

Design and Construction of Smart Garage Using Ultrasonic Sensor HC-SR04 and MQ-2 Gas Sensor Based on Arduino Uno

Mariza Wijayanti

Jurusan Sistem Komputer Fakultas Ilmu Komputer dan Teknologi Informasi
Universitas Gunadarma

Email: mariza_w@staff.gunadarma.ac.id

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Abstract. The trash can is a place for humans to throw garbage, but the problem that arises is the laziness of humans to dispose of garbage in its place due to the dirty cover of the trash can, besides that smelly trash cans can also disturb people around them. Therefore, a tool is designed that can work to make it easier for humans to dispose of garbage in its place, dispose of garbage that already smells bad, and help cleaners in emptying the trash in a timely manner. Smart trash cans are the answer to the problem of people's laziness in disposing of garbage, foul-smelling garbage and the delay of cleaning staff in emptying the trash. Working with Arduino UNO, this tool is expected to be able to open the trash can cover automatically and notify if the existing garbage smells bad. By using an ultrasonic sensor and providing an indicator to the cleaning staff through the sound produced by the buzzer, this tool works when the foot or garbage is within the range of the ping sensor. In addition, the Buzzer function on this tool is to notify that the existing garbage has disturbed the human sense of smell. This can help humans in disposing of their trash without touching the lid of the trash can, emptying the trash in a timely manner, and reducing humans to inhale bad odors from existing trash cans.

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1. INTRODUCTION

Along with the increasingly rapid development of the era, the need for effectiveness and efficiency is prioritized in various fields. This has encouraged humans to be creative and innovate in the field of technology to create a more effective and efficient tool to facilitate human work. The development of technology at this time can be seen with the many tools that have been created in order to provide convenience to the community in carrying out work.

Every day humans produce waste, both household waste and industrial waste in various forms and types. Poor waste management can cause adverse environmental problems. Garbage will be a problem because it can interfere with human health, cause bad smells and air pollution. The existence of trash bins doesn't seem to mean much because most people still don't understand the importance of disposing of garbage in its place.

The unpleasant smell of garbage can disturb the people around it and make them uncomfortable around them. The stench caused by piles of garbage and improper management can be a source of disease transmission and blockage of drainage channels. So some communities are needed to create a clean and healthy environment.

Trash cans found in office areas or shopping centers still use a simple way of opening and closing the lid of the trash can manually. The problem that arises is the dirty cover of the trash can which makes people lazy to dispose of garbage in its place due to the large number of bacteria found on the cover of the trash can and also the delay of the garbage cleaners in emptying the full trash can

so that garbage accumulates and is scattered on the floor.

To make a tool "Design Smart Trash Cans Using Ultrasonic Sensors HC-SR04 and MQ-2 Gas Sensors Based on Arduino Uno", it is necessary to have a theoretical basis related to the tools made so that the characteristics and working principles of these tools can be known as well as can produce the expected output. In general, this tool consists of:

Arduino is an electronic board that is open source, easy to use both hardware and software. Arduino can function like reading light input from sensors, turning on LEDs, running motors and it can also be used as publishing something online, for example with Twitter social media.

Arduino works based on a user's instructions into the microcontroller on the Arduino board in a software called Arduino Software (IDE) and the Arduino programming language as the basis for processing. Over the years Arduino has produced thousands of projects of scientific objects that are used for everyday use by several people, such as: students, artists, programmers and other professionals which can add knowledge to help a beginner.

HC-SR04 is a series of proximity sensors with ultrasonic waves, where in the sensor there are two parts, namely the receiver and transmitter which have a function as a wave generator and a wave receiver. Ultrasonic sensor HC-SR04 which has 4 pins. one VCC pin is a voltage input pin and the GND pin is offset for grounding, while the remaining two pins are triggers and echo pins that will affect the ultrasonic wave itself.

Servo motor is a device or rotary actuator (motor) designed with a closed loop feedback control system (servo), so that it can be set-up or adjusted to determine and ensure the angular position of the motor output shaft. Servo motor is a device consisting of a DC motor, a series of gears, a control circuit and a potentiometer. A series of gears attached to the DC motor shaft will slow down the rotation of the shaft and increase the torque of the servo motor, while the potentiometer with a change in resistance when the motor rotates serves as a determinant of the position limit of the servo motor shaft rotation.

The use of a closed loop control system on a servo motor is useful for controlling the movement and final position of the servo motor shaft. The simple explanation is this, the position of the output shaft will be sensed to determine whether the shaft position is exactly as desired or not, and if not, then the input control will send a control signal to make the shaft position exactly at the desired position. For more details about closed loop control systems, consider a simple example of some other applications of closed loop control systems, such as temperature adjustment in air conditioners, refrigerators, irons and so on.

Buzzer is an electronic component that functions to convert electrical vibrations into sound vibrations. Basically the working principle of a buzzer is almost the same as a loud speaker, so the buzzer also consists of a coil attached to a diaphragm and then the coil is energized so that it becomes an electromagnet, the coil will be attracted in or out, depending on the direction of the current and the polarity of the magnet, because the coil mounted on the diaphragm, every movement of the coil will move the diaphragm back and forth so that the air vibrates which will produce sound.

MQ-2 is an electronic component to detect levels of hydrocarbon gases such as isobutane (C₄H₁₀/isobutane), propane (C₃H₈/propane), methane (CH₄ / methane), ethanol (ethanol alcohol, CH₃CH₂OH), hydrogen (H₂ / hydrogen), smoke (smoke), and LPG (liquid petroleum gas).

This gas sensor can be used to detect gas leaks in homes or factories, for example to make an electronic circuit for detecting LPG leaks. By using this MQ-2 Hydrocarbon Gas Sensor, it can detect levels of hydrogen gas in the air by connecting this sensor to a microcontroller/board such as an Arduino.

The MQ-2 Gas Sensor is used to detect the presence of gas in the air. When the heating process occurs, the coil will be heated so that the ceramic SnO₂ becomes a semiconductor or as a conductor so that it releases electrons and when smoke is detected by the sensor and reaches the aurum electrode, the MQ-2 sensor output will produce an analog voltage. The MQ-2 sensor consists of three power supplies (Vcc) of +5 volts to activate the heater and sensor, Vss (Ground), and the output pin of the sensor.

The output of this sensor is an analog resistance which can easily be converted into a voltage by

adding an ordinary resistor (you can also use a potentiometer so that the detection sensitivity threshold can be adjusted as needed). By converting this impedance into a voltage, the sensor readings can be read by the ADC (analog to digital converter) pin on the microcontroller.

Servo motors are commonly used in industrial applications, besides that they are also used in various other applications such as radio-controlled toy cars, robots, aircraft, and so on.

Therefore, these problems can be overcome with a tool that can work automatically. Automation can be done using a microcontroller, in this case Arduino which has the ability to store programs. By using a microcontroller as a controller and ultrasonic sensor these problems can be overcome. Therefore, a tool called "DESIGN AND BUILD OF SMART WASTE PLANT USING ULTRASONIC SENSOR HC-SR04 AND MQ-2 GAS SENSOR BASED ON ARDUINO UNO

was made". Where this tool is useful for opening the lid of the trash can, so that hands remain hygienic, giving automatic warnings to officers in the form of a buzzer sound indicator and notifying that the existing garbage smells in the form of a buzzer sound indicator from the smell that is read by the gas sensor.

2. METHOD

Research plan or design in the sense of narrowly interpreted as a process of collecting and analysis of research data. In the broadest sense as research design includes the planning process and research implementation.

Preparation steps in making tools to turn on lights using voice command is as following:

Literature Study, The author examines the references obtained from several scientific works such as thesis journals. The library method, namely data collection and information by reading references, websites, documents. This includes research that has been appointed, related articles and journals with the object of research.

Done in consultation with the lecturer mentor to solve problems encountered during device manufacture software and hardware manufacturing. This is done by experimenting testing modules as well as integrate the module with program to control the agar system become a unified whole and obtained maximum possible results.

3. RESEARCH RESULTS AND DISCUSSION

3.1 Design and Test

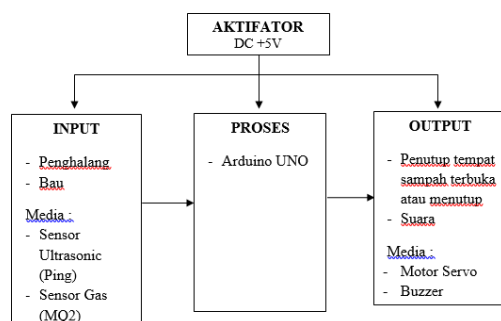


Figure 1. Tool Design in Block Diagram

In this writing, there are several stages in the process of analyzing and designing tools, including:

1. Block diagram design of the tool: in this stage the author explains the block diagram of each input input starting from the activator, input block, process block, and output block to match the desired design.
2. Detailed design: at this stage the author makes a detailed design that explains each input and output of each sensor so that the tool can work perfectly and as expected.

3. Tool Design Stage: at this stage the author explains the stages in designing a tool that explains how to connect Arduino UNO with a buzzer, connect Arduino UNO with Ultrasonic sensors, connect Arduino UNO with Servo Motor, and connect Arduino UNO with Gas Sensor.
4. Arduino Program Listing Analysis: here explains the program listing on Arduino so that the expected process can be as expected later.
5. How to operate the tool: the next step is to explain how to operate the tool, starting from connecting the tool to the power bank, until finally testing the MQ-2 gas sensor which functions as an input medium, it will capture the gas produced by the object and if the value read meets the conditions, buzzer will sound.
6. Analysis in Flowchart Flowchart: here describes the program in a flowchart that explains the flow from start to finish on the Flowchart.

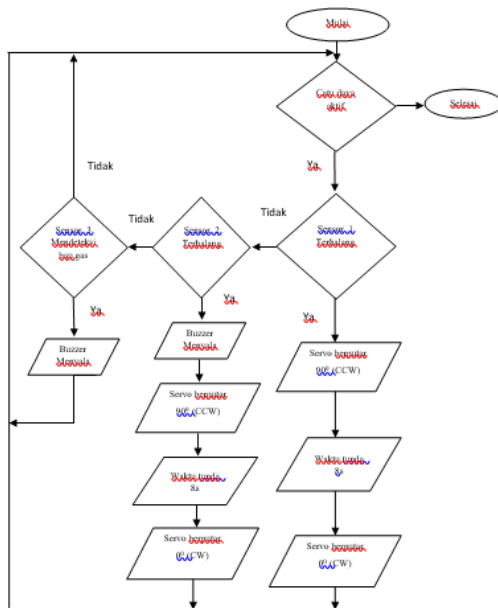


Figure 2 Flowchart

The next stage is testing the tools used, as for some tests including:

1. Observation of automatic trash bins: this test is carried out to determine the distance needed to move the ultrasonic sensor, servo in some conditions and the delay in the required servo.
2. Observation of Waste Capacity Detection: the test is carried out in several stages to see how far it is needed to move the ultrasonic sensor, buzzer, servo in several conditions and delay the servo so that the full garbage can be opened and give a warning to the available buzzer.
3. Observation of the smell of gas detection in the trash: In this test, an odor test was carried out on the garbage whether the odor could be detected properly by the MQ-2 sensor.

4. CONCLUSION

From the test results, it can be concluded that the design and manufacture of "DESIGN AND CONSTRUCTION OF SMART WASTE PLACES USING ULTRASONIC SENSORS HC-SR04 AND GAS SENSORS BASED ON ARDUINO UNO" functions properly and as desired. From the experimental results, it is concluded that this tool does its job if the object is within a distance of 5 cm, the buzzer will sound and the door in the trash can will open for 8 seconds to notify the trash can is full. If the detected distance is < 30 cm, the door in the trash can will open automatically and delay for 8 seconds to give time to dispose of garbage. In addition to the Gas Sensor, if the data obtained is > 300 then the buzzer will sound which means the trash can smells.

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