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Implementation of particulate measuring and SO_2 gas based on Android

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Abstract. In the development of science and technology in the electronics field. So it can provide inspiration in the development of measuring instruments for the measurement of SO_2 Particulates and Gas which provide economic and efficient value, so that it can be used by the public in measuring SO_2 Particulates and Gas levels in the Sidoarjo Mudflow area. The Android-based measurement system on SO_2 Particulates and Gas is an implementation of previous developments in terms of data display visible on smartphones and can be accessed remotely or anywhere connected to Wi-Fi or the internet network. So that it can easily take data in the measurement of SO_2 Particulates and Gas. The design of this tool consists of ESP32 NodeMCU as a microcontroller, Particulate (Dust) sensor and MQ136 (SO_2) sensor. Wi-Fi network or internet to facilitate communication between sensors and smartphones. The test results obtained a value of 0.104 (mG/Nm3) from the Particulate sensor with the category still at a safe level when compared to quality standards, and 15 ppm for SO_2 Gas detected around the Sidoarjo Hot Mud. This shows that the sensor is working optimally and is very sensitive at the reading level.

1. Introduction

Air is one component of the environment that must be kept clean, because it is an important source of life for living things. Air quality is maintained from pollution because it affects human health [1-3]. Air pollution is mostly caused by dust particles and various gases from industrial waste and motor vehicles, as well as mud volcanoes [4].

Hot mud overflows near Banjarpanji-1 exploration well Reno Kenongo Village, Porong District, Sidoarjo Regency, East Java, occurred since May 29, 2006. Hot mud and gas overflows with an average discharge of 7500-10000mV/day, and have a total volume of 8.4 million, called Lusi [4]. The increase in the volume of hot mud causes an impact on the respiratory health of the community, especially for residents around the site, in the form of a very strong smell of gas. Lusi is located close to the highway, this causes increased air pollution due to polluted by vehicle particulates that pass through the highway and mixed with the strong smell of gas around the Sidoarjo hot mud. Ozone, suspended particulate matter, hydrogen nitride, SO_2, CO are pollutants [5-8].

SO_2 is a substance/pollutant in the form of gas and is included in the sulfur group, has a very close relationship with respiratory disease. Therefore, WHO states that SO_2 is a pollutant that is very dangerous for human health [9,10]. The impact will get worse if humans are directly exposed to particulate pollutants, because SO_2 and these particles can cause a synergistic effect on humans [11]. This synergistic effect is a greater total effect and is often caused by two components compared to the effects arising from each component [11-13].

This study implements particulate and SO_2 content measurement at locations around the Sidoarjo hot mud to monitor and control air pollutants. This measuring instrument uses a Dust Sensor as a particulate detection sensor and MQ136 as a SO_2 sensor. The output from this sensor will be sent to the NodeMCU ESP32 microcontroller to be processed and then made to control particulates and SO_2 gas that has been set up remotely based on IoT [14-20].

2. Method

Implementation of SO_2 particulate and gas levels using the NodeMCU ESP32 microcontroller, this microcontroller uses Arduino and Android software to measure the levels of ambient particulates and SO_2 gas in Sidoarjo hot mud. Figure 1 explains the diagram of the device made.

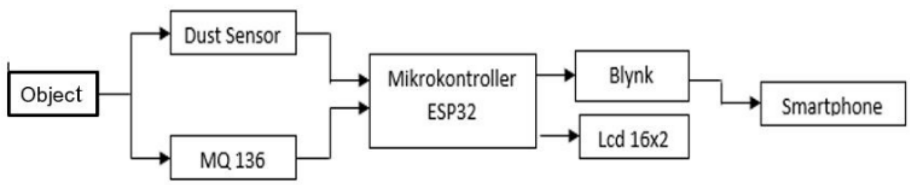

Figure 1. Block diagram.

The process of sending data starts from a sensor that is read by a NodeMCU ESP32 microcontroller. After the sensor is read by the microcontroller, the read data will be sent to the Web Server using a Wi-Fi network. After the Web Server gets the data, the android smartphone will read the data in the Web Server. So the results of the data sent by the microcontroller can be seen on an android smartphone by passing the Blynk application.

3. Results and discussion

The general picture that is developed can be seen in Figure 1. Block Diagram which includes (1) Dust Sensor (dust) and MQ136 (SO_2) measuring the object to be determined, (2) NodeMCU ESP32 microcontroller as a media of data communication and data processing, then sending sensor readings results to Blynk and LCD equipment, (3) Blynk then sends data to the smartphone in the form of data from the NodeMCU ESP32 Microcontroller, (4) Smartphone displays data in the form of numbers received.

The connection design can be shown in Figure 2. is an overall circuit showing the relationship of each overall circuit of the device consisting of a series of particulate sensors (Dust Sensor), SO_2 gas content sensor (MQ136), 16x2 LCD and ESP32 Microcontroller.

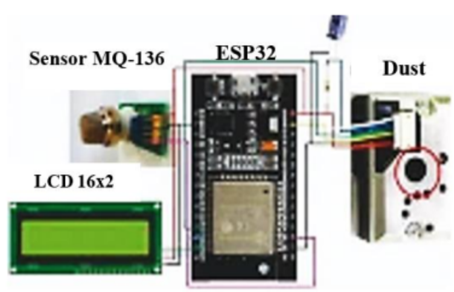

Figure 2. Overall sequence.

The microcontroller uses the NodemCU ESP32 which gets input from 2 sensors namely the sharp GP2Y1010AU0f particulate sensor and the MQ136 sensor. On the output there is one output that is LCD 16x2 inches. To get measurement data this tool uses a 16x2 LCD and Blynk webserver. The data will be processed by a microcontroller and will be sent to Blynk on condition that the system is connected by the internet. The data displayed in the measurement are in the form of graphs. The measurement results of Dust Sensor with point of measurement location are shown in Table 1 and the display of measurement results in graphical form is shown in Figure 3.

Table 1. Dust sensor measurement results.

No	Smartphone	Trial Time									Place Description
		Day & Date	Time	Dust quality standard (mg/Nm³)	Point 1 Dust (mg/Nm³)	Point 2 Dust (mg/Nm³)	Point 3 Dust (mg/Nm³)	Weather	Average Dust Per point (mg/Nm³)	Dust Deviation Standard (mg/Nm³)	
1				0,26	0.23	0.13	0.08		0,16	0,0031	First point (Next to the northern corner of the hot mud 500 m distance)
2			08.00	0,26	0.13	0.26	0.16	Bright	0,146	0,011	
3				0,26	0.14	0.05	0.14		0,126	0,0015	
4				0,26	0.01	0.02	0.13		0,013	0,000035	
5		6-4-	14.00	0,26	0.01	0.02	0.22	Cloudy	0,02	0	
6		2019		0,26	0.02	0.02	0.02		0,123	0,01	
7				0,26	0.15	0	0		0,096	0,0042	
8			19.00	0,26	0.02	0	0.03	Drizzle without wind	0,003	0,000033	Second point (West hot mud distance of 250m)
9	Oppo A71			0,26	0.12	0.01	0.1		0,043	0,00275	
10				0,26	0.01	0.2	0.10		0,09	0,0097	
11			08.00	0,26	0.2	0.03	0.07	Bright	0,14	0,0091	
12				0,26	0.06	0.19	0.08		0,083	0,00023	
13		7-4		0,26	0.05	0.13	0.05		0,096	0,0032	
14		-2019	14.00	0,26	0.08	0.12	0.14	Bright	0,13	0,0001	The third point (in front of the Tanggulangin train station 800m distance from the hot mud)
15				0,26	0.16	0.14	0.13		0,106	0,0024	
16				0,26	0.03	0.13	0.13		0,103	0,00675	
17			19.00	0,26	0.16	0.08	0.14	Bright	0,113	0,0008	
18				0,26	0.12	0.13	0.6		0,29	0,072	
	Average								0,104	0,0043	

Dust Sensor measurement results are tested for two days at 08.00, 14.00, and 19.00 at three points of measurement location, each location point is tested three times by taking into account the direction of the wind and weather. Dust measurements were carried out at three locations near the Sidoarjo hot mud location with the testing standard. The measurement results obtained the smallest average with a value of 0 (mG/Nm³) and the largest 0.29 (mG/Nm³), for the smallest data at a standard deviation of 0 (mG/Nm³) and the largest 0.01 (mG/Nm³) in Dust Sensor.

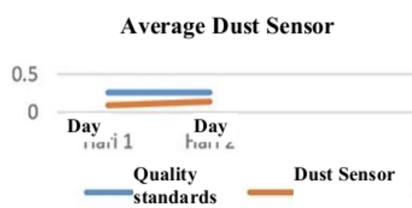

Figure 3. Dust sensor average graph.

Table 2 is the result of the MQ136 sensor measurement, where the average SO_2 gas measurement results obtained 16.20 ppm with a standard deviation of 3.96 ppm. So it can be said MQ 136 sensor is running well and according to the measurement results at each location point, the weather conditions and the direction of the wind that occurs around the measurement location makes the sensor better at detecting the presence of SO_2 levels. The measurement results obtained by the SO_2 content data in Sidoarjo hot mud with the location of the measurement point is shown in Table 2 and the display in graphical form is shown in Figure 4.

Table 2. SO_2 measurement results.

No	Smartphone	Trial Time								Place Description
		Day & Date	Time	Point 1	Point 2	Point 3	Weather	Average	Standard Deviation	
				MQ136 (ppm)	MQ136 (ppm)	MQ136 (ppm)		MQ136 (ppm)	MQ136 (ppm)	
1				38	15	25		41,6	30,34	First point (Next to the northern corner of the hot mud 500 m distance)
2			08.00	48	26	20	Bright	25	91	
3				39	34	16		20.3	20,33	
4				12	12	11		15,33	9,33	
5		6-4-2019	14.00	18	16	8	Cloudy	14,33	4,33	
6				16	15	4		7,66	12,33	
7				7	13	7		7,66	0,33	
8			19.00	8	14	9	Drizzle without wind	13,66	0,33	Second point (West hot mud distance of 250m)
9	Oppo A71			8	14	6		7,33	2,33	
10				27	38	14		26,66	132,33	
11			08.00	38	23	11	Bright	26	117	
12				15	17	12		12,33	2,33	
13				48	4	0		39,33	92,33	The third point (in front of the Tanggulangin train station 800m distance from the hot mud)
14		7-4-2019	14.00	41	0	0	Bright	1,33	5,33	
15				29	0	0		0	0	
16				11	13	9		9	3	
17			19.00	8	17	10	Bright	15	4	
18				8	15	8		9	1	
	Average							16,20	3,96	

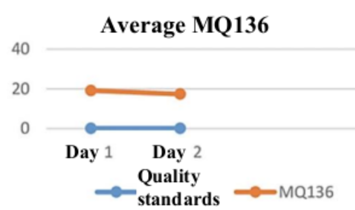

Figure 4. MQ136 average.

4. Conclusion

In accordance with the results of the implementation of an Android-based SO_2 particulate and gas content measuring instrument in weather conditions and the direction of the wind according to the specified sampling technique. The results of measurements of SO_2 particulates and gas, the communication distance of the device with an Android smartphone, the analysis of SO_2 particulates and SO_2 measurements is measured using Dust Sensor and MQ136 where the value obtained is very good or still in a safe level with an average value 0.11 (mG/Nm^3) and measurement of SO_2 levels using the MQ136 sensor obtained an average value of 16.20 ppm.

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References

[1] Syahrorini S, Hadidjaja D, Ahfas A, Rahmansyah A and Pramono S H 2018 Design Measuring Instrument Dust Based Internet of Things *IOP Conf. Ser. Mater. Sci. Eng.* **434** 1
[2] Dhoble V, Mankar N, Raut S and Sharma M 2018 IOT Based Air Pollution Monitoring and Forecasting System Using ESP8266 *Int. J. Sci. Res. Sci. Eng. Technol.* **4** 7 23–28

[3] Nasution T H, Muchtar M A and Simon A 2019 Designing an IoT-based air quality monitoring system *IOP Conf. Ser. Mater. Sci. Eng.* **648** 1

[4] Mustopa R S and Risanti D D 2013 Karakterisasi Sifat Fisis Lumpur Panas Sidoarjo dengan Aktivasi Kimia dan Fisika *J. Tek. Pomits* **2** 2 256–261

[5] Bahino J, Yoboué V, Galy-Lacaux C, Adon M, Akpo A, Keita S and Gnamien S 2018 A pilot study of gaseous pollutants' measurement (NO 2, SO 2, NH 3, HNO 3 and O 3) in Abidjan, Côte d'Ivoire: contribution to an overview of gaseous pollution in African cities *Atmospheric Chemistry and Physics* **18** 7 5173

[6] Beecken J, Mellqvist J, Salo K, Ekholm J, Jalkanen J P, Johansson L and Frank-Kamenetsky D A 2015 Emission factors of SO 2, NO x and particles from ships in Neva Bay from ground-based and helicopter-borne measurements and AIS-based modeling *Atmospheric Chemistry & Physics* **15** 9

[7] Cheng Y, Wang S, Zhu J, Guo Y, Zhang R, Liu Y and Zhou B 2019 Surveillance of SO 2 and NO 2 from ship emissions by MAX-DOAS measurements and the implications regarding fuel sulfur content compliance *Atmospheric Chemistry and Physics* **19** 21 13611-13626

[8] He H, Vinnikov K Y, Li C, Krotkov N A, Jongeward A R, Li Z and Dickerson R R 2016 Response of SO2 and particulate air pollution to local and regional emission controls: A case study in Maryland *Earth's Future* **4** 4 94-109

[9] Colvez A, Castex A and Carriere I 2003 Réversibilité de l'incapacité chez les personnes âgées: Une étude du devenir à long terme en Haute-Normandie *Rev. Epidemiol. Sante Publique* **51** 6 565–573

[10] Kaur S, Sharma S and Bawa S 2019 Smart indoor air quality monitoring system *Int. J. Recent Technol. Eng.* **8** 2 989–996

[11] Analitis A, De'Donato F, Scortichini M, Lanki T, Basagana X, Ballester F and Michelozzi P 2018 Synergistic effects of ambient temperature and air pollution on health in Europe: results from the PHASE project *International journal of environmental research and public health* **15** 9 1856

[12] Linzon S 2000 Chapter 10 Effects of sulfur dioxide on vegetation : critical levels *Office* **1** 1–17

[13] He H, Wang Y, Ma Q, Ma J, Chu B, Ji D and Hao J 2014 Mineral dust and NOx promote the conversion of SO 2 to sulfate in heavy pollution days *Scientific reports* **4** 4172

[14] Johnston S J, Basford P J, Bulot F M, Apetroaie-Cristea M, Easton N H, Davenport C and Cox S J 2019 City scale particulate matter monitoring using LoRaWAN based air quality IoT devices *Sensors* **19** 1 209

[15] Hahne M, Schumann P, Mursell M, Strehl C, Hoff P, Buttgereit F and Gaber T 2018 Unraveling the role of hypoxia-inducible factor (HIF)-1α and HIF-2α in the adaption process of human microvascular endothelial cells (HMEC-1) to hypoxia: redundant HIF-dependent regulation of macrophage migration inhibitory factor *Microvascular Research* **116** 34-44

[16] Marques G, Roque Ferreira C and Pitarma R 2018 A system based on the internet of things for real-time particle monitoring in buildings *Int. J. Environ. Res. Public Health* **15** 4

[17] Taskar P A C 2017 IOT-Enabled Air Pollution Meter with Digital Dashboard on Smart-Phone for Vehicles *Int. J. Res. Appl. Sci. Eng. Technol.* **V** X 768–771

[18] Rout G, Karuturi S and Padmini T N 2018 Pollution monitoring system using IOT *ARPN J. Eng. Appl. Sci.* **13** 6 2116–2123

[19] Jadhav A A, Biradar N, Bhaldar H, Mathpati M S, Wadekar R and Scholar R 2019 *International Journal of Innovative Research in Computer and Communication Engineering Design and Analysis of Triple Band Miniaturized Antenna for Wearable Application* 585–591

[20] Ahmed M U, Björkman M, Čaušević A, Fotouhi H and Lindén M 2016 An overview on the internet of things for health monitoring systems L*ect. Notes Inst. Comput. Sci. Soc. Telecommun. Eng. LNICST* **169** 429–436

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