GPS-based fire detection system (Global Positioning System) and SMS Gateway

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Abstract. This research aims to produce a GPS-based fire detection system (Global Positioning System) and SMS Gateway. The benefits of this detection system can detect early fire occurrence based on the detection of temperature conditions by accommodating the nature of the fire and able to detect any rise in temperature caused by the existence of the fire. This detection system must also be able to read any smoke produced by a fire. To realize the system, required sensors capable of reading the temperature and smoke. The Arduino Uno microcontroller is the brain control system of the system. At a temperature of > 35 °C, the system will activate the DHT 11 and MQ 2 sensors that detect smoke > 50 ppm from fire. The system will activate Buzzer as a warning in the form of the next alarm sound Global Positioning System (GPS) will provide information in the form of coordinates of the location of the point of fire through GSM SIM900 Module Short Message Service (SMS) to the user. The results obtained mq2 = 128 ppm and temperature value = 38 °C and GPS data with latitude of -3.04798388 and a longitude of 104.78263092. From the data it is seen that the mq2 value reaches > 50 ppm and the temperature value reaches > 35 °C, and the detector outputs buzzer sound and warning notification of coordinate point in the form of SMS containing the message "FIRE available" with the coordinates of the location of the fire detected by GPS.

1. Introduction

Fire is a disaster that can be caused by human factors, technical factors and natural factors that cannot be estimated when the occurrence. Fires that occur almost always caused by human activities, such as clearing land by burning the forest. Forest fires are a frequent fire in Indonesia [1].

The delay in knowing a fire is very fatal to the safety of the human soul and property. Previously, fire detectors were created with smoke detectors [2]. The sample used is transparency in lieu of smoke. The main component of this tool is the sensing that will convert the physical beam of light beam to an analog voltage signal, a transistor as a switch, a thread as a memory (latch), a multivibrator that will generate pulses and loudspeakers that produce sound as output. How the fire detector works with this smoke detector depends on the amount of light intensity received by the sensor. The sensor is the LDR (Light Dependent Resistor) which is inserted in the smoke cell [3]. The smokes cell is a box that smoke easily penetrates. In addition to LDR, on smeared cells are also installed light-emitting diodes. Sensory testing is done by inserting transparency in place of smoke in smoke cells that contain LED and LDR. The test results show that the sensor works in accordance with its function that is as a forming pulse are low and high logic [4].
The fire monitoring system should be able to accommodate the nature of the fire. By utilizing LM35 sensor that serves to observe the temperature rise [5] and AF30 sensor to observe the existence of smoke around it can be made by detecting temperature and smoke by using LM35 sensor and AF30 sensor based on microcontroller AT89S51 and equipped facility of sending SMS if dangerous situation or existence of indication will happen fire. In the test, by heating on the temperature sensor, side up to 55° Celsius, by providing thick smoke (cigarette smoke and combustion smoke gathered paper) [6].

In this research will be in Design of Fire Detection System based on GPS (Global Positioning System) [7,8] and SMS Gateway [9]. This fire detection system to be designed can detect early fire occurrence based on the detection of temperature conditions by accommodating the nature of the fire and able to detect the temperature rise caused by the existence of the fire. In addition, the system must also be able to read any smoke generated by the fire. To realize the system, required sensors capable of reading the temperature and smoke. This system is also equipped with a GPS system as a teller point to the coordinates of fire [10] to the user sent via short message (SMS) and buzzer as an alarm notification to the people around the place of fire.

2. Research methodology
The research method is illustrated in the form of block diagram as in the following figure.

![Figure 1. Research methodology.](image)

Observation, field study, and literature study through books and articles from the internet, through the literature conducted on data collection. In the design of fire prediction system is required hardware and software components. The main hardware is Arduino ATmega328 [11], DHT11 temperature sensor [12,13], MQ2 smoke sensor [14] and supporting hardware such as GPS NE06MV4, GSM Module SIM 900 [15], buzzer, power bank solar cell. While the software used is programming algorithm using C language programming. The design results are tested and followed by data retrieval / research variables that include testing DHT11 temperature sensor, MQ2 smoke sensor testing, and fire point coordinate testing are sent by SMS.

The following is the block diagram of the circuit:
2.1. The working principle of the tool

Arduino Uno microcontroller is a brain control system work, where the microcontroller program application fire detection based on the detection of temperature conditions that must be able to accommodate the nature of the fire. Arduino Uno microcontroller must be able to detect any temperature rise caused by the existence of the fire. In addition, the system must also be able to read any smoke generated by the fire. At a temperature of > 35 C, the system will activate the DHT 11 and MQ 2 sensors that detect smoke > 50 ppm as a result of a fire fire, as input of the program input. The system will activate Buzzer as a warning in the form of alarm sound and then Global Positioning System (GPS) will provide information in the form of coordinate point of location of fire through SIMSI GSM Module in the form of Short Message Service (SMS) to the user.
3. Results and discussion

Figure 5 Shows the results of electronic design, software and mechanics that is the overall assembly of GPS-based Global Positioning System (GPS) and SMS Gateway. Electronic design includes all stages that are directly related to a system designed among them is to determine the properties and specifications of the tool, component selection, component installation and soldering. In designing software, input obtained from sensor then processed Arduino and output in the form of SMS which adjusted to program Arduino. In the mechanical design includes the selection of boxes to be occupied by a component, drilling, and the making of the box so that the desired tool.
3.1. Coordinate point notification via SMS when detected fire and smoke

In figure 6 above is the message content of the coordinate point notification when a fire occurs. Coordinate point on the above notification is -3.05,104.78. Where the coordinate point consists of latitude, i.e. -3.05 and longitude, i.e. 104.78.

The first number is specified in the latitude coordinates between -90 and 90. While the first number is in longitude coordinates between -180 and 180.

To see the coordinates of the location is done by copying the coordinates in the notification, then open the Google Maps app and paste the coordinates in the search box at the top. Fig 7 is a coordinate location view on Google Maps.

![Figure 6. Fill message notification via SMS.](image)

![Figure 7. GPS coordinate point display in Google Maps.](image)
3.2. Display data on the Arduino serial monitor screen

![Figure 8. Display data on Arduino serial monitor screen.](image)

Figure 8 on the monitor serial display above obtained results when tested on fire simulation using wax and anti-mosquito burn, that the value \(mq2 = 128 \text{ ppm}\) and temperature value = \(38 \text{ °C}\) and GPS data with latitude -3.0479388 and longitude coordinates 104.78263092. From the data it is seen that the \(mq2\) value reaches > 50 ppm and the temperature value reaches > 35 ° C, so the detector outputs buzzer sound and warning notification of coordinate point in the form of SMS containing the message "FIRE ADA" and with the coordinates of the location of the fire detected by GPS.

| Condition                        | SMS Timeframe | Successful |
|----------------------------------|---------------|------------|
| No Fire and Smoke Detected       | No SMS        | Successful |
| Detected Fire and Smoke          | 9.9 detik     | Successful |

4. Conclusion

This automatic fire detector works when the DHT11 sensor detects a temperature rise > 35 ° C and the MQ2 sensor detects smoke with a value > 50 ppm generated by the presence of fire. When the device detects a fire the buzzer will issue an alarm sound as a warning and the GSM SIM900A module will send SMS as a notification containing the coordinate points detected by the GPS. Preferably the use of this tool is placed open space so that GPS can accurately detect the point coordinates. For further development on the tool can be added application to monitor the circumstances around the tool with real time.

References

[1] One Data Indonesia 2014 Data of Forest Fire Disaster 2011 – 2014 [online] retrieved from https://data.go.id/dataset/data-disaster-fire-forest-2/resource. Accessible date 23 March 2018
[2] Apryandi S 2013 Design Build Fire Detector System via Mobile Based Microcontroller (Pontianak: Tanjungpura University Final Report)
[3] Anonim 2014 LDR (Light Dependent Resistor) Sensor [online] retrieved from http:// basics.electronics.web.id/ component /transducer-sensor/-ldr-lightdependent-resistor/
[4] Widodo C E, Winarto and Sumariyah 2003 Making Fire Detector Equipment With Smoke Detector Periodical physics 6(3) 51-54
[5] Anunggo R S 2012 Temperature Monitoring System Based Sensor Temperature LM35 and GPS (Yogyakarta: Vocational School UGM)
[6] Usuman I and Ardhii H 2010 Temperature And Smoke Detector System In Closed Space Utilizing Lm35 Sensor And AF30 Sensor Periodical physics 13(2) B1-B6
[7] Andi 2009 Global Positioning System (Yogyakarta: Andi Publisher)
[8] Abidin H Z 2007 “GPS Positioning” (Bandung: Satellite Survey Lecture Module)
[9] Katankar K 2010 Short Message Service Using SMS Gateway *International Journal on Computer Science and Engineering* 2(4)

[10] Habibi W 2011 Development of Tracking Systems And Tracking Device Software Based Global Positioning System (GPS) On Google's Software Platform

[11] Arduino 2016 *Arduino Uno Board* [online] retrieved from https://www.arduino.cc/en/Main/ArduinoBoardUno

[12] Prasetyo 2012 *DHT11 Temperature and Humidity Sensor* [online] retrieved from http://darysiupats.lt/dht11-temperature-and-humidity-sensor.html

[13] Adi 2012 The temperature and humidity monitoring system is displayed on the LCD screen, utilizing Arduino as the brain of the system created and the DHT11 sensor as a temperature and moisture reader sensor (Yogyakarta: UGM)

[14] SeedsStudio 2011 *Gas Sensor Datasheet And Smoke MQ-2* [online] retrieved from http://www.seeedstudio.com/depot/data sheet/MQ-2.pdf

[15] Boxall J 2014 *Arduino and SIM900 GSM Modules Tutorial* [online] retrieved from http://tronixstuff.com/2014/01/08/tutorial-arduino-and-sim900-gsm-modules/