ISSN NO: 2770-4491
March 2024

Intelligent Control System Determinations Of Carbon Oxide Concentration In Biogas

Ismoilov Zhamshid Shavkat ugli – master
National Research University "TIIIAME"

ABSTRACT

This article discusses the development and implementation of an automated system for determining the concentration of carbon monoxide (CO). The level of carbon monoxide plays a significant role in the sale of biogas. Therefore, accurate and reliable determination of its concentration is an important aspect in monitoring and ensuring environmental safety. The article describes the operating principle of the developed system, including the selection of sensors, measurement techniques, and automated processes for data collection and analysis. An algorithm for data processing and presentation of results is also discussed, which provides operators and researchers with easy access to information on CO concentrations.
Keywords: automation, carbon monoxide, sensors, monitoring, environmental safety, data analysis.

Introduction. The concentration of carbon monoxide (CO) in biogas is an important parameter that can affect production and the environment. For example, high concentrations of CO can be hazardous to the production process, so monitoring and controlling this parameter is important. In this article we will consider the development of an automated system for monitoring and controlling CO concentrations with data management [1]. Carbon monoxide (CO) gas analysis is important in many areas, including industry, environmental protection and safety. Carbon monoxide is a poisonous gas that can pose a threat to human health [2]. We will also consider the process of creating an automated carbon monoxide gas analysis system, starting with problem statement and ending with conclusions.

Formulation of the problem. The tasks facing an automated CO concentration monitoring system can be formulated as follows:

1. Data collection: The system must have a sensor to measure the concentration of CO in the atmosphere and a method for collecting data.
2. Data analysis: The obtained data must be processed and analyzed to determine the current CO concentration.
3. Control: If a high concentration of CO is detected, the system must take measures to prevent or control the situation.
4. Data logging: For subsequent analysis and monitoring, it is necessary to maintain a log of CO concentration data.
5. Visualization and presentation of data: The system must provide data visualization to the user [3].

Problem solving. Let's look at the steps to solve problems associated with an automated CO concentration system:

1. CO Sensor Selection: The system must be equipped with a CO sensor capable of accurately measuring gas concentration. Sensors such as the MQ-7 or MQ-9 can be used for this purpose.
2. Analog Data Reading: The CO sensor typically produces an analog signal that can be read using the controller's analog input.
3. Programming in C++, which will read data from the CO sensor and analyze it. If the CO concentration exceeds a certain threshold, the controller must activate a relay or alert the user.
4. Data Logging: CO concentration data can be recorded in a file or database for later analysis [4].
5. Data Visualization: You can create an interface using software tools such as Processing or Python with Matplotlib to visualize CO concentration data.

ISSN NO: 2770-4491
March 2024

Fig.1. Gas sensor MQ-135

The MQ-135 Gas Sensor reacts to the presence of harmful gases and impurities in the air, which allows you to indirectly assess its quality. The sensor reacts to the following gases:

• carbon dioxide (CO_2)
• ammonia (NH_3)
• nitrogen oxides (NO_2)
• ethanol
• gasoline
• smoke

The sensor has two outputs - analog and discrete TTL. The voltage at the analog output varies depending on the concentration of impurities in the air 0-5 V [5]. The response threshold of the MQ135 gas sensor via a discrete output is adjusted by a potentiometer.

Characteristics:

Supply voltage 5 V	Supply voltage 5 V
Current consumption 130 mA	Current consumption 130 mA
Output signal High/Low and analog	Output signal High/Low and analog
Comparator used LM393	Comparator used LM393

C++ code for an automated carbon monoxide concentration system

```
const int gasSensorPin = A0;
const int relayPin = 7;
const int thresholdValue = 500;
void setup() {
pinMode(relayPin, OUTPUT);
digitalWrite(relayPin, LOW);
Serial.begin(9600);
Serial.println("Gas analyzer ");
}
void loop() {
int gasValue = analogRead(gasSensorPin);
Serial.print("Gas value:");
Serial.println(gasValue);
if (gasValue > thresholdValue) {
digitalWrite(relayPin, HIGH);
Serial.println("Gas detected! Relay on.");
} else {
```

```
digitalWrite(relayPin, LOW);
Serial.println("No gas detected. Relay off.");
}
delay(1000);
}
```

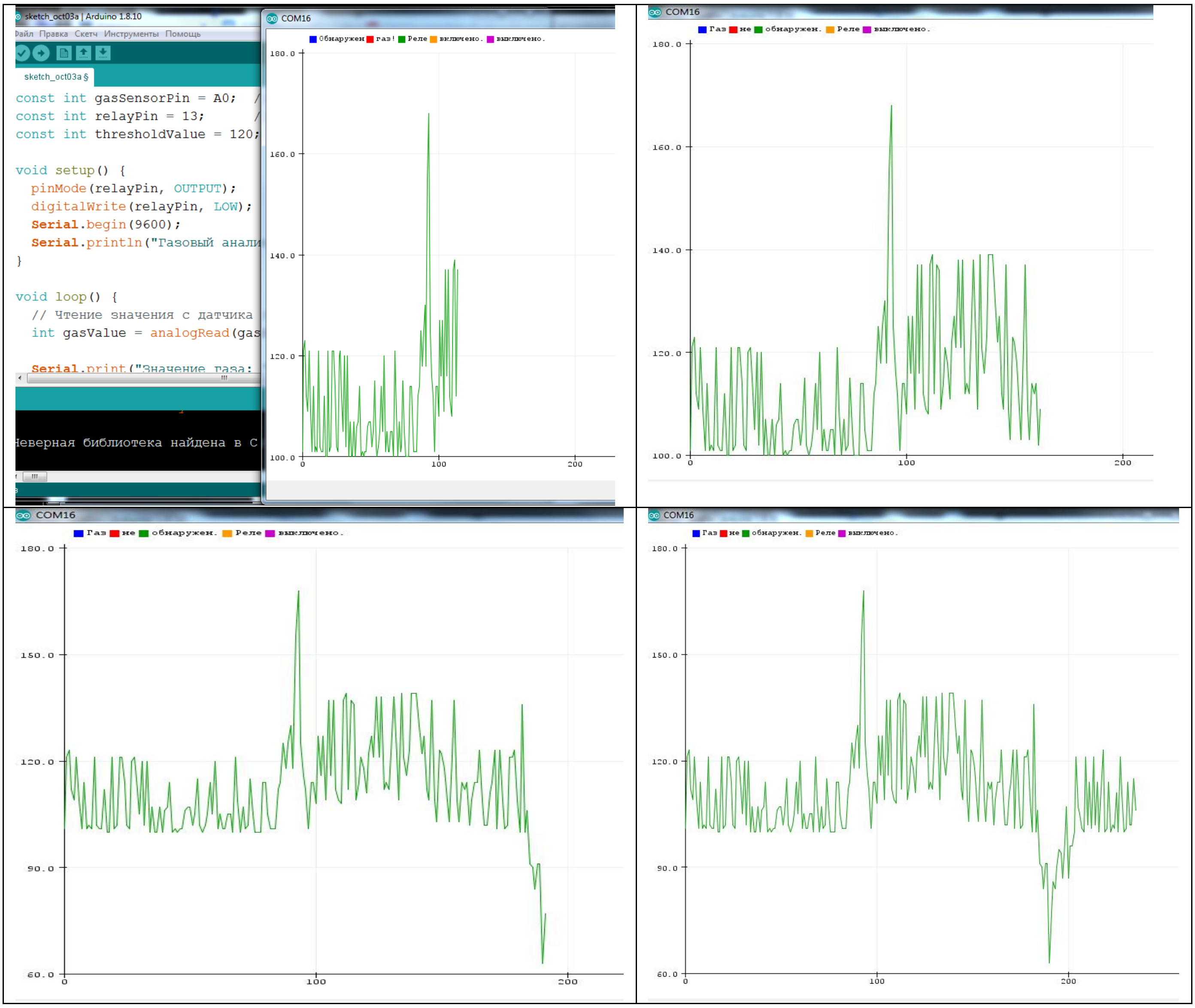

Fig.2. Experimental part of an automated carbon monoxide concentration system

Conclusions. An automated carbon monoxide concentration system is an important tool for monitoring and ensuring improved economic performance associated with biogas production, as well as safety in a variety of areas, including industrial, domestic and automotive applications. Its creation requires careful selection of a CO sensor, software development, and solving problems of data collection and analysis. With the help of a developed program and a compiled technological process, it makes it possible to improve and increase the reliability and quality of biogas production.

List of used literature.

1. Datasheet MQ-7 Gas Sensor: (https://www.sparkfun.com/datasheets/Sensors/Biometric/MQ-7.pdf)
2. Datasheet MQ-9 Gas Sensor: (https://www.sparkfun.com/datasheets/Sensors/Biometric/MQ-9.pdf)
3. Arduino Official Website: (https://www.arduino.cc/)

ISSN NO: 2770-4491
March 2024

4. Application of sensors for gas analysis: (https://www.researchgate.net/publication/273179081_Primechenie_datcaikov_dlya_gazoanaliza)
5. Methods for analyzing carbon monoxide in the atmosphere: (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4863926/)