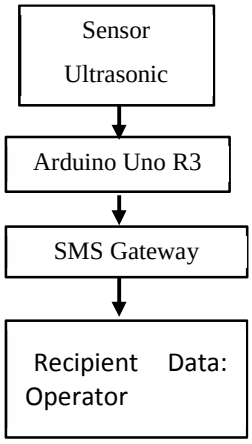

Figure 1. Integration sensor with microcontroler

Arduino microcontroller connected to the ultrasonic sensor (PING) as a tool to measure the distance of the object level altitude landslides and accelerometer sensors as tools for measuring slope angles. Data processing such as elevation, slope angle made by the microcontroller as per the order desired by the user, after which the data will be sent in the form of SMS to the driver via a GSM modem in case of landslides, and SMS notification indicator as an indicator of the occurrence of landslides.

In this study used tools and materials as follows: Parallax PING Ultrasonic Sensor 2.1, Ultrasonic sensors are used to measure altitude avalanche object is an ultrasonic sensor PING parallax, had 4 feet of the pin include a trigger pin, pin and pin VCC to ground voltage, can be seen in the picture.

Figure 2 Parallax PING Ultrasonic sensors

Specifications ultrasonic sensors:
1.Measurement range 3 cm - 3 m.
2.Input -positive TTL trigger pulse, 2US min., 5US typical.
3. Echo hold off 750uS of the fall of the trigger pulse.
4. Delay before next measurement 200uS.
5. Burst indicator LED to show activity sensor.

There frees microcontroller interrupt function of time wasted to collect data (continuous polling data), an interrupt can be set to. generate an interrupt trigger signal (wakeup interrupt signal) of one or a combination of events (event-driven interrupt) that enables these sensors to monitor the condition while in power saving mode, thus this module is very suitable for use in portable electronic devices are powered by batteries.

2.3 Arduino Uno R3

Arduino Uno R3 is a microcontroller board based ATmega328. The Arduino Uno Have 14 input pin of digital output, 6 pin input can be used as PWM outputs and 6 analog input pin, 16 MHz crystal oscillator, a USB connection, a power jack, ICSP header, and a reset button. To use the Arduino simply connect the USB cable from the computer to arduinonya, but it can also use the adapter and battery. For arduino programming language using the C language and open source. Specifications Arduino Uno R3:

1. The microcontroller ATmega328
2. Operation with 5V power
3. Input voltage (recommended) 7-12V
4. Input Voltage (limits) 6-20V Digital I/ O Pins 14 (6 provide PWM output)
5. Analog Input Pin 6
6. DC Current per I/O Pin 40mA
7. When 3.3V Pin 50 mA DC, Flash Memory 32 KB (ATmega328) which 0.5 KB used by booloader
8. SRAM 2 KB (Atmega 328)
9. 1KB EEPROM (ATmega328) and 16 MHz Clock Speed

Figure 3 Microcontroller Arduino Uno R3

Arduino Uno R3 can be powered via the USB connection or with an external power supply (automatic). External (not USB) power can come either from the AC-to-DC adapter or battery. The adapter can be connected by plugging a jack plug positive center measure 2.1 mm connector POWER. The head end of the battery can be inserted into the GND and Vinpin header from the power connector. The range of power requirements suggested for the board Uno is 7 to 12 volts, if given a power of less than 7 volts possibility of pin 5V Uno can operate but unstable then if given more power than 12V, the voltage regulator could overheat and damage the board arduino uno.

Gambar 4 Mikrocontroller Arduino uno R3

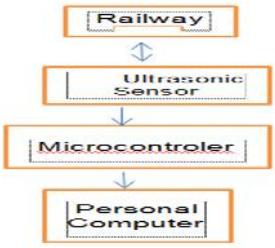

Figure 5 ultrasonic sensor testing program with the PC hardware

In figure 4 is a PC with hardware integration program in which the microcontroller is connected to the PC using a serial cable DB9 male to USB type. The reading of the tilt angle can be displayed on the monitor using the serial arduino generation software 1.6.5. hardware resources early warning system is derived from the voltage PC, different after the program uploaded to the hardware will use its own power supply. This programming running on a PC with an operating system windows 7 ultimate version

3.Results and Discussion

Testing Ultrasonic Sensor

Rollmeter testing ultrasonic sensors use as a comparison value to obtain an error value. By providing third distance value as parameter measurement of 50cm, 100cm, 150cm. The measurement results appear in the serial monitor.

$$E = \frac{(S \quad r \quad r)}{s \quad r \quad r} - \text{x The Final Value } 100\%$$

[15].....(2)

Tabel 2 Data *error* sensor ultrasonic

No	The results of sensor readings (cm)	The final value of the actual (cm)	*Error*
1	49	50	0.68%
2	50	50	0.68%
3	50	50	0.68%
4	100	100	0.00%
5	100	100	0.00%
6	100	100	0.00%
7	150	150	0.00%
8	150	150	0.00%
9	150	150	0.00%

Based on the average results of testing ultrasonic sensors in Table 2 can be seen that the measurement object surface landslides using ultrasonic sensors have an average percentage error of 0.68%. Errortime begins at a distance of 50 cm. In determining the value of the error percentage ultrasonic sensor readings by formula determination errors ultrasonic sensor readings are considered absolute positive values although the calculation result is negative because in this calculation the researchers just wanted to know the difference between the value of the ultrasonic sensor readings with measurements manually using the meter. When viewed from the average yield testing ultrasonic sensors contained in Appendix only 0-1 cm difference in measurements made by the measurement of ultrasonic sensors manually, it can still be tolerable for a system that works in real time and quickly

Discussion

Based on the results of testing early warning system for landslides, in Table 3 can be seen the results of ultrasonic sensor readings with the object surface conditions loosened artificial avalanche container in danger of landslides. Tests 1 to 27 early warning system for landslides, the distance to the object sensor reads 50cm, 100cm and 150cm appropriate knowledge base embedded programmable. And then micro modem will enable the team to send an SMS as a confirmation or a direct warning to the operator.

Conclusion

Based on the results of the design and testing of ultrasonic sensor to the early warning system crash caused by landslide-based microcontroller arduino it can be concluded: the first, The result of the design of ultrasonic sensors and The secound, Results of testing the average percentage error (error) on the accelerometer sensor readings ranged from 1 to 3.84% and the percentage of errors in ultrasonic sensor is still below 5%.

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