

Prototype of LPG Gas Leakage Detector Using Flame Sensor and MQ-2 Sensor

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Abstract

The conversion of kerosene use in household to gas, in addition to the decision of the Republic of Indonesia minister in relation to the movement of kerosene to gas, gas also given an affordable price, how to use it more effectively. But the public is also expected to be careful about how to use it, because the gas is explosive and leaking causing unpleasant odor (gas leak) even a more dangerous side effect is the explosion of gas cylinders. To overcome these problems then need a tool that can detect gas leakage, in order to prevent gas leakage early. Therefore the authors designed a device that can detect gas leakage by using Sensor Mq-2 and will issue sound gas alarm warning leak by Modul ISD 1760, and will stop the gas flow from the tube to the stove using a Solenoid Valve. There is also a Flame Sensor's hardware to detect a fire if there is a spark emerging and spraying water into spots that are likely to spark fire. All hardware will be in if using ATmega 328microcontroller. Monitoring can use android smartphone, with the application that can send a warning to the mobile phone

Keywords: Sensor, Relay 4 Channel, Solenoid Valve, android

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1. Introduction

The "smarthouse" technology is one realization of home automation ideals using a specific set of technologies. It's a house that has highly advanced automatic systems for lighting, temperature control, security, appliances, and many other functions. Code signals are sent through the home's wiring to switches and outlets that are programmed to operate appliances and electronic devices in every part of the house. Smart home appears "intelligent" because its computer systems can monitor many aspects of daily living. Smart house can also provide a remote interface to home appliances or the automation system itself, via telephone line, wireless transmission or the internet and android application, to provide control and monitoring via a smart phone or web browser. The growing numbers of elderly population and increasing life expectancy have brought enormous challenges to many aspects of human life, especially in health and healthcare [1]. But, in this research will be discussed about the Smart Kitchen like LPG Gas Leak Detector Using Flame Sensor And MQ-2.

LPG (Liquified Petroleum Gas) is a blend of various elements of hydrocarbon derived from natural gas, with the added pressure and lowers the temperature so that the gas turns into liquid. LPG gas users in Indonesia from various backgrounds such as housewives, to teenagers who already own live independently. They've been using LPG gas since there is a decision of the Minister of energy and Mineral resources No.: 1971/26/MEM/2007 May 22, 2007, the Government is planning the conversion of oil (kerosene) to natural gas (LPG). Program conversion switch into natural gas (LPG) that what is meant is the replacement of the use of kerosene as fuel for cooking [2].

LPG gas has a shortage in starting using them compared petroleum which will burn if it is triggered by a fire that was nearby. LPG gas storage areas should use a tube that is strong and not easy to leak. Because if the storage tube gas leaked at the time used will be flammable. As for the kerosene storage could use a conductor or a used bottles.

LPG gas that began much used by people not worth the gas cylinder producers who experience a decrease in terms of quality, so that it can cause hazard due to the lack of supervision of the gas tube products. Since the Government is planning the conversion of kerosene to LPG gas lots of events

hit the gas tubes are hazardous to people or the surrounding communities. Proven in field found a broken tube, easily corroded, dented, so it is very prone to LPG gas leaks in the tubes [3].

The explanation of this gas tube manufacturer encourages writers why how to needed the manufacture and development of gas leakage detector to minimize accidents due to gas leaks can be seen in the table sourced from The National Consumer Protection Agency

Table 1. Total List of Due Gas Leakage

No	Year	Total Cases	Number Of Victims
1	2010	33 cases	8 people died, 44 people were injured
2	2009	30 cases	12 people died, 48 people were injured
3	2008	27 cases	2 people died, 35 people were injured

Source :The National Consumer Protection Agency(BPKN)

Therefore this research wants to provide solutions on how these problems can be anticipated with LPG gas leaks in the gas cylinder by a gas sensor using a microcontroller and if they meet the conditions of detection has been determined, then it can give a warning beep first response when the condition of the gas leak, after 3 minutes there is no response from the user then a second beep alarm will appear with a greater voice, and the solenoid will be activated with the help of the relay to cut off the gas supply from the tube to the next burner if the sparks began to emerge then the fire sensor. Flame sensor will read it and will automatically be doused water towards the Sparks to minimize fire that will progressively enlarged.

A Smart phone is a mobile phone based on a mobile operating system, with more advanced computing capability and connectivity than a feature phone. Android is a software stack for mobile devices that includes an operating system, middleware and key applications. Android, by simple definition, is an operating system for many mobile phones. Android is a customizable platform that can look and feel very different on every different handsets. Android gives us tools for creating apps that looks great and take more advantage of the hardware capabilities available on each device. Android is mainly based on Linux operating system which uses java- like languages for running applications. The main purpose of using android is to send the control signals from smart phone through bluetooth. [4]

If this tool is already create then this tool fits applied to those users who have a home industry, household, food and restaurants. It is hoped this tool could be an alarm early when people are busier and less attentive to the conditions of treatment of gas cylinders, hoses, regulators, and stoves.

The explanation based on the author's research and manufacture tools micro-controllers with the title "LPG Gas Leakage Detector Tool using the Flame Sensor and MQ-2 Sensor". The existence of this tool is the author of hope can be useful to detect leaks of un-early on LPG gas cylinders.

2. Research Method

In the implementation of the research, and to facilitate solve the problems faced, it is necessary to first describe the steps needed to solve the problem. This chapter contains a thorough explanation of the problem-solving stages used in this research. The main purpose is to clarify the scope and steps - steps needed at each stage of the research. The stages of the methodology of this study are illustrated as in Figure 1 which shows the research methodology in the form of diagram.

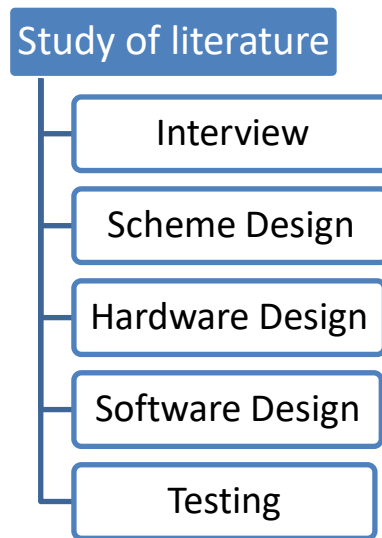


Figure 1. Research Method

Design research required in conducting research and manufacture of this tool, including the following activities:

- a. Study of literature
The use of literature in this process is done by studying concepts, data collection, in the form of theory and material, sourced from books, journals, and other sources on matters relating to the development of tools to be designed.
- b. Interview
interviews with users of gas cylinders to obtain information on the problems and expected solutions.
- c. Scheme Design
Designing schemes created as objects of analysis of the possibilities that occur when a tool is created. This is done to minimize the error of connecting some modules that are combined in a microcontroller.
- d. Hardware Design
The design of hardware is done by connecting some sensor module used in ATMega328 microcontroller.
- e. Software Design
Software design is the writing of program code that is used to make instruction to every hardware component.
- f. Testing
The test is done to know each component functioning or not functioning.

2.1 Method of data collection

Data collection was conducted in order to obtain the information needed to solve the problems that lead to an engineering. The research methodology used is as follows:

2.2 Literature Study

The use of literature in this process is done by studying the concepts, data collection, in the form of theories and materials, sourced from books, journals, and other resources on issues related to the development of tools that will be designed.

2.3 Interview

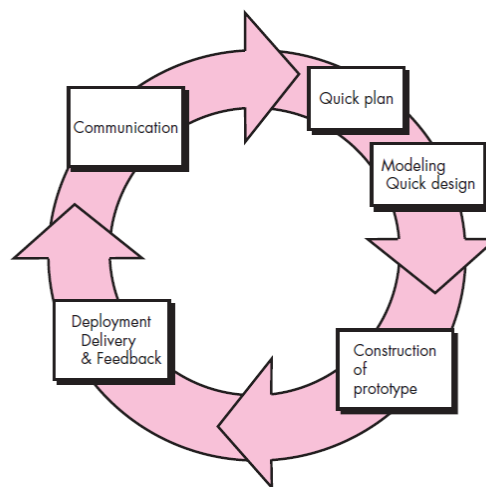
Conducted a series of discussions with the users of the gas tube to get information the problems that occur and the expected solution

2.4 Literature Studies

The use of literature in this process is done by studying the concepts, the collection of knowledge in the form of theory and materials, sources of books or other literature on matters relating to LPG Gas Leakage Detector Using Flame Sensor AndMQ-2 Sensor or anything that leads to the solution problem.

2.5 Systems Development Method

Development methods used in the manufacture of prototype LPG Gas Leakage Detector Using Flame Sensor And Solenoid Valve Based Microcontroller This is a prototype method, namely development methods and consumers can interact during the process of making the tool. The prototype method, starting with the collection of customer needs on the tool to be created, defines the overall objective of the hardware and software, identifies all the needs, and then "flash design" is focused on presenting the necessary aspects to make the customer more imaginative with what is actually desired.



Source : Pressman RS. *Software Engineering : A Practitioner's Approach, 7th ed.* Mc Grow Hill.2010. [5]

3. Results and Analysis

3.1 System Analysis

Design of research conducted in the completion of this research includes the design of hardware or hardware.

3.1.1. Software Analysis

Design and manufacture of LPG gas leak detector using flame sensor and solenoid valve based on microcontroller ATmega 328 there are some software used are as follows:

Table 2. Software Analysis

No	Name
1	Software Arduino 1.8.2
2	Software Fritzing
3	CorelDraw Graphics Suite X4
4	Android Studio

3.1.2. Hardware Analysis

The following components or materials used in the design and manufacture of LPG gas leak detection equipment using flame sensors and solenoid valve based microcontroller ATmega 328 are presented in Table 3.

Table 3. Hardware

No	NamaKomponen	Jumlah
1	Sensor MQ-2	1
2	<i>Flame</i> Sensor	2
3	Modul ISD 1820 + Speaker	1
4	Solenoid Valve	2
5	Relay 4 <i>Channel</i>	1
6	Bread Board	1
7	ArduinoUnoModul	1
8	Jumper male to male cable	3
9	Jumper male to female cable	3
10	Green Led, Blue Led, white Led	3
11	Adaptor 5V	1
12	Connectors Solenoid Valve	2
13	Power Supply 24v	1
14	USB Supply Arduino Cable	1
15	Portable Stove	1
16	Gas Cylinders	1
17	Water Hose Diameter 4mm	1
18	Single Cable	3

3.1.3 Tool Overview

The design and manufacture of LPG gas leak detector using ATmega 328 microcontroller which has the function as a processor from the input of both sensors ie, sensor mq-2 and flame sensor into several outputs. This tool will be active in its entirety if the indicator light is on as an indicator if it is active, and the gas sensor will read if there is a gas leak and transmit it to ATmega 328 microcontroller, then output from the microcontroller ie activate the solenoid to normally close, and issue a sound warning that gas is leaking from the ISD1820 module. The fire sensor will be active if there is a spark and the microcontroller will activate the solenoid valve to normally open and flush water into the spark. Monitoring can use android smartphone, with the application that can send a warning to the mobile phone.

3.1.4 Block Diagram

The block diagram is structured to facilitate the understanding of the overall workings of the entire designed circuit. From the making each block diagram created has different functions depending on how the circuit is designed, so that when combined several block diagrams will produce a working system that works in stages with more complex functions. The following block diagram in the planning and manufacture of LPG gas leak detection equipment using flame sensors and micro-controller solenoid valve of ATmega 328 is presented in Figure 2.

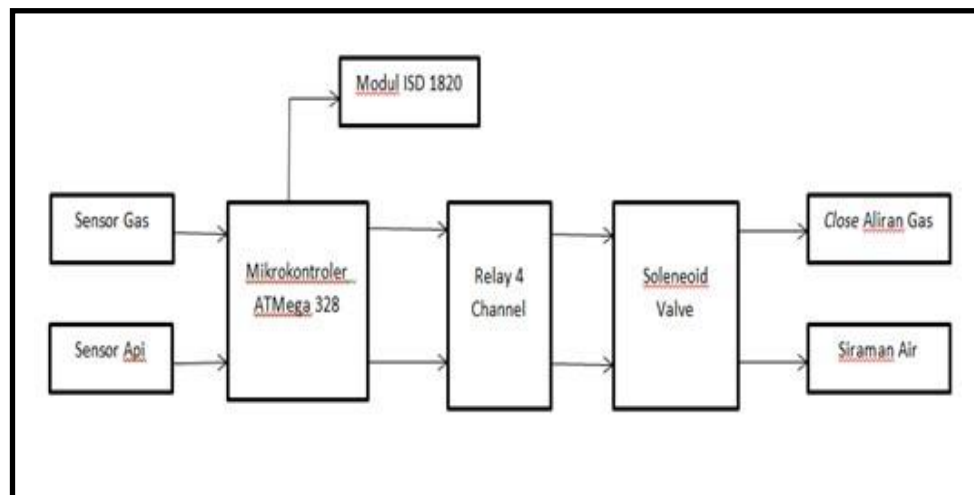


Figure 2. Block Diagram

3.1.5 The principle of work tools

The working principle is a tool designed in the preparation of this research are as follows:

1. when the sensor detects the gas leak gas or smoke will then be used as a the input to be sent to the microcontroller to be processed into several output, one of the output will use the relay which will serve to supplement the power needed solenoid.
2. Solenoid active according to command "normally open or normally closed" when one of the active sensor.
3. A warning sound to let users know if a gas leak i.e. presence of alarm sound from the sound module ISD 1820. All these instructions are stored in the microcontroller ATmega 328.

3.2 Design System

The main objective of the design of the system is to provide an overview of the design of the system to be built or developed, as well as to understand the flow of information and processes in the system. The following specified stages or steps to be made in the design of the system:

1. Sensor MQ-Series 2
2. The circuit module ISD 1820
3. The series of sensor api
4. Circuit Relay 4 Channel
5. Circuit Relay 4 Channel to the Solenoid Valve

Aside from the stages of design that has been described above, there are specifications of the tool used in the design and manufacture of gas leakage detector tool using the flame sensor and solenoid valve ATmega microcontroller-based This 328 of which were as follows:

1. There are two modules modules i.e. the Arduinouno and voice module ISD 1760.
2. There are also two sensors namely gas sensor MQ-2 and sensor APIs.
3. Use a Solenoid Valve
4. Use the 4 Channel Relay

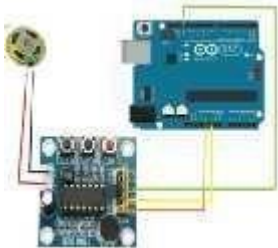
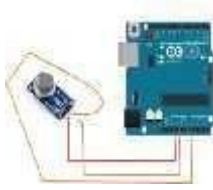
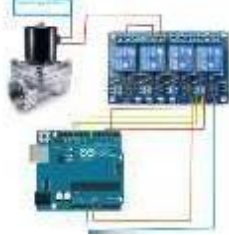
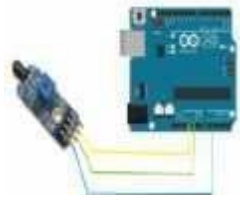

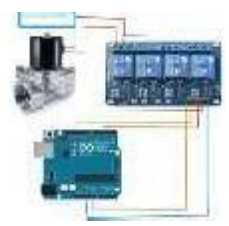
		
Modul ISD 1760	Sensor-MQ 2	Solenoid Valve For fire
		
Flame Sensor	Relay 4 Channel	Solenoid Valve Gas

Figure 3. Set Of Tools

3.3 System Implementation

The system implementation stage is based on the results obtained in system design. Making this tool starts with the process of system analysis, scheme design, hardware design, software design and tool testing. Testing tool is done by identifying problems that arise when the device is operated, in order to be repaired so that in accordance with the needs of users and the process flow that has been determined.

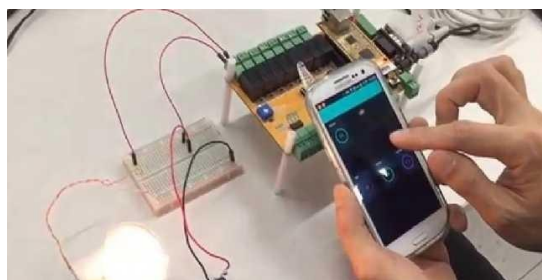


Figure 4. Connection to Android SmartPhone

3.4 Testing Tools

This test is done to ensure that the tool has been designed to function properly and in accordance with the goal.

3.4.1 Gas Sensor TestingMQ-2

The test of the gas sensor mq-2 is through the sensitivity level of the gas sensor by looking at the serial monitor in arduinouno software. Data will be presented in table 4.

Table 4. Result TestSensitivity of Gas Sensor MQ-2

Result Test Gas Sensor MQ-2			
Test Scenario	Expected Results	Observation	Result
A surge of gas amounted to 215	Solenoid Valve is still in NO state and sound alarm does not sound	Relay1 is on (Solenoid NO), Alarm Off	OK
A surge of gas amounted to 228	Solenoid Valve is still in NO state and sound alarm does not sound	Relay1 is on (Solenoid NO), alarm off	OK
A surge of gas amounted to 413	Solenoid Valve change to be NC and alarm ON	Relay1 Off, (Solenoid NC), alarm ON	OK
A surge of gas amounted to 436	Solenoid Valve change to be NC and alarm ON	Relay1 Off, (Solenoid NC), alarm ON	OK
A surge of gas amounted to 429	Solenoid Valve change to be NC and alarm ON	Relay1 Off, (Solenoid NC), alarm ON	OK
A surge of gas amounted to 241	Solenoid Valve is still in NO dan sound alarm dosen not sound	Relay 1 ON (Solenoid NO), alarm Off	OK

4. Conclusion

Based on the research, design, and manufacture of the tool then it can be taken a few conclusions are as follows.

1. This Detection Tool can help users through alarm sounds and disconnection of gas flow in anticipation of the beginning if the absence of action from the user to minimize the presence of sparks.
2. the Solenoid is very useful on this device because doing first aid if the gas sensor detects gas leaks then solenoid will decide on gas flow, by contrast with the usefulness of the solenoid to fire sensor open water flow if the flame sensor detect any spark.
3. Notification by the alarm sound very helpful users if the user is not sensitive to the smell of leaking gas, then the user can know of any gas leaks through the alarm sound

References

- [1] Sook-Ling Chua and Stephen Marsland and HansW. Guesgen" Behaviour Recognition in Smart Homes Sook" Proceedings of the TwentySecond International Joint Conference on Artificial Intelligence 2011.
- [2] Pressman RS. *Software Engineering : A Practitioner's Approach, 7th ed.* Mc Grow Hill.2010.
- [3] Informasi Penurunan Kualitas Tabung Gas LPG Pada Produsen Tabung Gas. Sitewww.vivanews.com [Diakses: 06/04/2017]
- [4] *Black Box Testing*. Sitewww.iansyahbelajar.com. [Diakses:05/11/2017]
- [5] Pengertian Sensor Pendeteksi Gas LPG MQ-2. Sitewww.geraicerdas.com. [Diakses:11/11/2017] Roslin John Robles1 and Tai-hoon Kim1" Applications, Systems and Methods in Smart Home Technology: