Journal of Computer Networks, Architecture and High Performance Computing
Volume 6, Number 1, January 2024
https://doi.org/10.47709/cnahpc.v6i1.3472

Submitted : January, 23, 2024
Accepted : January 25, 2024
Published : January 26, 2024

Spreadsheet-based Car Engine Temperature and Compression Pressure Gauge

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ABSTRACT
Measuring the engine's temperature and compression pressure in cars is a crucial part of engine maintenance and performance evaluation. The objective of this study is to develop an accurate and efficient spreadsheet-based measurement system for determining engine temperature and compression pressure in automobiles. For this investigation, data from car engines was collected using engine temperature thermometers and compression pressure gauges. The collected data is then fed into a spreadsheet designed specifically to assess and automatically calculate engine temperature and compression pressure. The results show how reliable and accurate the measurements made using this spreadsheet-based measurement technique are. This approach's main benefits are also its flexibility and ease of use, since users can rapidly adapt the spreadsheet to the particular needs of the engine being tested. With this technology in place, car owners or professionals who do engine maintenance can quickly detect potential engine problems, such as valve leakage or unexpected temperature increases. Therefore, to increase fuel efficiency and extend engine life, spreadsheets can be utilized as a tool for measuring engine performance. The goal of this project is to facilitate the work of auto repair shop owners by utilizing the Esp8266 microcontroller for the DS18b20 sensor and compression sensor. Even so, there are several difficulties, like a sluggish internet connection that delays uploading data to the LCD and spreadsheets that are less useful because of a bad internet connection.

Keywords: compression pressure; engine temperature; spreadsheet; Esp8266; DS18b20

INTRODUCTION

Automotive technological advancements, such as the creation of measurement tools for upkeep and repair, are crucial to maintaining vehicle functionality and avoiding component damage. The change from analog to digital measuring devices is one illustration of how automobile technology has advanced. Scales and needles are used by analog measuring devices, including analog multimeters, to display measurement results (Anshory et al., 2021)(J. Jamaaluddin, 2019).

Additionally, the creation of digital measurement tools, such as digital multitesters, has simplified the maintenance and repair of automobiles for automotive technicians. They are simple to use, offer helpful extra features, and produce measurement results that are more accurate (RAGIL FANNY SETIYA AJI & Sulistiyowati, 2021)(Mluyati & Sadi, 2019). To stay proficient and effective in maintaining contemporary cars, it's critical to continuously update knowledge and abilities in line with the advancements in automotive technology (J. Jamaaluddin & Sumarno, 2017)(Firdaus et al., 2022).

One of the primary sources of air pollution in many large cities across the world is vehicle exhaust. Nitrogen oxides (NOx), hydrocarbons (HC), carbon monoxide (CO), and other dangerous compounds are found in exhaust fumes and can contaminate the air, endangering both human health and the environment. Turbochargers are used in diesel engines to improve combustion and lower harmful exhaust emissions (Suriana et al., 2020). By boosting the amount of air that enters the combustion chamber, a turbocharger is a device that is mounted to the diesel engine's combustion system to increase combustion efficiency (Mahendra, 2021)(Studi et al., 2020)(Pranoto & Hidayat, 2017).

Diesel engines can create better and more efficient combustion, maximize fuel efficiency, and minimize environmentally harmful exhaust emissions by using turbochargers (Dewantara et al., 2023)(Alwie et al., 2020). To ensure that the turbocharger continues to operate as intended and does not adversely affect engine performance or cause unintended exhaust emissions, it is crucial to clean and repair it on a regular basis (Sulistiyowati et al., 2019)(Sulistiyowati et al., 2020)(Afrizal & Kunang, 2022).

The ThingSpeak platform will be used to create the tool that analyzes this research, and its design makes use of

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the Internet of Things (IoT) (Jamaaluddin, 2021)(Purnomo & Munahar, 2019). Cloud computing is used as a service to gather, visualize, and analyze data. The goal of this project is to create a monitoring system that uses an internet of things-based platform to interpret exhaust emissions readings and identify exhaust emissions in motorized vehicles (Yusuf et al., 2019). The waterfall technique is applied, beginning with the creation of a tool for system requirements analysis, system design, program code authoring, and system testing with devices like an Arduino Uno, MQ-7 Sensor, ESP8266 Module, and LCD (Di et al., 1826)(Eureply et al., 2021)(Wilantara & Raharjo, 2019).

Therefore, using a NodeMCU ESP8266 microcontroller linked with an IoT-based Wi-Fi module, I built a measurement system for engine compression pressure and automobile engine temperature in this research that has superior system accuracy than earlier research. With a system like this, users may also keep an eye on the engine temperature and compression pressure measurements via a spreadsheet.

LITERATURE REVIEW

2019 saw the completion of a study titled "Development of Compression Tester Measuring Instruments" by Bahtiar Wilantara and Raharjo. The goal of this project is to convert an analog compression tester measurement tool into a digital compression tester measurement tool so that consumers can benefit from its efficacy and efficiency (Wilantara & Raharjo, 2019)(Parihar, Sing, 2019). Research and development, or R&D, is what this study is all about. The problem identification, information collection, product design, product manufacture, expert validation, product revision, trial, and final production were the steps taken in conducting this research. Twenty students, media specialists, and material experts initially confirmed the construction of an analog compression tester for field trials (Zulkifli et al., 2021)(J. Jamaaluddin & Sumarno, 2017).

Eka Putra conducted a study in 2020 entitled "DESIGN OF A CARBAGE GAS EMISSION MONITORING SYSTEM USING ARDUINO UNO BASED ON INTERNET OF THINGS". The design of the tool that examines this research is the application of IoT to the tool that will be made using the ThingSpeak platform which utilizes cloud or cloud computing as a service to collect, visualize and analyze data. This research aims to produce a monitoring system that can detect exhaust emissions in motorized vehicles and determine the results of exhaust emissions readings using an internet of things-based platform. The method used is the waterfall method which starts from designing a system requirements analysis tool, designing the system, writing program code and testing the system using equipment such as Arduino Uno, MQ-7 Sensor, ESP8266 Module and LCD.

Research conducted by Elvis Kase, I Wayan Suriana, I Nyoman Gede Adrama (2020), namely the Design of the Under Counter Chiller Temperature Monitorinng System at the Hilton Hotel Based on the Internet of Things. This tool uses an IoT (Internet of Things) system, where this tool uses an ESP8266 microcontroller by connecting to a web server whose function is so that users can monitor the Under Counter Chiller room directly(Suriana et al., 2020).

METHOD

This study primarily focuses on a spreadsheet-based vehicle engine compression pressure and temperature gauge that measures engine temperature and compression pressure using a DS18b20 sensor and a pressure sensor. After pressing the push button to upload the sensor information to the spreadsheet, the LCD shows the engine's temperature and compression pressure (Syahrorini & Kurniawan, 2018)(Anshory, 2017)(Wisaksono et al., 2020).

System Design

There are three sections to the design of this tool. The first stage of the system design process is wiring design, which specifies the parts that will be used in the system and their connections(Safitri, 2019). The second stage is to create a block diagram that shows the input, processing, and output components of the system along with their interactions. Creating a flowchart that illustrates the system's workflow and the relationships between its many components is the third phase. These three parts provide a comprehensive understanding of the system's architecture and operation (Suprayitno et al., 2015)(O. Jamaaluddin et al., 2015)(Fahruddin & Sidoarjo, 2015).

Wiring Design

The hardware circuit of the Car Engine Temperature And Compresiom Pressure Gauge Spreadsheet-Based system has a microcontroller, there is a NodeMCU Esp8266 module component. additionally, there are push buttons, DS18b20 sensors, pressure sensors, and 16x2 i2c LCD (Masriwilaga et al., 2019).

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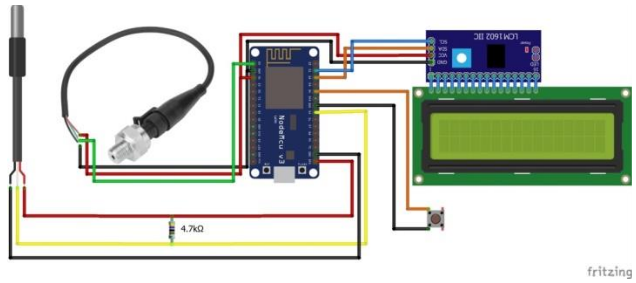

Fig. 1 Wiring Design

Table 1. NodeMCU Port Usage

NO	NodeMCU Port	Usage
1	GND	GND PRESSURE SENSOR
2	5V	VCC PRESSURE SENSOR
3	A0	OUTPUT PRESSURE SENSOR
4	3.3V	VCC DS18B20 SENSOR
5	D5	OUTPUT DS18B20 SENSOR
6	GND	GND DS18B20 SENSOR
7	5V	VCC LCD
8	GND	GND LCD
9	D2	SDA LCD
10	D1	SCL LCD
11	D4	RIGHT FOOT PUSH BUTTON
12	GND	LEFT FOOT PUSH BUTTON

Block Diagram

To facilitate the design and manufacture of tools, a block diagram of the system as a whole is made. The following is a block diagram of the Car Engine Temperature And Compresiom Pressure Gauge Spreadsheet-Based system shown in the Figure 2.

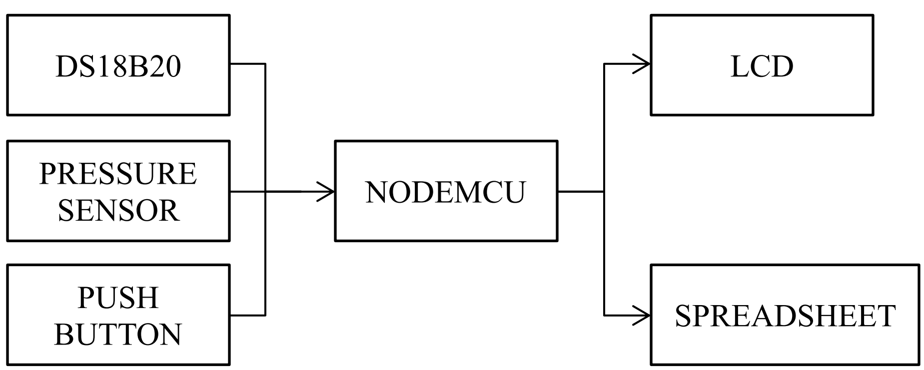

Fig. 2 Block Diagram

The hardware is made up of one database to hold the spreadsheet's computation results in addition to five components: a pressure sensor, push button, Nodemcu, 16x2 i2c LCD, DS18b20 sensor, and push button. The push button serves as both a reset button and a means of uploading data into the spreadsheet. Nodemcu serves as a microcontroller, and the LCD i2c 16x2 shows the findings from the two sensors. The DS18b20 sensor here is used to detect engine temperature, while the pressure sensor here is used to detect engine compression pressure.

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System Flowchart

Firstly, check if the Nodemcu Esp8266 is connected to the internet. If it is, the DS18b20 sensor and pressure sensor will read. The results of the two sensors will be shown on the LCD after they have been read. Subsequently, the sensor reading results are uploaded to the spreadsheet by pressing the push button.

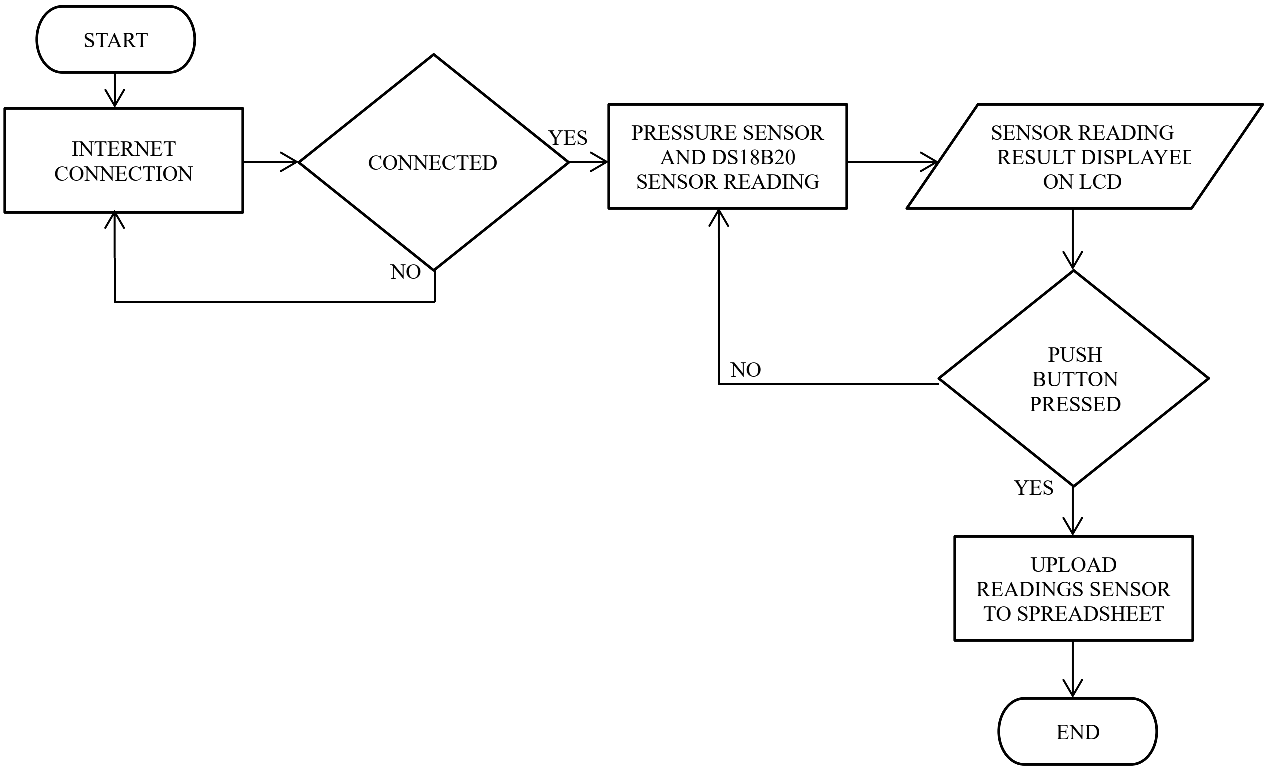

Fig. 3 System Flowchart

RESULT

These are the outcomes of the tool's realization. Figure 4 shows the tool's realization. The following numbering will be used to explain the tool's components: 1. ESP8266, 2. LCD 16x2 i2c, 3. Pressure Sensor, 4. DS18b20 Sensor, 5. Push Button

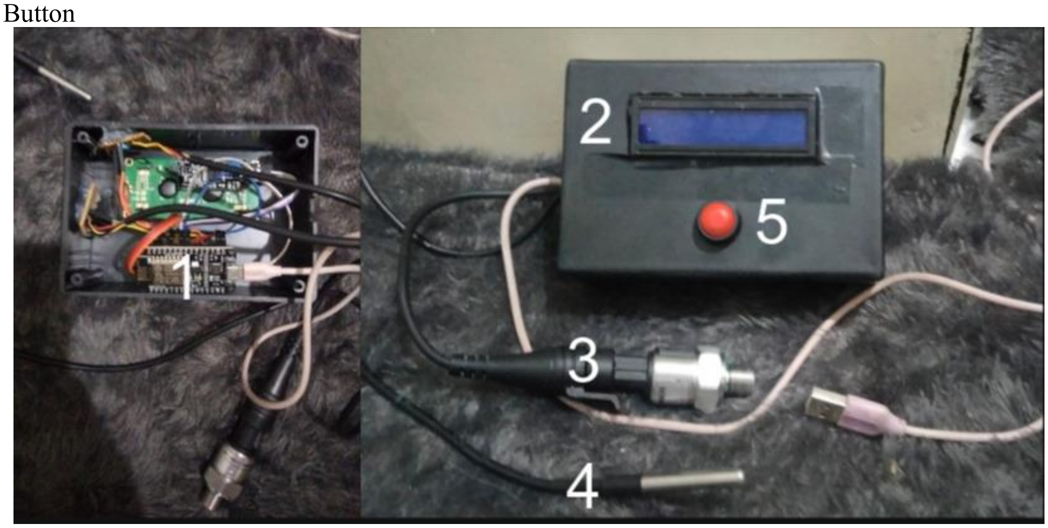

Fig. 4 Result Of Tool Realization

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How to use this tool is as follow :
1. Connect the ESP8266 to the internet
2. if it is connected, the DS18b20 sensor and Pressure Sensor read
3. After that, the result display it on the LCD, then the push button is pressed to upload the result to spreadsheets and reset the results.

ESP8266 to Spreadsheet connection testing

Testing the Wi-Fi connection to the NodeMCU ESP8266 was tested with a waiting time of 5 and 6 seconds, and the test results are shown in Table 2. The test results show that the ESP8266 can establish a medium-speed Wi-Fi connection. establish a medium-speed Wi-Fi connection.

Table 2. Wifi ESP8266

Testing to-	Condition	Waiting Time (s)	Speed
1st Test	Connected	5	Medium
2nd Test	Connected	6	Medium
3rd Test	Connected	5	Medium
4th Test	Connected	5	Medium
5th Test	Connected	6	Medium
6th Test	Connected	5	Medium
7th Test	Connected	6	Medium
8th Test	Connected	5	Medium
9th Test	Connected	5	Medium
10th Test	Connected	6	Medium

5v power supply testing

Table 3 shows 10 tests of 5 volt voltage with a multitester. This test obtained a deviation of 0.0 and 100% accuracy, and it can be concluded that the voltage used of 5 volts in this tool is accurate. This 5 volt voltage will be used for the power supply of the output control circuit.

Table 3

5v power supply testing

Testing to -	**Voltage needed (V)**	**Multimeter (V)**	**Deviation (V)**	**Accuracy (%)**
1	5	5	0	100
2	5	5	0	100
3	5	5	0	100
4	5	5	0	100
5	5	5	0	100
6	5	5	0	100
7	5	5	0	100
8	5	5	0	100
9	5	5	0	100
10	5	5	0	100
Average	5	5	0	100

Testing DS18b20 Sensor

The results of the 10 tests clearly show that the DS18b20 sensor operates as it should and complies with the given guidelines. observe the given guidelines. The accuracy of the commands and readings of the DS18b20 sensor

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with the thermogun results a difference of 1 degree Celsius each trial and has an average accuracy rate of 90% the test results are shown in Table 4. This shows that the testing and validation carried out on the DS18b20 sensor is sufficient.

Table 4. Testing DS18b20 Sensor

Testing to -	Sensor DS18B20	Thermogun	Deviation	Accuracy (%)
1	45,06	44,1	0,96	97,87
2	45,00	44,8	0,2	99,56
3	43,50	42,5	1	97,70
4	48,58	49,9	1,32	97,28
5	48,73	49,5	0,77	98,42
6	38,88	40,0	1,12	97,12
7	38,83	39,4	0,57	98,53
8	38,78	37,8	0,98	97,47
9	38,75	39,7	0,95	97,55
10	39,05	41,2	2,15	94,49
	Average		1,002	97,60

Testing Pressure Sensor

The results of the ten experiments using pressure sensors matched the commands. Good results were frequently seen in the tool test findings displayed in Table 5. All of the Pressure sensor tests were accurate and matched the commands, meaning that every one of them functioned properly.

Table 5. Testing Pressure Sensor

Testing to -	Sensor *Pressure Transmitter*	Sensor *Pressure* (Manual)	Deviation	Accuracy (%)
1	84,83	85	0,17	99,80
2	84,52	85	0,48	99,43
3	89,75	90	0,25	99,72
4	91,19	95	3,81	95,82
5	83,32	85	1,68	97,98
6	77,09	80	2,91	96,23
7	75,11	75	0,11	99,85
8	76,05	75	1,05	98,62
9	56,95	55	1,95	96,58
10	55,78	55	0,78	98,60
	Average		1,319	98,26

Overall Testing

Ten testing of spreadsheet apps are displayed in Table 6. It is clear from the test results that the Spreadsheet-Based Car Engine Temperature And Compression Pressure Gauge can be used effectively.

Table 6Overall Testing

Testing to-	Sensor DS18B20	Sensor Pressure Transmitter	Spreadsheet
1st Test	45,06	84,83	Uploaded
2nd test	45,00	84,52	Uploaded
3rd test	43,50	89,75	Uploaded

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4th test	48,58	91,19	Uploaded
5th Test	48,73	83,32	Uploaded
6th test	38,88	77,09	Uploaded
7th test	38,83	75,11	Uploaded
8th test	38,78	76,05	Uploaded
9th test	38,75	56,95	Uploaded
10th Test	39,05	55,78	Uploaded

DISCUSSION

For further research, there are several suggestions that can be taken into consideration in the research, namely making a more practical tool for checking cars or adding sensors that function and are effective for checking cars and making data collection through an application that is easily accessible and used. and making data collection through applications that are easy to reach and use.

CONCLUSION

The gadget could be connected to transfer spreadsheets with sensor values, and the efficiency of the internet connection test appeared to be at its highest level. even though the connection took an average of five seconds to establish. The DS18b20 sensor's test results indicate that it has an accurate engine temperature reading. For determining the compression pressure in automobile engines, this pressure sensor is incredibly accurate.

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