Smart and Affordable Fuel Grade Analyzer Design

By

Afsana Rahman Reme
18221040
Md. Rawnak Islam
18121093
Takia Tanjim
18321058
Nafiz Nazafi
18321045
K. M. Ekramul Haque
17221007

A Final Year Design Project (FYDP) submitted to the Department of Electrical and Electronics Engineering in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical & Electronic Engineering

Department of Electrical and Electronic Engineering
Brac University
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Declaration

It is hereby declared that

1. The Final Year Design Project (FYDP) submitted is my/our own original work while completing degree at Brac University.
2. The Final Year Design Project (FYDP) does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The Final Year Design Project (FYDP) does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. I/We have acknowledged all main sources of help.

Student's Full Name & Signature:

Afsana Rahman Reme 18221040	**Md. Rawnak Islam** 18121093
Takia Tanjim 18321058	**Nafiz Nazafi** 18321045

K. M. Ekramul Haque
17221007

Approval

The Final Year Design Project (FYDP) titled "Smart and Affordable Fuel Grade Analyzer Design" submitted by

1. Afsana Rahman Reme (18221040)
2. Md. Rawnak Islam (18121093)
3. Takia Tanjim (18321058)
4. Nafiz Nazafi (18321045)
5. K. M. Ekramul Haque (17221007)

of Fall, 2022 has been accepted as satisfactory in partial fulfillment of the requirement for the degree of Bachelor of Science in Electrical & Electronic Engineering on December 08, 2022.

Examining Committee:

Academic Technical Committee (ATC): (Chair)

_____

Dr. A. S. Nazmul Huda
Assistant Professor, Department of EEE
BRAC University

Final Year Design Project Coordination Committee: (Chair)

_____

Dr. Abu S.M. Mohsin
Assistant Professor, Dept. of EEE
BRAC University

Department Chair:

_____

Dr. Mosaddequr Rahman
Professor, Department of EEE
BRAC University

Abstract

This paper presents the design of an innovative and cost-effective fuel grade analyzer with advanced features and capabilities. The analyzer is designed to measure the fuel grade of gasoline and diesel fuels, thereby enabling users to accurately determine the fuel grade of their vehicles. The analyzer is designed to be simple to use, with a single-button operation, and features a built-in wireless connection, self-calibration, and an intuitive graphical user interface. Furthermore, the analyzer can be used in a variety of environments, including in-vehicle, in-lab, and in-field settings. Finally, the analyzer is designed to be reliable and accurate, and capable of detecting a wide range of fuel grades. The paper includes a detailed description of the design and a comprehensive evaluation of its performance. The performance of the analyzer was evaluated using a variety of different tests and experiments. The results of these tests indicate that the analyzer is capable of providing accurate readings for a wide range of fuel grades, including unleaded, super unleaded, and diesel fuels. Overall, the design of the fuel-grade analyzer presented in this paper is cost-effective, reliable, and accurate. The analyzer is designed to be rugged and reliable and capable of providing accurate readings for a wide range of fuel grades.

Keywords: Fuel Grade Analyzer, Temperature, Density, Fuel Flow Rate.

Dedication

This project is dedicated to our beloved parents who raised us to be the persons we are today, who were always there for us whenever we needed them, and who constantly support us with their love and kindness.

Acknowledgement

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Chapter 1: Introduction

1.1 Introduction

Fuel grade measurement devices are essential tools for analyzing fuel quality. It has always been an important factor in the automotive industry. From improving vehicle performance to reducing emissions, fuel grade measurement devices are essential for ensuring that fuel is of the highest quality. The fuel grade measurement device is designed to measure the quality of fuel in a variety of ways. The device measures the quality of fuel by evaluating its properties, including gasoline rating, temperature, density, flow, and other parameters. It can also measure the presence of water, alcohol, and other contaminants. By analyzing the fuel, the device can determine the fuel grade, which is an indication of its suitability for use in a particular engine or application. The Fuel Grade Measurement Device is equipped with a number of features that make it an ideal choice for fuel testing. It has a high-resolution display that allows users to easily read the results of the tests. It is also equipped with a wide range of sensors that enable accurate and precise readings. The device is designed to be robust and durable, making it suitable for use in a variety of environments. The device is also user friendly and easy to use. It has a straightforward and intuitive user interface, making it easy to operate.[1] The device is also equipped with advanced software that enables users to get the result on their smartphone using Bluetooth. This makes it easy to identify any issues with the fuel. In addition to measuring octane rating, the device can also measure other fuel parameters such as ethanol. This allows users to ensure that the fuel meets the necessary standards for use in vehicles. The Fuel Grade Measurement Device is a reliable device that can be used to ensure that fuel is of the highest quality. It is an essential tool for professional and personal use. .[2]

1.1.1 Problem Statement

The demand for gasoline resources has been significantly higher recently. So many fuel filling stations have been structured and supplying octane, diesel, patrol etc. But according to BSTI, the rate of dirty fuel and grade of petroleum have degraded alarmingly. In more studies, many filling stations are supplying mixed fuel which are much downgraded. Due to that vehicles, machines and engines are getting seriously harmed. Even people are not feeling trusted in every filling station and in many cases, they are facing more issues in their vehicles. In a writing in Financial Express in January, 2021 States that BSTI Bangladesh Standard and testing Institution, have lowered the specifications of petrol because of the use of dirty fuel. Sources have ensured that this downgrade is an obstacle for the government strategy to control the environment. In addition, BSTI is working on it and imported cleaner which includes higher cost. Moreover, in another report it is clearly reported that, The Bangladesh Standards and Testing Institution (BSTI) and the district administration of Gazipur have issued fines totaling Tk1.85 lakh, to five petrol pumps, for weighing and measuring fraud. .[6] Two separate mobile court drives – led by Muhammad Amimul, BSTI executive magistrate, and Masudur Rahman, executive magistrate at the Gazipur Deputy Commissioner's Office – imposed the fines in the

Mirpur, Gabtali and Gazipur Saddar areas. So, this has now been a big issue for the people to not have the proper supply. More and more vehicles are getting hampered and damaged. Even after paying a lot of cost and energy on the vehicle's maintainers, they are not having the proper supply. So, in this project it has been clarified and making an affordable and smart fuel grade testing equipment which will make consumers clear and acknowledge about the pure fuel and will also be concerned and create the long durability of vehicles.

1.1.2 Background Study

Fuel grade measurement is a process that is used to determine the quality of a fuel, such as gasoline or diesel. It is important to know the fuel grade in order to ensure that the fuel is suitable for the engine and will provide the desired performance. The fuel grade measurement is based on the physical and chemical properties of the fuel, such as its viscosity, energy content, and other characteristics. This measurement is done by analyzing the fuel in a laboratory and comparing the results against a set of standards. The process of fuel grade measurement begins with analyzing the fuel in a laboratory but this is a very old method. The analysis includes all of the physical and chemical properties, such as density, viscosity, composition, and other characteristics. The results of the analysis are then compared to a set of standards, which are established by the fuel industry. These standards are based on the performance needs of the engine, and they provide a baseline to measure the quality of the fuel. The standards used in fuel grade measurement are set by the American Petroleum Institute (API). The API has developed a set of standards for gasoline and diesel fuels, which are known as the API Gravity and Distillation specifications. .[9]

1.1.3 Literature Gap

The measurement of fuel grade is an important subject in the field of fuel engineering. It is important for both the production of fuel and the use of fuel for combustion. However, there is a gap in the literature on fuel grade measurement. This gap is particularly concerning when it comes to measuring the quality of fuel that is used in combustion applications. The first issue that is seen in the literature gap is the lack of accurate and reliable methods for measuring fuel grade. In the past, measurements of fuel grade were taken by visual inspection and other subjective methods. However, these methods are highly unreliable and can lead to inaccurate results. Additionally, there is a need for more advanced methods that use sensors and other technologies to obtain accurate and reliable measurements. The second issue that is seen in the literature gap is the lack of research and development on fuel grade measurement. While there have been some studies that have looked at fuel grade measurement, there is still a need for more research to develop improved methods and technologies. Additionally, there is a need for more research to understand the effects of fuel grade on combustion performance. The third issue that is seen in the literature gap is the lack of standards and regulations for fuel grade measurement. Currently, there is no standardized method for measuring fuel grade. This lack

of standardization can lead to confusion and uncertainty when it comes to measuring the quality of fuel. Additionally, this lack of standardization can lead to errors in fuel grade measurements, which can lead to costly mistakes in the production and use of fuel. Overall, there is a significant gap in the literature on fuel grade measurement. This gap is concerning, as it can lead to inaccurate and unreliable measurements of fuel grade, which can lead to costly mistakes in the production and use of fuel. The literature gap must be addressed in order to ensure accurate and reliable measurements of fuel grade, as well as improved safety and performance in combustion applications.

1.1.4 Relevance to current and future Industry

Our initial goal is to assess gasoline grading based on temperature, density, fuel flow, and ethanol content. The majority of grading systems in use are based on chemical chromatography. Chromatography-based assays are reliable yet cumbersome to use. This technological gap is filled by the fuel grade analyzer device we offer. Additionally, this will be an excellent tool for letting customers know the caliber of the item they are purchasing. .[5]

Later on in the project, we can implement this technology in gas stations so that they can give customers concrete evidence of the high caliber of the fuel. Additionally, this can be included into the vehicle by using some external design strategies. Therefore, the car will come equipped with a technology that may automatically provide some preliminary results for fuel testing.

The fundamental objectives of our fuel grade analyzer project are listed below:

- To find out the actual grade of the fuel.
- To ensure the durability of the compassion engine of the vehicles
- To marketize Fuel Grade Analyzer at a cheaper rate.
- For the development of the petroleum sector and gaining the trust among the consumers.

The machine will display the quality of fuel compared to international standards. This beneficial feature of the Fuel Grading will instigate people to rely on gasoline. Moreover, the quality of fuel also has impact on our environment and our health as well as the duration of vehicles.

1.2 Specification, Requirement and constraints

1.2.1 Specifications

- Microcontroller for the codes and simulating result to show it to the display.
- Sensor for detecting the minimum value of the fuel grade so that to ensure that the fuel is mixed.
- Fuel injector to inject the fuel and know the grade.

- The ethanolol test tuber will get the amount of ethanol in the test tube.

1.2.2 Functional and Nonfunctional Requirements

Functional requirements:

Fuel quality:

In this project we are working over the quality of fuel or octane that is using in the petrol pump. Three ways we can know whether there is any mixer in the fuel, or it is usable or not. Those are shown below.

- By knowing the grading.
- By experimenting the fuel injector.
- By knowing the density of fuel.

Octane grading:

Every fuel has a grade rating. And in this experiment, we can find out the actual grading number of the octane so that it will be easier for the users to identify.

Fuel injection:

By the flow of fuel, we can easily get to know the quality of fuel. Even in this experiment by using the sensor we can also experiment with the fuel injection so that we can sum up the quality of fuel.

Ethanol testing:

As the percentage of ethanol degrades the quality of octane fuel, we put a test tube functioned with a microcontroller using Bluetooth so that it will provide the SMS to our mobile phones.

Fuel density:

As we are working on the quality of fuel or Octane so in this project we can also get know about the density of fuel or octane. So, we can easily measure that any mixer is there or not.

SMS System:

Our devices will be connected to the portal of the kit to get the notifications or SMS or messages of the ratings.

Non-functional requirements:

Fuel Level:

Fuel levels are already functioning in the fuel tank and it can now easily be installed.

Viscosity Sensor:

It is very difficult and costly to install the sensor for Viscosity measurement. And by measuring the temperature and density we can know the grading of the fuel.

Ethanol Test Tube:

As we are working on the vehicle's kit, ethanol percentage measurement by the microcontroller is the main concern here.

1.2.3 Technical and Non-technical consideration

Table 1.2: Technical and Non-technical consideration

Technical and Non-technical Specification			
System	**System Requirements**	**Component**	**Specification**
	Microcontroller	ARDUINO Board	• Microcontroller: AT mega 328P
			• Fuel temperature sensor range: if it is, For Octane 25°C - 30°C (good), below 25°C(avg.), above 30°C(bad). For Petrol
Fuel grading analyzer using ARDUINO and temperature and density sensor			• Fuel density (ρ) sensor range: if it is 820 – 860 (Kg/m3) (good), below 820 (Kg/m3) (avg.), above 860 (Kg/m3) (bad).

	Temperature sensor	DS18b20	
		Load Cell (HX711)	• OPW density measurement sensor detecting. • The highest capacity of the Load cell is 5kg.
	Density sensor		• Installation: Density and level measurement combined on one/ SL channel
			• Accuracy: ± 0.0025 g/cc
DIY based Bluetooth system to find out the Ethanol content and fuel temperaturze analysis.	Microcontroller	Aether standard with display board.	• Microcontroller: AT mega 328P • Voltage: 5V • Resistor: 4.7K to 10K Connect to the D10 pin to 5V pin of the board.

			• Sensor pigtail
	Bluetooth ethanol analyzer	Sensor battery connector.	• Flex-fuel sensor • AA2 Battery 9V • Android BLE Bluetooth connectivity
	OLED Display kit	LCD Display (2004)	• 9V battery
			• Range 0-5V (or 0.5-4.5V)
Fuel flow analysis to know the grade number of the fuel using ARDUINO.	Microcontroller	ARDUINO Nano Board	• Microcontroller: AT mega 328P

			• Operation voltage: 5V relay
	Fuel Flow	Liquid Flow Sensor (YF-S201)	• To calculate the flow in in RPL(Revolution per Liter) value. • the flow rate is 30 RPL

1.2.4 Constraints

Only octane's quality is being observed.

Octane's density may vary due to temperature change, tank's depth change Standard design may not be applicable for all kind of vehicles

1.3 Sustainability

While planning a project we should be aware of sustainability which is basically an approach that balances the environmental, social, and economic aspects of project-based work to meet present needs without harming future generations.

Table 1.3: Sustainability

Internal	**Sustainability**	
	Positive	**Negative**

	Strength	Weakness
	1. Cost efficient. 2. IoT based system. 3. Developed with advanced Technologies/sensors. 4. Can detect the actual fuel grade. 5. Can deliver more accurate result. 6. Will store our finding datas in the cloud	1. As it tests fuel, one must be careful to use 2. Unavailability of some resources(sensors) in our country 3. Extra tube or pot is needed

External	Opportunities	Threats
	1. As it has more advanced features than other existing fuel grade analyzers, so competition is less. 2. As its cost is lower than other similar types of devices it has less competition and more opportunities. 3. Can gather attention from the Government.	1. As better resources like sensors and other things are not available in our country, others can do better than ours by using advanced resources and technologies

So, from the table we can observe the strengths, weaknesses, opportunities and threats of our fuel grade analyzer. We are introducing more features in our device than the similar kinds of products available in the market. As similar types of products are existing in the market, we are taking the unique features from them and implementing them to build a better one. However, we are doing a low-cost setup which could be affordable for any type of company or industry or even for personal use as well. Initially, we are using all kinds of standard sensors and devices but in future we are hopeful to use more advanced technologies for more accurate results of fuel grading. If we can get help from the government side and introduce this type of device with industries, this will lead to social sustainability as well. So, that is all to prove that our project is sustainable. .[11]

1.4 Conclusion

The Smart and Affordable Fuel Grade Analyzer design is an innovative and cost- effective solution for accurately determining the quality of fuel in real-time. The design features an easy-to-use interface, efficient data processing, and reliable results. The analyzer is an invaluable tool for fuel suppliers and consumers alike, providing confidence that the fuel being supplied is of the highest quality. With its affordability and accuracy, the Smart and Affordable Fuel Grade Analyzer is sure to be a valuable asset to any fleet management system.

Moreover, it is an impressive technological development that offers numerous advantages over other fuel grade analyzers. The system is cost-effective, easy to use, and provides reliable results quickly. Furthermore, it is designed to be integrated into existing fleet management systems to maximize efficiency and accuracy. With its wide array of features and abilities, the Smart and Affordable Fuel Grade Analyzer is a powerful tool for fuel suppliers and consumers alike.

Furthermore, it has been thoroughly tested and proven to be a reliable and accurate tool for determining the quality of fuel. Its affordability and accuracy make it an invaluable asset to any fleet management system. The design is an innovative solution that is sure to benefit numerous industries and businesses. The Smart and Affordable Fuel Grade Analyzer is an impressive example of how technological advancements can benefit society and help improve the accuracy and efficiency of fuel analysis.

Chapter 2: Project Design Approach

2.1 Introduction

It has always been a necessary key point to notify the quality of fuel. Firstly, no device and process has been directly invented which can measure the quality of fuel. In this project, we have subjected to a make kit for any vehicles that are run by fuel or gasoline. This is to make the device with several researches, formulas and comparison with other parameters. We have three alternative designs where we can measure different parameters of fuel so that we can come up at a point where we can define that the fuel is good or bad. In the first design, we can measure temperature, density of the fuel. In the second design, we can know the percentage of the ethanol in the fuel and in the last design, we can identify the flow of the fuel. These parameters actually have effects on fuel. .[15] So we take all these and put them all together to get the efficiency. By this we can measure the quality of fuel.

2.2 Identifying multiple design approach

- Fuel Grade Analysis using Temperature and Density
- Fuel Grading Using Ethanol Percentage
- Fuel Grading using Fuel Flow Sensor

2.3 Describe multiple designs approaches

Design 1 Approach: Fuel grade analysis using temperature and density.

This design 1 is a prototype that shows the actual design of the Smart fuel grade tester. Here the microcontroller will show all the possible data such as the grading number, the measurements of how much fuel there is in the tank, the percentages of mixed product on the fuel. Next the valve is one side open valve that when the fuel gets in the tank it will open. As well as the sensor and buzzer will be used here to when the grade number will cross a minimum number then the sensor will read that and the buzzer will be on. Even if it will be connected to WIFI or with our mobile, the ratings will be passed to the phone. And lastly a tunnel will be connected outside the tank to pour it to the Vehicles. .[19]

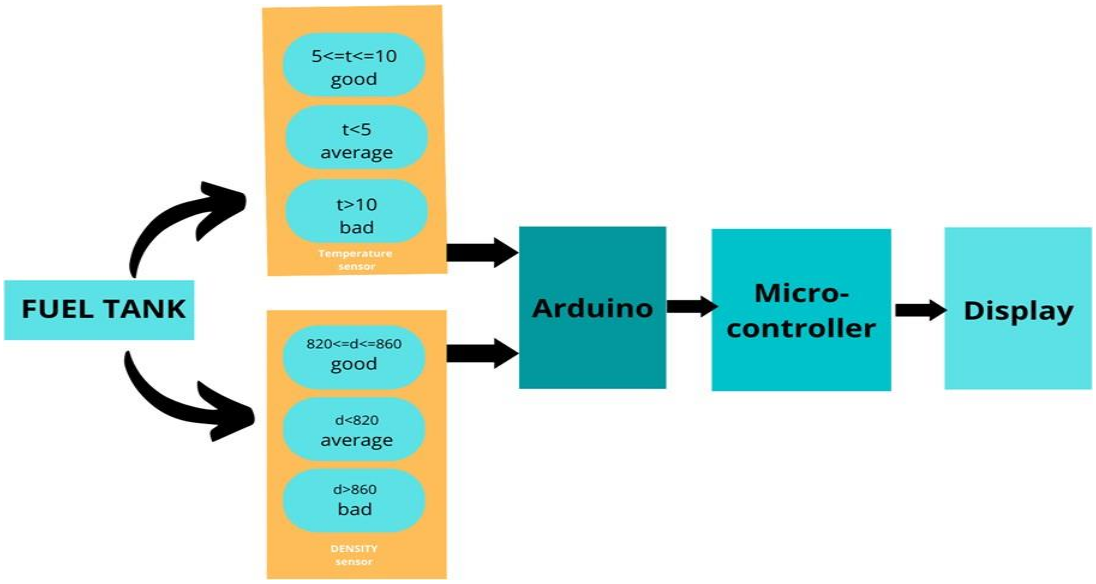


Fig 2.3: Fuel grade analysis using temperature and density

In this design 01, we are using Arduino Nano V2 which is the central processing unit. Our main aim in this design is to simulate the parameters (temperature and density) in proteus 8.12 through Arduino Nano V2. In the circuit we are using Visine 220V for the power supply and bridge rectifier for converting AC source 220V to 5V DC. A Temperature sensor has been used to read the temperature of the fuel named DHT11. Moreover, for the density sensor, we simply use the potentiometer connected with Arduino Nano V2 and the parameter's range is set by coding which is 820 kg/m^3 to 860 kg/m^3. Also, set the command if the reading is between 820 to 860 kg/m^3 then it will show in the display that "The Fuel Is Good". If it is below 820 kg/m^3 then it will show "Average" and above 860 kg/m^3 then it's "the fuel is very bad". Same as for temperature where the reading is 5°c to 10°c.

Here, density rating is dependent with temperature rating. We have used a switch to start the program as program reset. When we turn on the program reset switch, a frequency rating has been set which will control the potentiometer rating and the power supply will be connected to DC and the signal will pass to the Arduino Nano V2 and after comparing the parameters the result will be shown in the display. In addition, the capacitors are being used for decreasing the voltage ripple.

Design 2 Approach: Fuel grading using Ethanol percentage

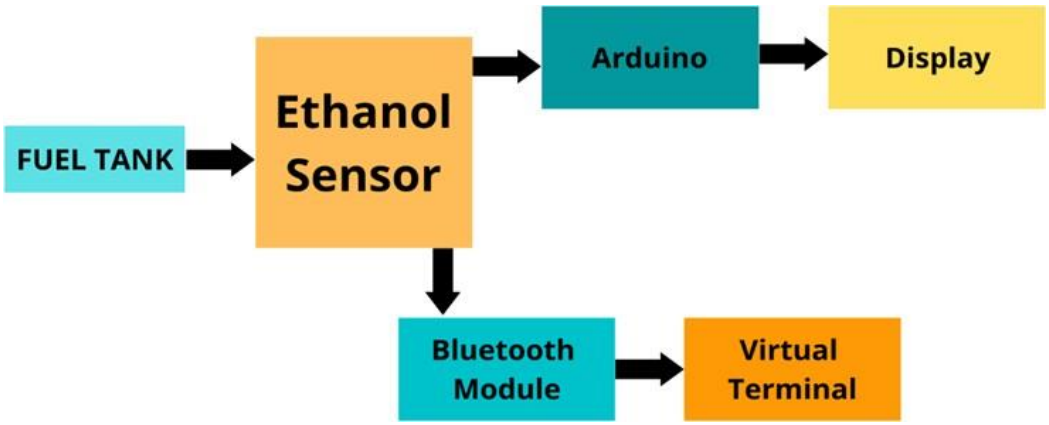


Fig 2.4: Fuel grading using Ethanol percentage

In this design approach, we will set an ethanol analyzer to check the amount of ethanol in the fuel. From a report we get to know that ethanol actually has a negative effect on volumetric efficiency. And this thing gradually decreases the grading of the fuel. So, it is really very important to find out the ethanol percentage in the fuel. Here, we will use a microcontroller, a flex fuel sensor for analyzing the ethanol amount. Then an OLED display to show the rate. And Bluetooth connectivity will also be attached with the microcontroller, so that the data will be transferred to the consumer's device. This approach will be used in vehicles as a kit.

In design 2, our main purpose is to calculate the ethanol parameters to grade the fuel. The circuit build up is quite similar to the design 01. Here, we have used the Arduino nano v2 as the central processing unit. AC to DC converter using bridge rectifier. We have used an additional part that is the Bluetooth connectivity which will immediately send the data to the users. We have used potentiometer for ethanol detection. Here, we are calculating the ethanol's parameters in average value to show it in the display and for the easier to the users. When we turn on the program reset button the signal passes through the potentiometer and the power supply will start to work on.

And it will start to detect the existence of ethanol in the fuel and it will collect the values in percentage where the range is set. Here, the connection goes through the Bluetooth connectivity to collect all the data from Arduino nano and send it to the consumers. As well as here the usage of capacitors is the same as design 01 to decrease the voltage ripple. This is how we can simulate our 2nd design in proteus.

Design 3 Approach: Fuel Grading through Fuel Flow

In this process, the prime intention is to analyze the flow of fuel-by-fuel injector. The components we have used here are the microcontroller, fuel injector and sensors. The main mechanism here is when fuel is filled in the tank and the fuel injector will be connected there. If the flow of fuel comes out straight from the injector that refers to the fuel is good to use. On the other hand, if the flow spreads away then it is considered that something is mixed with the fuel. A sensor will be connected with will be connected with the injector which will show the parameter of flow and with the WIFI module it will be sent in the media or phones of the consumer.

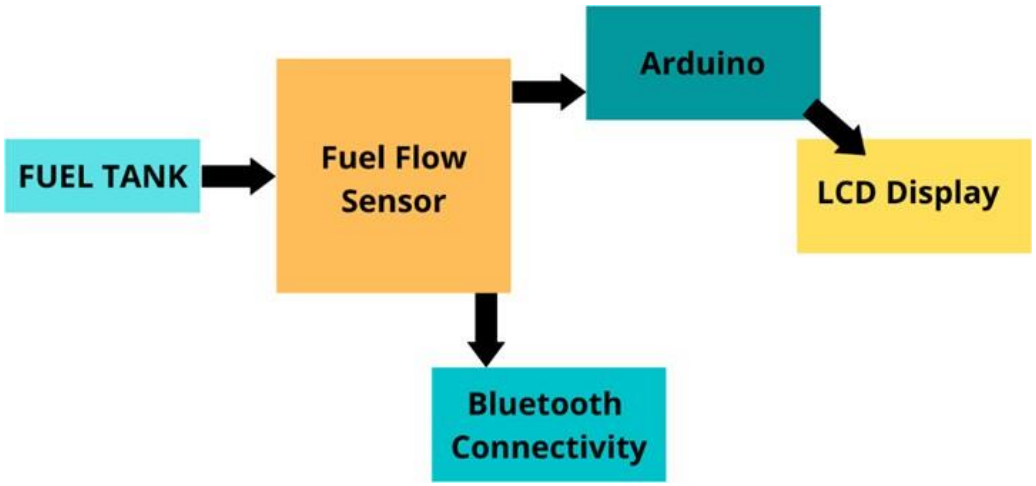


Fig 2.5: Fuel Grading through Fuel Flow

In our 3rd design, A fuel flow sensor has been connected with the Arduino nano V2 which will measure the fuel flow rate. Here, in the D2 pin of Arduino Nano V2 which continuously blinks. That is because of the flow of the substance. Similar use of power supply, capacitors. Here, the flow rates are calculated with comparison of several parameters such as pressure (MPa), injection time (ms), range(mm^3/H) and Dosages (mm^3/H). Here, we can see the percentage rate of the flow to determine whether the fuel grade is good or bad. The range that has been selected in the code is 80 to 50%. This rate is accumulated by using the frequency rate. This is one of the crucial ways of finding the grade of fuel (gasoline).

2.4 Analysis of multiple design approach

In the optimal design we can have all the parameters. In our final design and model, first we take some water to see if the hardware or kit is giving the accurate measure or not. It's actually giving the accurate value which is 1 g/cm3.Then we move for the next step. We take 200 ml octane for the initial measurement. With the room temperature of 25 °c. And for the octane the standard internationally, for the temperature the range is between 25 °c to 30°c and density it is 0.703 to 0.77 and for different fuel stations samples it gives different values and at some point it is so close to the actual value. But we know for some mechanical error or technical or

outside factors we take a constant value or ignore the minor differences. As we are comparing the parameters with the standards of all gasoline. And we keep doing the same process for petrol and diesel. All the machines or components we have used here have been given in the component's parts. Here, one of the most identifying parts is the flow measurement. We have used a liquid flow sensor. It actually calculates the flow according to the flow equipment used in the stations. Currently we are using a flow sensor with a motor 6v along with a bug converter which can catch the value at most 30 rpml (Revolution Per milliliter) . Therefore, for different fuels it actually vary the flow of the fuel. The theory is when something is mixed with the fuel the density will get high and it affects the flow of the fuel. Comparison of measurements have been given in another part. All these visual results actually gives a clear knowledge about the parameters which actually define the quality of fuel.

2.5 Conclusion

The design of a Smart and Affordable Fuel Grade Analyzer is a critical component of a fuel-monitoring system. This device can detect and measure the composition of fuel and provide the user with real-time information about the fuel's grade. By using this device, users can ensure that the fuel they're using is of the highest quality and meets the necessary safety standards. The key components of the Smart and Affordable Fuel Grade Analyzer design include a sensing unit, a data collection system, a communication module, and a user interface. The sensing unit detects the composition of the fuel, while the data collection system stores and sends the data to the user. The communication module sends the data to the user interface, which helps the user to interpret the data and make any necessary changes. Our designs were based on temperature, density, flow of fuel and ethanol percentage. Our 3 design approaches mainly worked on those categories and our main project design is combined all those three design approaches. Our main objectives were to make it cheap and affordable. And our designs reflect that perfectly.

Chapter 3: Use of Modern Engineering and IT Tool.

3.1 Introduction

The advancement and understanding of inventive frameworks, their products, effects, and applicability is also important to innovation, which may be a component of cutting-edge engineering. Concerns exist about non-technological tactics as well. .[21] For this project, we used a variety of cutting-edge engineering tools. Typically achieved by first attempting to memorize how the tool is used, using it to understand subject matter in appropriate courses and then applying it to develop, plan, and realize. This has made it possible for us to demand accurate information and makes it possible to examine the information gathered. To the best of our ability, we have adequately described each instrument.

3.2: Select appropriate engineering and IT tools

Table 3.1: Select appropriate engineering and IT tools

	Components	**Purpose**
Software	1. Proteus 8.12 Professional 2. Arduino	1. For simulation 2. To provide code to the system and run the logic
Hardware	1. Temperature sensor 2. Density sensor 3. Fluid flow sensor 4. Power supply 5. Buck converter 6. Display 7. Switch 8. Rectifier	1. Detects temperature of fuel. 2. Detects density of fuel. 3. Detects flow of fuel 4. Maintains proper power supply to the system. 5. Controls the input supply for the system at 5V. 6. Shows value 7. Resets the system 8. Works as AC-DC converter.

3.3 Use of modern engineering and IT tools

Proteus 8.12:

It is a simulation file which is mainly used for building up circuits and run them to simulate the circuit. There are several versions of this software. Proteus is very easier to find out the tools used in circuit build up. It has been conducted in English. It is conducted by the company named proteus. Here 8.12 Is the latest version of Proteus.

Arduino:

Based on the ATmega328, the Arduino Nano is a compact, comprehensive, and breadboard-friendly board (Arduino Nano 3.x). It comes in a different packaging but has roughly the same capabilities as the Arduino. It only lacks a DC power jack and uses a Mini-B USB cable rather than a conventional one to operate.

Temperature sensor, DHT11:

DHT11 is a commonly used temperature and humidity sensor that comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data. The sensor can measure temperature from 0°C to 50°C and humidity from 20% to 90% with an accuracy of ±1°C and ±1%.

Density sensor, OPW:

The sensor continuously measures the density of the fuel in the tank, providing a measure of even the smallest changes in product quality within the API density range. Fuel density reports can be displayed real-time on the SiteSentinel® family of controllers or exported to an external display. The density readings can be configured to either nominal or temperature-corrected density.

3.4 Conclusion

We utilized a variety of technologies for this project, which provided us the accuracy level for the reading. Additionally, we have selected the technologies that are most suited to address the issue of opaque fuel transactions.

Chapter 4: Optimization of Multiple Design and Finding the Optimal Solution

4.1 Introduction

Gasoline is a very important part of our daily life. It has use in many sectors. Now, as gasoline is a natural resource this is very valuable. In our project we are mainly focusing on Octane Petrol and Diesel. Our design is based on temperature, density, flow rate, percentage of ethanol of the fuel. Now, refined fuels cool and condense, like all liquids, taking up less space. On the other hand, they expand and occupy as they warm additional rooms. We must comprehend how the temperature influences the price per gallon if you are purchasing or selling fuel based on gross volume, or the actual volume at the current temperature. After all, the fuel's power to an engine, which is propelled by its mass, is what gives it its final value. [28]

4.2 Optimization of multiple design approach

Design 1 Approach:

Fuel grade analysis using temperature and density

This design 01 uses Arduino Nano V2 which is the central processing unit. The main goal of this design is to simulate Proteus 8.12 parameters (temperature and density) via Arduino Nano V2. This circuit uses Vsine 220V as the power supply and uses a bridge rectifier to convert the AC power supply 220V to 5V DC. A temperature sensor was used to read the temperature of the fuel called DHT11. And for the density sensor, just use a potentiometer connected to the Arduino Nano V2, the parameter range is set from 820 kg/m^3 to 860 kg/m^3 by coding.

Also, if you set the command when the reading is between 820 and 860 kg/m^3, the display will show "The Fuel Is Good". Below 820 kg/m^3 it says "average" and above 860 kg/m^3 it says "very bad fuel". The same is true for temperatures reading between 5°C and 10°C. Here the density rating depends on the temperature rating. I used a switch to start the program as a program reset. When the program reset switch is turned on, the frequency weighting that controls the weighting of the potentiometer is set, the power supply is connected to DC, the signal is passed to the Arduino Nano V2, and after comparing the parameters, the result is displayed in the ad. Capacitors are also used to reduce voltage ripple.

Software Simulation:

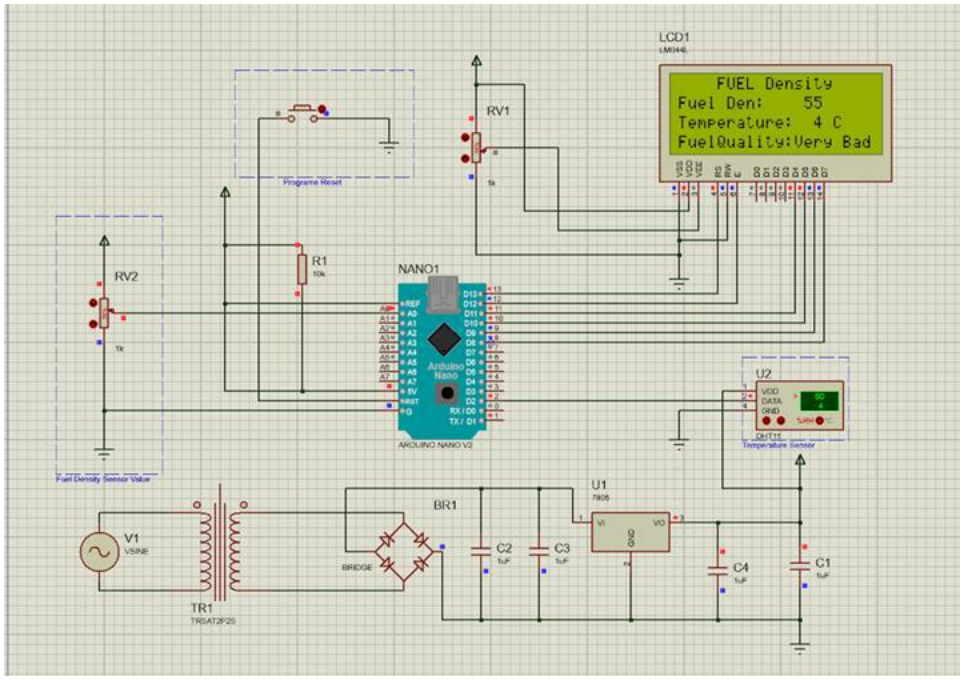


Fig 4.1: Software Simulation

This model has been created in PROTEUS to simulate. It is basically a system representation of how this model will work in real life. In this model we have provided some discrete inputs which will be taken as the fuel density. The temperature sensor will take the temperature reading of the fuel. All the readings will be seen after the simulation in an LCD display. Comparing the ideal temperature and density of a certain type of fuel, this model will conclude if the grade of the fuel is ok or not. We have decided this grading into three parts depending upon the two parameters, Temperature and Density. If both the parameters fall under ideal numbers, it will show good quality fuel in the display. If one of them is ok, the fuel quality will be indicated as an average quality fuel. Lastly, if none of the parameters match with the ideal numbers, it will be shown as a very bad fuel. .[30]

Advantages

1. It is portable so that anyone can use this device from anywhere without any hassle.
2. The production cost is less than other devices.
3. Consumers do not need to take any extra tube or pot for testing

Disadvantages:

1. It cannot detect the amount of Ethanol in the fuel.
2. This design cannot give an accurate result. It can show the average value.

3. It cannot test different types of fuel at the same time. Consumers need to properly clean the tank for every single test.

Design 2 Approach:

Fuel grading using Ethanol percentage

This design approach uses an ethanol analyzer to check the amount of ethanol in the fuel. From the report, we can see that ethanol indeed has a negative effect on volumetric efficiency. And this is starting to lower the fuel rating. Therefore, it is very important to examine the percentage of ethanol in fuel. Here we use a microcontroller, a flex fuel sensor, to analyze the amount of ethanol. Then an OLED display that shows the rate. A Bluetooth connection is also connected to the microcontroller, so the data is transferred to the consumer's device. This approach is used for vehicles as a kit.

Software Simulation:

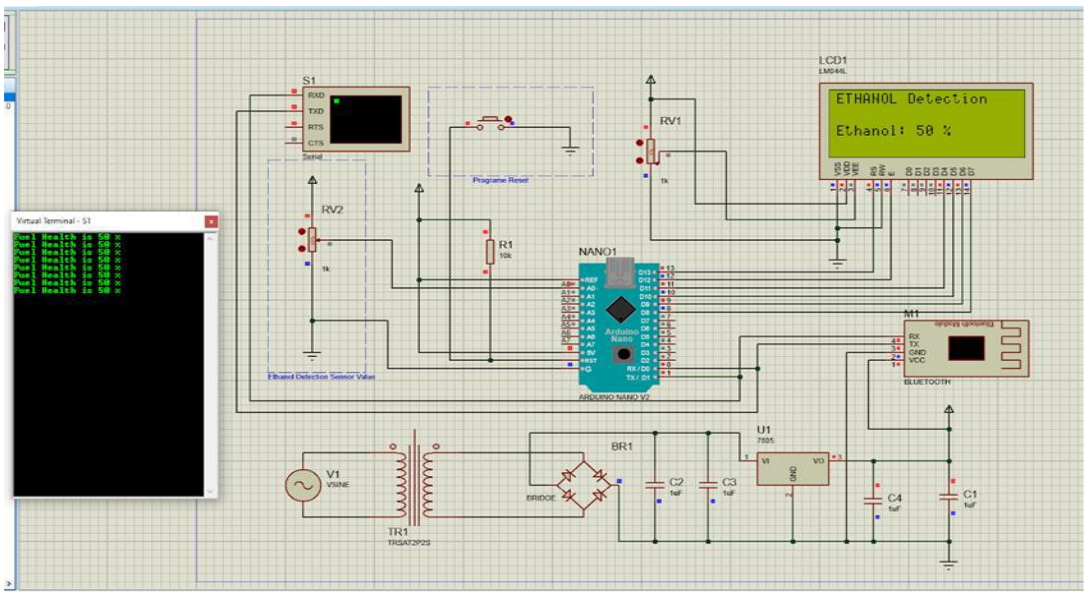


Fig 4.2: Software Simulation

We have designed this model in PROTEUS as well. This model is quite simple but can provide the most accurate result because of the direct use of the ethanol testing sensor via which we get exactly the parameter we need to actually declare the grading of fuel. We have used an Arduino nano with an lcd. As there is no actual ethanol testing sensor in the PROTEUS library, we have manually created a prototype system that represents the sensor. The lcd will show the ethanol percentage as well as the health percentage of the fuel. The Bluetooth module is used for remote access and ease of use. Reset button will fully reset all the calculated data that were stored previously.

Advantages:

1. It can give a better result by detecting the amount of Ethanol.
2. Low production cost and portable.
3. As it is a testing kit so consumers can use it in a very easy way.

Disadvantages:

1. It is vulnerable as it is smaller than the previous design. So consumers need to use it carefully.
2. Consumers need extra tubes or pots for testing.

Design 3 Approach:

Fuel Grading through Fuel Flow

In this process, the main purpose is to analyze the fuel injector flow according to the fuel. The components we use here are the microcontroller, fuel injectors and sensors. .[22] The main mechanism here is when the fuel is filled into the tank and the fuel injector will be connected to it. If the fuel flow goes straight out of the injectors and back, the fuel is still good to use. Conversely, if the flow is spreading, it is considered that something is mixing with the fuel. A sensor that will be connected to will be linked to the nozzle which will show the flow parameter and with the WIFI module it will be sent to the consumer vehicle or phone.

Software Simulation:

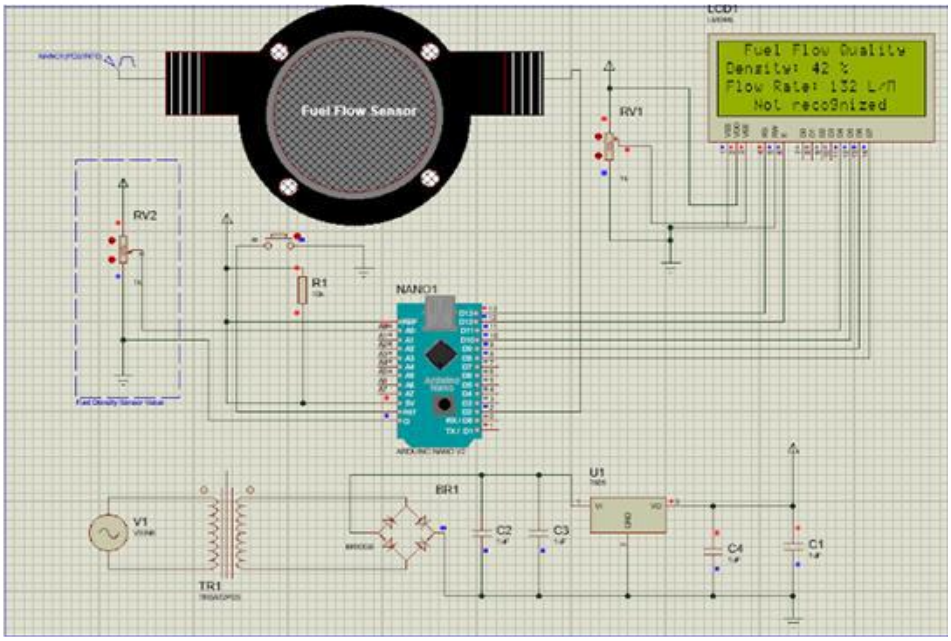


Fig 4.3: Software Simulation

This model is also one of the approaches that passively indicates the fuel health unlike the model 2. A flow of fuel through the fuel flow sensor will show us the health of the fuel. The most obvious drawback of this design is it is influenced by various atmospheric or external parameters. The flow of fuel can be manipulated, and inaccurate data might be observed. Other than that, this design is quite simple to build with an Arduino nano and only just with a fuel flow and density sensor. Finally, a push button is there as well for resetting the readings. .[27]

Advantages:

1. Consumers do not need to carry any devices for testing as this device will be fitted with their vehicle's fuel tank.
2. This is a time-consuming process.
3. This can be processed automatically so consumers do not need to give any extra effort for testing.

Disadvantages:

1. This is a fixed device. Consumers cannot use it for several purposes.
2. It may not show the exact value. However, it can only show you the bad fuel, good fuel and the moderate fuel category.
3. For specific consumers only. (Ex: The people or the company who have personal vehicles/ fuel reserve tank

4.3 Identify optimal design approach

Table 4.4: Identify optimal design approach

Comparison Feature	Design 1	Design 2	Design 3
Measuring parameter of fuel quality	Temperature and Density	Ethanol percentage	Flow of fuel
Power Supply	AC to DC power converter	AC to DC power converter	AC to DC power converter
Complexity of circuit	High	Medium	Medium
Operating flexibility	Medium	High	High
Price	3590/=	2642/=	3644/=

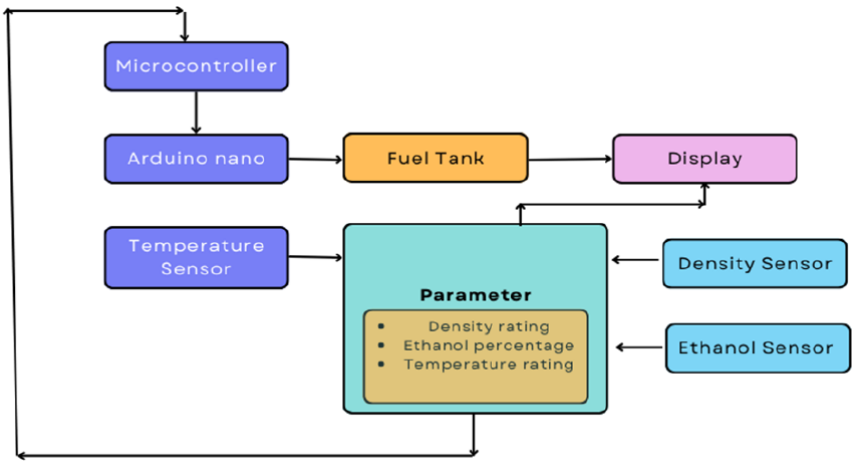


Fig 4.4: Identify optimal design approach

1. Includes all necessary parameters.
2. It will provide accuracy.
3. More than 10% Ethanol is harmful for ignition engine.

In this optimal design, it will merge all the parameters altogether. It will directly show the ratings and calculate its efficiency and show the results that if the gasoline is good or bad or average. For the final design we have tried to get all the parameters right. In this part we verified all the things individually. Now ethanol is a very important fact [Ethanol is an organic compound. It is an alcohol with the chemical formula C_2H_6O. Its formula can be also written as $CH_3{-}CH_2{-}OH$ or C_2H_5OH. Ethanol is a volatile, flammable, colorless liquid with a characteristic wine-like odor and pungent taste. When a gasoline has 10% ethanol we can say that's standard. Since ethanol has a greater octane rating than gasoline, it offers superior mixing qualities. Engine knocking is prevented, and drivability is ensured by minimum octane number regulations for fuel. To get the required 87 octane, 10% ethanol is combined with lower-octane gasoline. Depending on the volume % of ethanol in the blend, ethanol has a variable amount less energy per gallon than gasoline. About 30% less energy is contained per gallon in denatured ethanol (98% ethanol), compared to gasoline. Whether an engine is designed to run on gasoline or ethanol and the amount of ethanol in the fuel both affect fuel economy. [29]

Constrains:

Now we decided to measure ethanol manually because Ethanol sensors are highly expensive, and we want to make it affordable. Now if we can get proper results with measuring density temperature and flow rate then we can skip ethanol texting. That is why we are counting the % of ethanol in the lab. Therefore, our final components used in the device are:

1. LCD display 2004
2. Arduino Nano
3. Load cell HX711
4. Temperature Sensor DS18b20

5. Pressure Sensor
6. Bluetooth (HC-05)
7. Liquid Flow Sensor (YF-S201)
8. Push button
9. Liquid deceleration sensor
10. Power Supply 12V
11. DC-DC Step Down Convertor

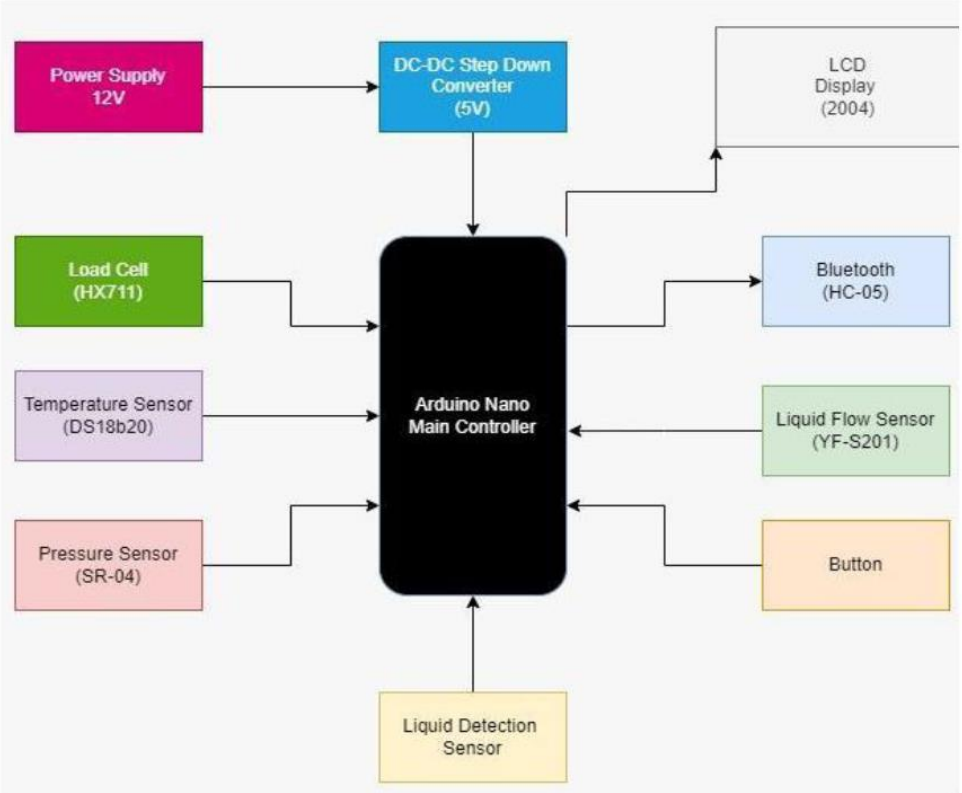
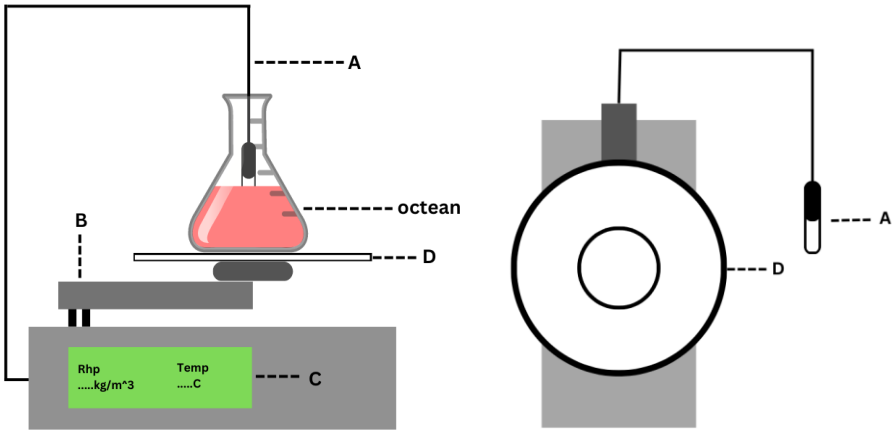


Fig 4.5: Arduino Operation

We didn't use a density sensor, rather we used $\rho = m/V$, where m = mass of the substance and V = volume. For this we used a fixed Test Tube for gasoline and a Load cell HX711 for measuring the mass.

Final Design Structure:



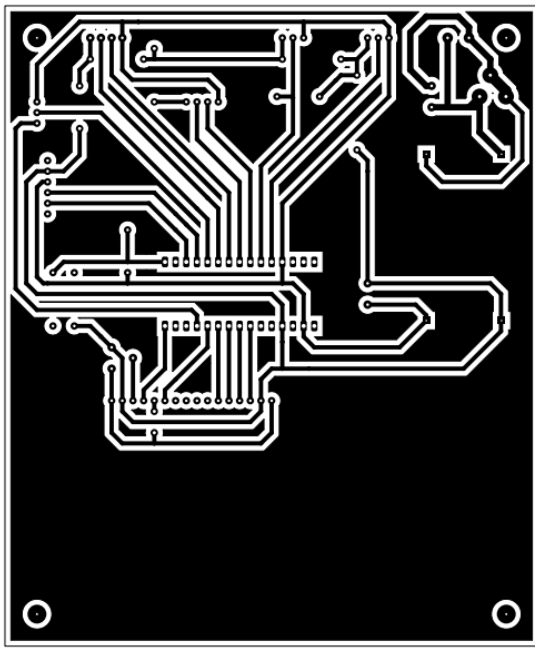


Fig4.6: PCB

4.4 Performance evaluation of developed solution

Now for verifying the performance of the device we measured water to determine if the device provides actual values. For water we found density 1 g/cm3. Which is universal. We found the temperature to be the same as room temperature for water and the flow rate was 30 liter per minute which is the maximum capacity of our used motor. As we got the standard measurement for water so we can come to a conclusion that our device is able to provide almost accurate measurement.

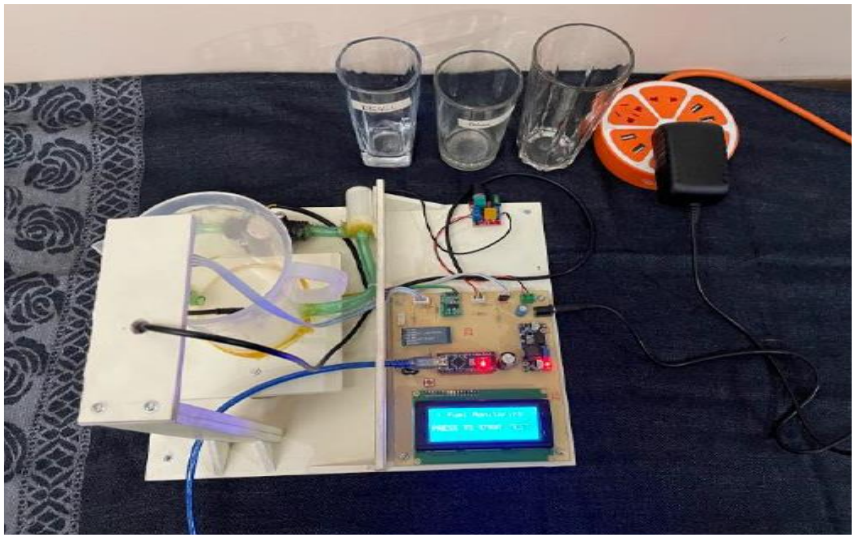


Fig4.7: Fuel monitoring system

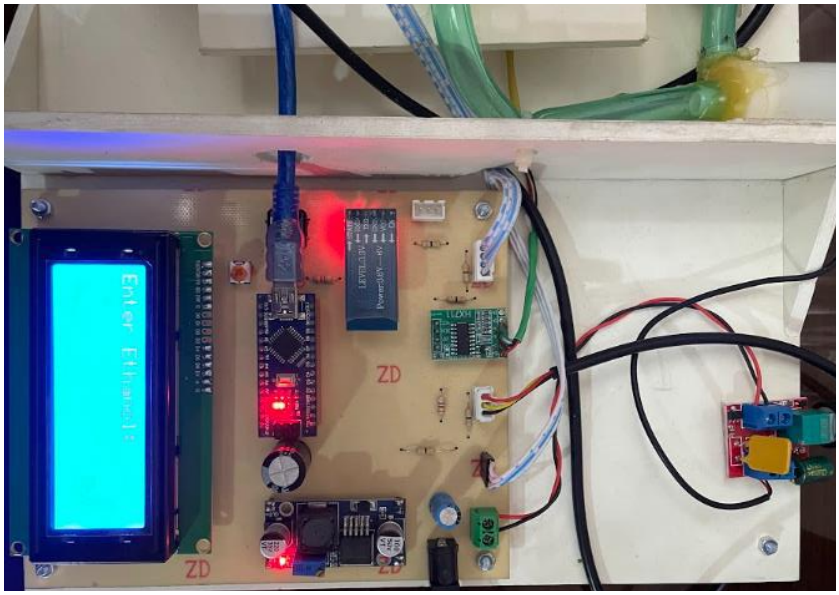


Fig4.8: Fuel monitoring system

Data Collection:

Fig4.9: Data Collection

Experiment for diesel:

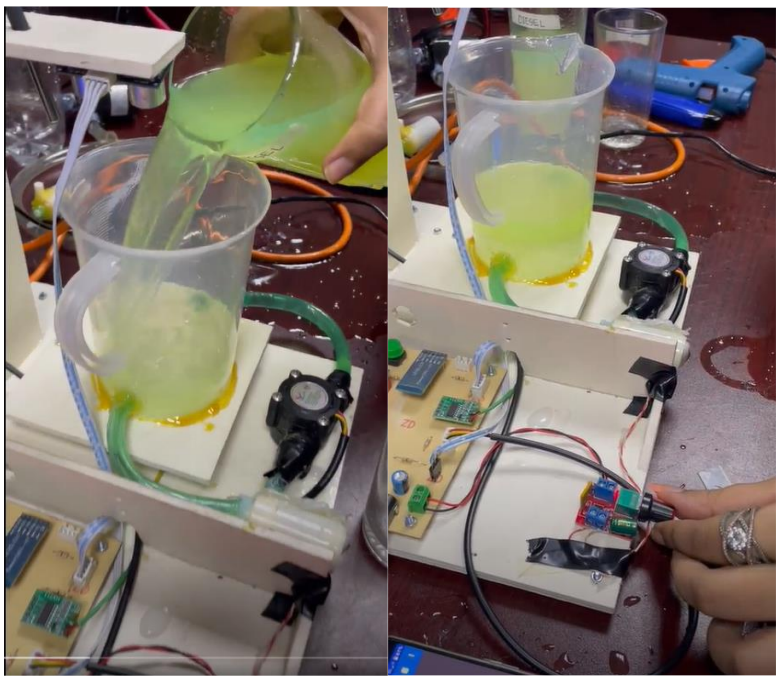


Fig4.9.1: Adding diesel to device

Fig4.9.2: Final value

4.5 Conclusion

Adulterated gas may harm your health, damage your car's engine, and cost the government money in lost tax income. With the recent liberalization of Concerns about the quality of Bangladesh's gasoline have been growing in the Bangladesh oil market. The ethanol content of the gasoline is being increased, ethanol is being used in hydrated form, or foreign solvents are being added. In this study, a portable electronic approach for estimating ethanol content is presented. Fuel monitoring devices can be very available and affordable for the common people as it is very low budget. As well as we can access all the parameters in our mobile device through bluetooth. This will help us to identify the fuel quality of the fuel we are using in our vehicle.

Chapter 5: Completion of Final Design and Validation.

5.1 Introduction

In our final design, we take all the devices in one kit and take all the data and compare those to meet the desired solution. For the ethanol we have taken the manual process. And in the density test we have taken a weight with the volume of the tank we can measure the density. Eventually, using all the sensors we calculate all the required data.

5.2 Completion of final design

This is the device or kit where it is programmed by the Arduino nano. Used the bug converter to convert the voltage rate of the motor from 12v to 6v. The HX711 Load cell has been used for the density measurement. This can measure at most 5 kg weight. Over this we put the beaker or tank where we will pour the fuel. Then a bluetooth connectivity is connected where it will run by the user's phone. The ethanol percentage has to be set 10% as the 10% standard has been provided in Bangladesh. For temperature we have put the DS18b20 sensor. This can be used in any vehicles. For the flow, as the flow from the gasoline pump of every station is fixed and by the mixture of anything in the fuel it can vary the rate of the fuel flow. So, all these things have been set up to meet the desired results. This is our final design.

5.3 Evaluate the solution to meet desired need

We have taken a few samples from several fuel stations and have an experiment on them. It has been explained below:

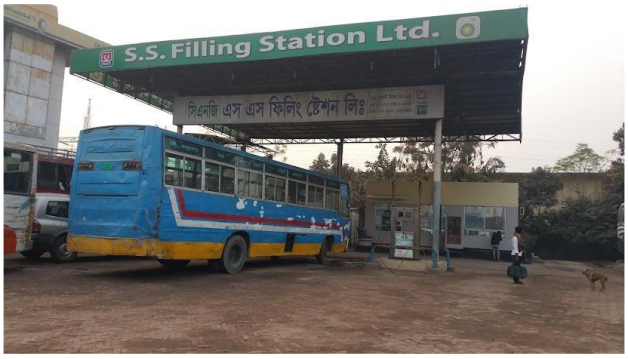


Fig 5.1: Fuel station

Fig 5.2: Fuel Station

For Octane:

Table 5.3: Data Collection

Fuel Stations	**Octane**			
	Temperature 0° C	Density g/cm^3	Flow Lit/min	With mixer water
Gulshan Service Station	24.93	0.71	26.01	Tem: 26.22 Density: 0.641 Flow: 16.83
S.S filing Station, Dhaka-Aricha Road.	24.91	0.763	30	Tem : 25 Den: 0.71 Flow: 28.13
Mitali filing Station, Bogura	25	0.701	29.201	Tem : 26.03 Den: 0.713 Flow : 26

For Petrol:

Table 5.4: Data Collection

Fuel Stations	**Petrol**			
Gulshan Service Station	Temperature 0° C	Density g/cm^3	Flow Lit/min	With mixer water
	24.94	0.93	29	Tem: 25.19 Density: 0.96 Flow : 16
S.S filing Station, Dhaka-Aricha Road.	24.902	0.935	30	Tem : 25.13 Den : 0.92 Flow : 22.03
Mitali filing Station, Bogura	25.01	0.912	29.23	Tem : 27.02 Den : 0.941 Flow : 14.1

For Diesel:

Table 5.4: Data Collection

Fuel Stations	**Diesel**			
	Temperature 0° C	Density g/cm^3	Flow Lit/min	With mixer water
Gulshan Service Station	26.12	0.89	29	Tem: 31 Density: 0.91 Flow : 21
S.S filing Station, Dhaka-Aricha Road.	25.1	0.87	23	Tem : 26.03 Den : 0.936 Flow : 24.06
Mitali filing Station, Bogura	24.123	0.81	30	Tem : 29.11 Dem : 0.931 Flow : 13.6

5.4 Conclusion

We took samples from different fuel stations and we can see the results in the chart as well as in the device. We put all the data and compare those with the standards, and we see some actual differences in the results. We put an efficiency graph of the database. It actually provides us the main fact which we were willing to see.

Chapter 6: Impact Analysis and Project Sustainability

6.1 Introduction

Impact analysis and project sustainability of fuel grade measurement is a critical issue for both the environment and the economy. Fuel grade measurement describes the quality of the fuel that is used to power a vehicle. This is a crucial factor in determining how efficiently a vehicle runs and how much pollution it produces. The quality of fuel is determined by the amount of sulfur and other contaminants present in it. Poor quality fuels can lead to inefficient operation, increased fuel consumption, higher emissions, and greater environmental pollution. As such, it is important to ensure the sustainable use of fuels by measuring their grade accurately and consistently. Impact analysis is the process of assessing the potential impacts of a project or policy on the environment. This may include both direct and indirect impacts, such as air and water pollution, land use, biodiversity, and climate change. In order to ensure the sustainability of a project, it is important to understand the potential impacts it may have and how these can be mitigated or managed. Project sustainability is defined as the ability of a project to maintain its objectives and outcomes over time. This includes ensuring that the project is economically viable, that it minimizes environmental impacts, and that it produces long-term social benefits. In order to achieve this, projects must be designed with sustainability in mind. This includes considering the environmental, economic, and social impacts of the project and ensuring that these are taken into account when making decisions. Fuel grade measurement is an important component of project sustainability and environmental protection. It enables fuel suppliers to ensure that their products meet the required standards and that they are providing consumers with the best possible fuel quality. This in turn reduces air and water pollution, minimizes fuel consumption and emissions, and contributes to the long-term sustainability of the project. In order to effectively assess the impact and sustainability of fuel grade measurement, it is important to consider a range of factors, including the type of fuel being measured, the quality standards and regulations in place, and the availability of appropriate technology. This paper will provide an overview of the impact analysis and project sustainability of fuel grade measurement, highlighting key considerations for achieving sustainability. .[32]

6.2 Assess the impact of solution

The impact of solutions such as fuel grade measurement can be far reaching and highly beneficial to the environment. Fuel grade measurement is the practice of measuring the quality of fuel used in vehicles and machines in order to reduce the emission of harmful pollutants into the environment. As fuel grade measurement is a relatively new environmental solution, its effectiveness in reducing emissions has yet to be fully assessed. One of the most obvious benefits of fuel grade measurement is the reduction in air pollution. Air pollution is a major

environmental issue and is responsible for a range of health problems, from lung cancer to heart disease. By ensuring that the fuel used in vehicles and machines is of the *correct* grade, harmful pollutants such as carbon dioxide and nitrogen oxides are drastically reduced. This, in turn, helps to reduce the amount of smog and other airborne pollutants which contribute to air pollution.

Fuel grade measurement also helps to conserve natural resources. The use of high-grade fuel is more efficient than lower-grade fuel, meaning that less fuel needs to be used in order to achieve the same results. This helps to reduce the amount of fuel that needs to be extracted from the earth, which helps to conserve valuable resources. The reduced use of fuel also helps to save money, as lower-grade fuel is generally cheaper than higher-grade fuel.

Finally, fuel grade measurement helps to reduce the amount of greenhouse gases that are released into the atmosphere. Greenhouse gases are responsible for global warming, and the reduction of these gases helps to slow down the process of climate change. By reducing the amount of greenhouse gases released into the atmosphere, fuel grade measurement helps to ensure that our planet remains habitable for future generations.

Overall, fuel grade measurement has the potential to make a significant impact on the environment. By reducing the amount of air pollution, conserving natural resources, and reducing the amount of greenhouse gases released into the atmosphere, fuel grade measurement is a highly effective environmental solution. Its effectiveness in reducing emissions is yet to be fully assessed, but the potential benefits of this environmental solution are clear.

6.3 Evaluate the sustainability

Fuel grade measurement devices are becoming increasingly important for monitoring and managing the quality of fuel. The sustainability of fuel-grade measurement devices is an important consideration for any organization that relies on them. In order to evaluate the sustainability of these devices, it is necessary to examine their environmental impact, cost-effectiveness, and reliability.

Environmental Impact:

The environmental impact of fuel grade measurement devices is a key factor in determining their sustainability. These devices are typically powered by electricity and require some form of fuel to operate. As such, the amount of energy consumed, and the type and quantity of emissions released into the atmosphere as a result of their operation, are important considerations. Additionally, the type of materials used in the device construction should be considered, as some materials may be eco-friendlier than others.

Cost-Effectiveness:

The cost-effectiveness of a fuel grade measurement device is an important consideration in determining its sustainability. The cost of purchasing and maintaining the device should be taken into account, as well as any additional costs associated with its use. The device's performance, accuracy, and reliability should also be taken into account, as these factors can have a significant impact on the overall cost-effectiveness of the device.

Reliability:

The reliability of a fuel grade measurement device is also an important consideration when evaluating its sustainability. The device should be designed and constructed to withstand the harsh conditions of its operating environment. Additionally, the device should be able to provide accurate and reliable readings for an extended period of time without requiring frequent recalibration or repairs.

Moreover, while planning a project we should be aware of sustainability which is basically an approach that balances the environmental, social, and economic aspects of project-based work to meet present needs without harming future generations. We are introducing more features in our device than the similar kinds of products available in the market. As similar types of products are existing in the market, we are taking unique features from them and implementing them to build a better one.

However, we are doing a low-cost setup that could be affordable for any type of company or industry or even for personal use as well. Initially, we are using all kinds of standard sensors and devices but in the future, we are hopeful to use more advanced technologies for more accurate results of fuel grading. If we can get help from the government and introduce this type of device to industries, this will lead to social sustainability as well. So, that is all to prove that our project is sustainable. Overall, the sustainability of fuel grade measurement devices is determined by its environmental impact, cost-effectiveness, and reliability. Organizations should carefully evaluate each of these factors before making a purchase decision. By doing so, they can ensure that they are investing in a device that is both financially and environmentally sustainable.

6.4 Conclusion

The impact analysis and product sustainability of fuel grade measurement devices has been studied in depth in this paper. It has been found that these devices have a positive impact on the environment, as they help to reduce air pollution by providing an accurate measurement of fuel grade and helping to reduce fuel waste.

Furthermore, these devices have been shown to be cost effective and reliable, making them an attractive option for businesses and consumers alike. In conclusion, the impact and product sustainability of fuel grade measurement devices has been demonstrated to be a positive one. They are cost effective, reliable, and help to reduce air pollution by providing an accurate measurement of fuel grade.

In addition, these devices can help to reduce fuel waste and help to improve fuel efficiency. As such, these devices are a viable solution for businesses and consumers looking to reduce their environmental impact and reduce their overall costs. Overall, the impact and product sustainability of fuel grade measurement devices has been shown to be positive. These devices can help to reduce fuel waste, reduce air pollution, and help to improve fuel efficiency. As such, they are an attractive option for businesses and consumers alike.

Chapter 7: Engineering Project Management.

7.1 Introduction

Engineering project management is the application of knowledge, skills, tools, and techniques to project activities in order to meet project requirements. It involves a wide range of activities from concept to design, development, and implementation of a project. In this essay, we will discuss the engineering project management of making a fuel grading system. We will discuss the importance of project management in this type of project, the different phases of the project, and the steps involved in each phase. We will also discuss the tools and techniques that can be used to ensure a successful outcome.

The Importance of Project Management:

Any engineering project must have project management as a critical component. Making ensuring the project is finished on schedule and within budget is beneficial. Additionally, it aids in ensuring that the project is finished in accordance with the required quality standards. The identification of any prospective risks or concerns and the planning for their resolving are two additional benefits of project management.

With the aid of project management, it is possible to guarantee that the project will be finished on schedule and with the resources that have been allotted. Additionally, it makes sure that the project is completed on schedule and in accordance with the customer's needs.

7.2 Define, plan and manage engineering project

Project Phases:

Any engineering project must have project management as a crucial component. Planning, allocating resources, and monitoring a project's development from inception to conclusion are all part of it. The engineering project management of creating a gasoline grading system will be the main topic of this report. This study seeks to identify possible hazards and strategies for managing them while also giving a general overview of the project management process. A gasoline grading system's engineering project management goes through many stages. Included in these are the phases of planning, designing, implementing, and maintaining.

Planning Phase:

The project's earliest step is the planning phase. The project team obtains all the data required to specify the project's scope, goals, and requirements during this phase. This include determining the project's goals and objectives, the client's needs, the project schedule, and the resources available.

The first step in project management is to specify the project's scope for creating a gasoline grading system. This should contain the project's goals and objectives, as well as the necessary resources, budget, and schedule. It should also contain the project's specifications and needs, such as the kind of fuel that will be graded and the precision of the system. A project plan may be created once the project's scope has been determined. This strategy has included a timeline for activities, a resource allocation plan and a risk management plan.

Design Phase:

The project's second phase is the design phase. The project team creates the gasoline grading system's design during this phase. This entails taking into account the needs of the client, environmental restrictions, cost and budget restraints, and the necessary performance.

Implementation Phase:

The third stage of the project is the implementation phase. The project team constructs the gasoline grading system in accordance with the concept during this phase. This entails setting up the required hardware and software parts and making sure the system complies with the needs of the client.

Maintenance Phase:

The fourth and last phase of the project is maintenance. The project team checks the gasoline grading system's functionality and conformance to client specifications during this phase. This entails dealing with any problems that emerge and modifying the system as necessary.

Tools and Techniques:

To guarantee a good end in the engineering project management of creating a gasoline grading system, a number of tools and strategies may be applied. These include quality management tools like the Six Sigma technique, risk management tools like fault tree analysis and event tree analysis, and project management tools like Gantt charts and PERT charts.

At first stage, we came up with our project by considering risks, impacts, demands in market, importance in real life. After finding out the proper demands of project holders, we went through various academic research paper, videos to find a suitable project and its different solution. We then calculated our risks, scopes and opportunities and after all that we proposed our project.

7.3 Evaluate project progress

We have divided our work for the project into 3 phases. These stages are shown below.

Phase 1:

In this phase of our project, we divided our responsibilities into 3 parts. The next step in project management is to identify the stakeholders and assign roles and responsibilities. This includes identifying the project team and assigning tasks to each individual. It is also necessary to identify potential risks that could affect the project and develop a risk management plan to mitigate them. This plan should include steps to monitor and control risks, as well as contingency plans for potential issues. One group has researched a few papers to get a complex engineering problem. Another group talked to the stakeholders about what type of problems they are facing and tried to find some existing solutions. After all that, we compared components, discussed our findings and design systems and we came up with 3 system designs.

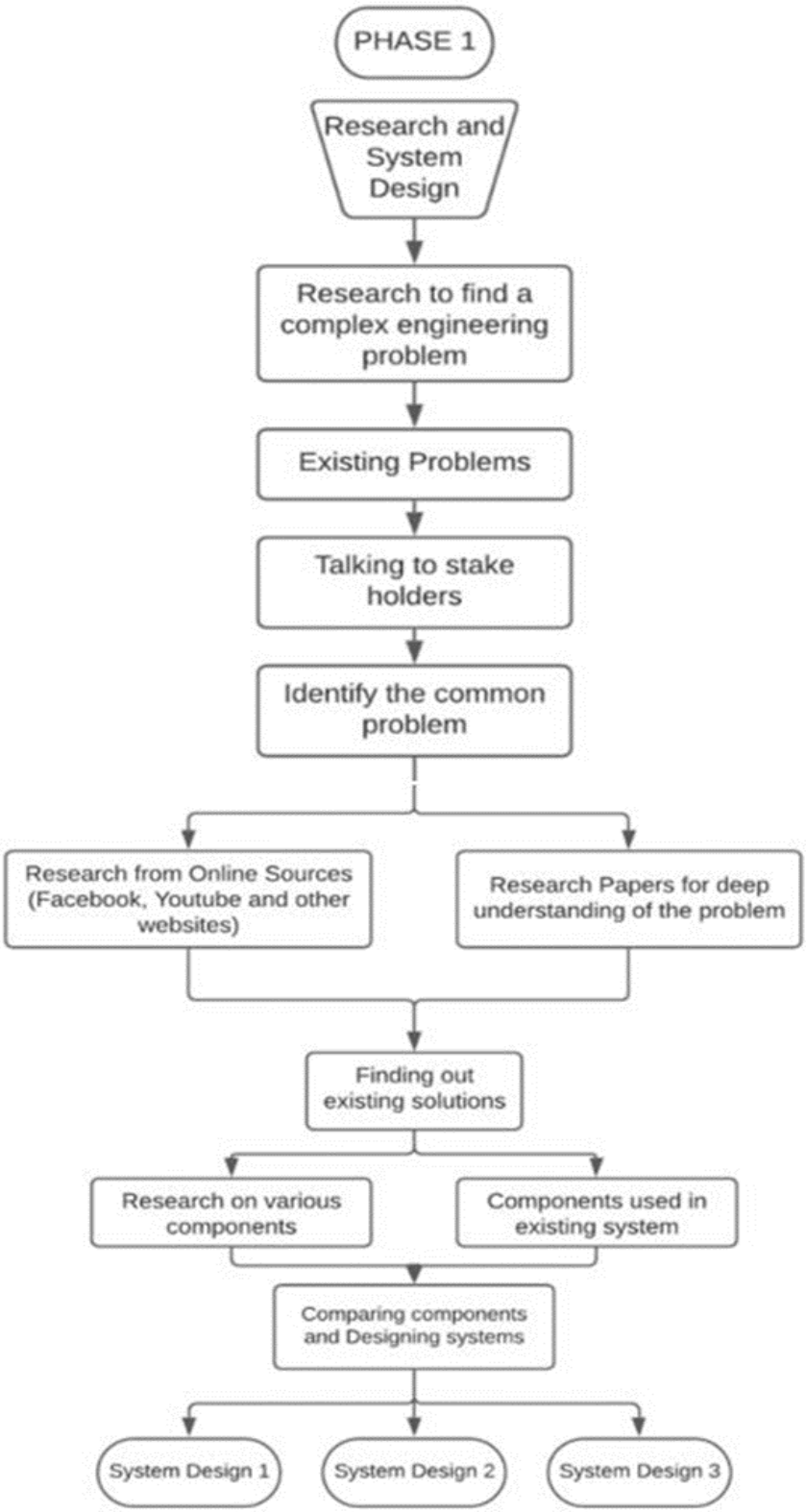


Fig 7.1: Phase 1

Phase 2:

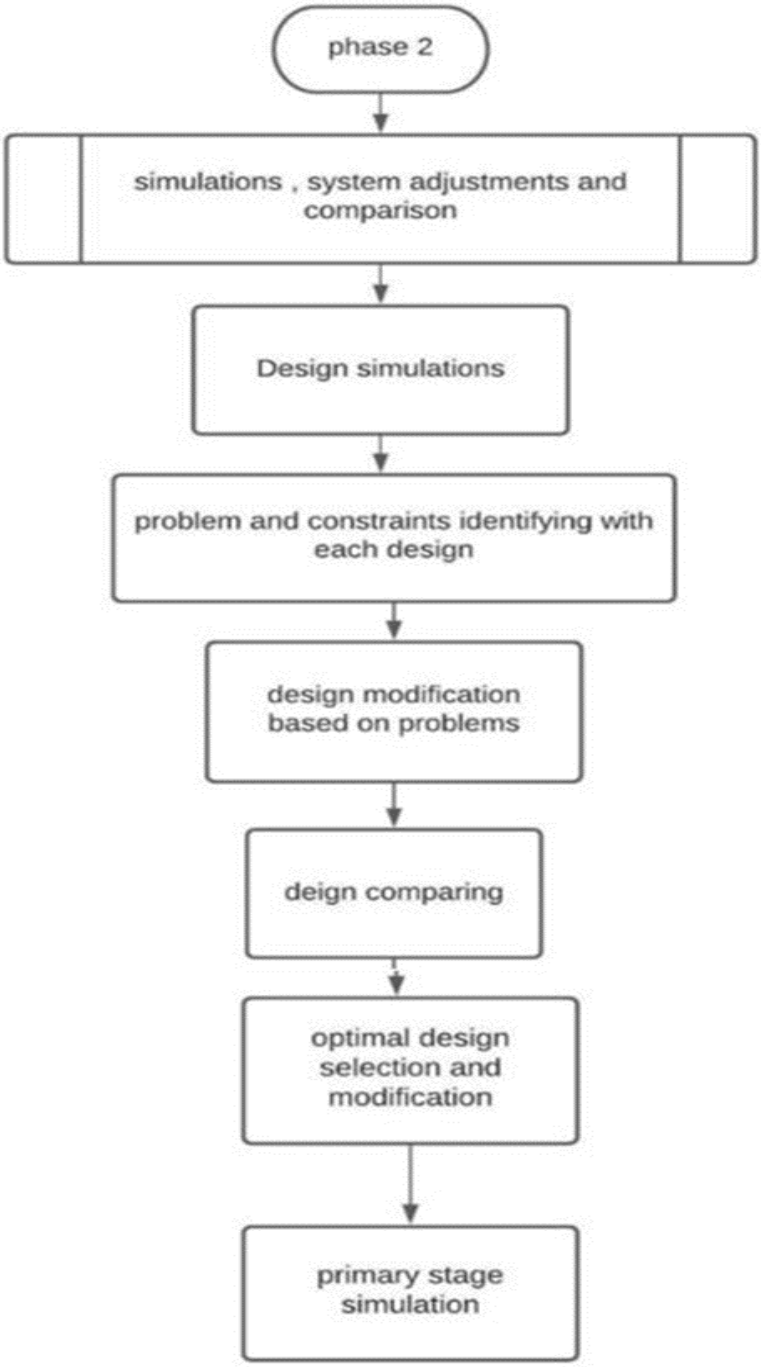


Fig 7.2: Phase 2

In this phase our main goal was to simulate the designs properly and find out the problems and its solution. After comparing all these things, we approached to our primary stage of simulation. In this phase we also divided our responsibilities. One group did the simulation, other two groups found the problems and solutions.

Phase 3:

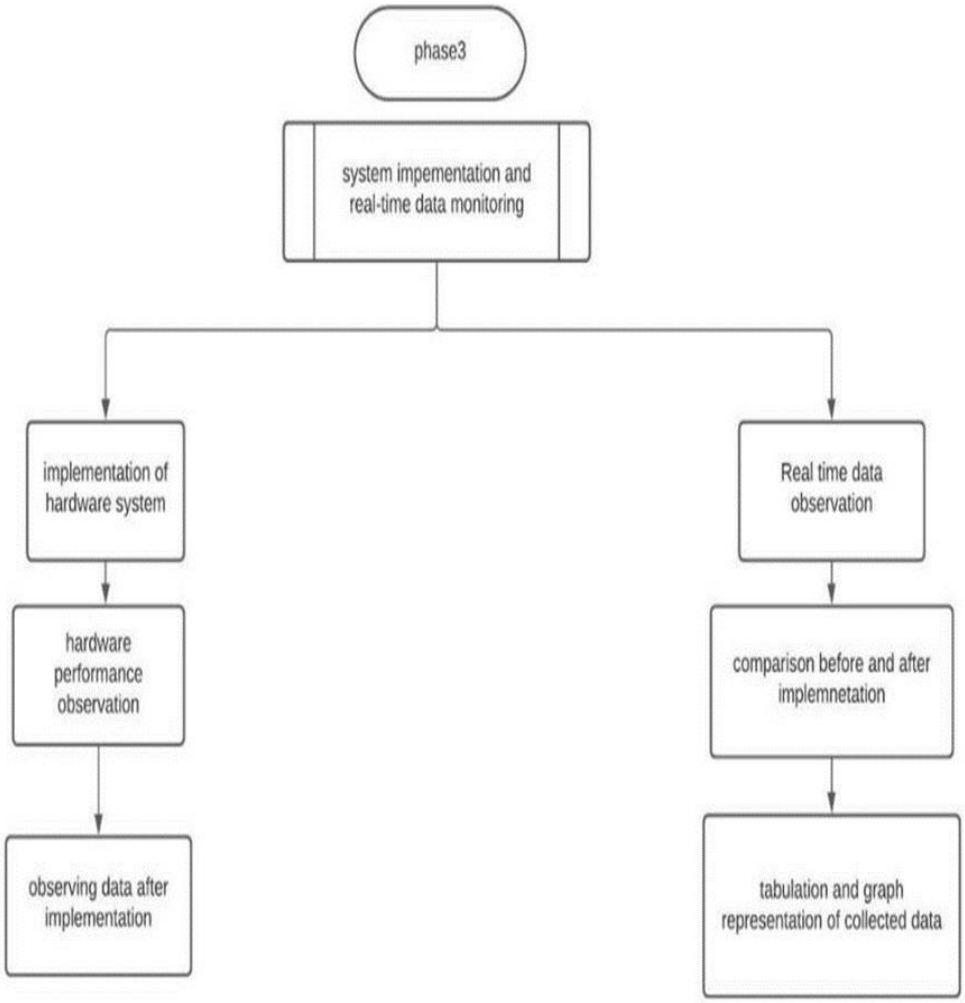


Fig 7.3: Phase 3

In this phase 3 of our project, we divided ourselves into groups. One implemented a hardware system and another one monitored real-time data. Then, we compared the data before and after implementation of the system.

In project management for making a fuel grading system is to develop a project schedule. This will include the timeline for activities and tasks, as well as the milestones that need to be achieved in order to complete the project. It is important to ensure that the timeline is realistic and achievable. It is also important to consider the resource requirements for the project, in order to ensure that there are no delays due to lack of resources. To make our final project it took almost 2 months. From finding and buying components to make a budget and assembling the project and running it. We all contributed and did our jobs almost perfectly. Before making the final project, there were a lot of things to do and we had minimum time to do those. But with some hiccups here and there, we were still able to do everything in time. We met our expected final result in expected time.

Identifying components, software simulation, finding and buying components, making the machine and solving problems immediately along the way. We faced problems during our project like not finding proper ethanol sensor, but we managed it to do in a very creative way and made it happened within our allocated time frame. More or less it took 2 months to build our project. And at the end we successfully overcame our problems, solving in a very creative way and completed our project in time. So just like big projects we divided our parts early and appointed one of our group mates to oversee all of our works. As I said, we faced many problems but we overcame those problems by helping each other. One couldn't able to do his/her task, other helped out. From buying components to building the machine, we all contributed and made up for each other's shortcomings. So, at the end like every-other projects, our journey of making this project was not easy, but we planned and were prepared for any difficulties and at the end we succeeded and make this project in projected timeframe.

When it came to budget and costing, it's a very important part of project management. We couldn't find proper ethanol sensor in our budget, so we had to make one manually. We faced difficulties during our coding. But the planning for this project was too professional. If anyone faces any problem, Others helped out and found solutions. We assigned a leader and his job was to make sure everyone is doing their jobs in time and follow proper instructions. Our job got easier when we divider our whole projects into 3 phases. It reduced our pressure and we were able to build a mind map and able to track our regular tasks quite easily. Also, the tasks were divided upon our own specialties. One is expert in on site, we gave him/her that part. In that way, no individual felt more pressure than others. And if they did, others helped. So, the project was successful because of our planning to handle all type of situation and difficulties and communication between ourselves.

Following the creation of the project plan and schedule, it is crucial to keep an eye on the project's development. All stakeholders should get regular progress updates, and project management tools should be used to monitor progress. Potential problems must be found and solved as soon as feasible.

Finally, after the project is over, it is crucial to evaluate its success. This evaluation ought to point out any areas that might be improved in the future and ought to provide the stakeholders input.

7.4 Conclusion

In conclusion, managing the engineering project to create a gasoline grading system is a difficult task. It requires a number of stages, from preparation through execution and upkeep. You may utilize project management methods and tools to make sure the outcome is successful. By following the steps outlined in this essay, project teams can ensure that the fuel grading system is completed according to the specified quality standards, within the allocated resources, and within the specified.

Chapter 8: Economical Analysis.

8.1 Introduction

Fuel grade measurement has an important part of the world's economy. It is used to determine the actual energy content of a fuel and to indicate the presence of any impurities or contaminants. Fuel grade measurement helps to ensure the proper operation of vehicles, machines, and other equipment that rely on fuel for power. It also helps to protect the environment by making sure that fuel is burned efficiently and does not release toxic pollutants into the air. The results of fuel grade measurement can then be used to make decisions about fuel usage and pricing. The data can be used to compare different fuels, such as gasoline and diesel, to determine which is more cost- effective. It can also be used to identify potential problems with fuel, such as contaminants or impurities, and to determine whether or not the fuel is suitable for use. The economic analysis of fuel grade measurement is an important tool for governments and businesses. Governments use the information to determine fuel taxes and regulations, while businesses use it to decide which fuels to purchase and sell. By understanding the economic implications of fuel grade measurement, governments and businesses can make informed decisions about fuel usage and pricing.

8.2 Economic Analysis

Fuel grade measurement is an important aspect of the fuel industry, as it ensures that fuel meets the necessary quality and safety standards to be used in cars, planes, ships, and other vehicles. Fuel grade measurement is also important for economic reasons, as it helps to ensure that fuel is priced correctly and that it meets the needs and expectations of consumers.

The measurement of fuel grade is based on a standard metric known as octane ratings. Octane ratings measure the performance and quality of gasoline, diesel, and other types of fuel, and help to guide consumers in their fuel purchases. Octane ratings are determined by a variety of factors, such as the type of fuel, the amount of oxygen present in the fuel, and the amount of hydrogen present in the fuel.

The economic importance of fuel grade measurement is evident in the fact that it helps to ensure that fuel is priced properly. If fuel is not properly measured, then it may be priced too cheaply or too expensively, which can lead to economic inefficiencies. For example, if fuel is priced too cheaply, then consumers may purchase more of it than they actually need, leading to excess consumption and waste. On the other hand, if fuel is priced too expensively, then consumers may be reluctant to purchase it, leading to a decrease in demand and a drop-in price.

Fuel grade measurement also helps to ensure that fuel meets the needs and expectations of consumers. If fuel is not properly measured, then it may not perform properly or efficiently, leading to a decrease in consumer satisfaction. This, in turn, can lead to a decrease in demand for certain types of fuel, as well as a decrease in overall economic activity.

Finally, fuel grade measurement helps to ensure that fuel is safe and meets the necessary safety standards. If fuel is not properly measured, then it may contain contaminants that can cause harm to people and the environment. This, in turn, can lead to a decrease in consumer confidence, as well as a decrease in economic activity.

Overall, fuel grade measurement is an important economic tool that helps to ensure that fuel is priced correctly, meets the needs and expectations of consumers, and meets the necessary safety standards. By ensuring that fuel is properly measured, the fuel industry can help to ensure that economic activities remain efficient, productive, and safe.

8.3 Cost benefit analysis

The cost benefits of fuel grade measurement are considerable. The most important cost benefit is the increase in engine efficiency. By measuring the fuel grade, it is possible to ensure that the correct fuel is being used in the engine. This can help to increase the efficiency of the engine, as the correct fuel grade provides the best performance. Additionally, measuring the fuel grade can help to reduce fuel consumption. This can help to save money on fuel costs, as the engine will be using the most efficient fuel possible.

Another cost benefit of fuel grade measurement is the increased safety of the engine. By measuring the fuel grade, it is possible to ensure that the engine is not running on fuel of a lower grade than what it is meant to. This can help to avoid engine damage, which can be costly to fix. Additionally, it can help to reduce the risk of a fuel-related fire or explosion. By measuring the fuel grade, it is possible to ensure that the correct fuel is being used and that the risk of a fuel-related incident is minimized.

The cost benefits of fuel grade measurement also extend to the environmental impact of fuel usage. By measuring the fuel grade, it is possible to ensure that the engine is running on the most efficient fuel possible. This can help to reduce the amount of emissions produced by the engine. Additionally, it can help to reduce the amount of fuel being wasted. By measuring the fuel grade, it is possible to ensure that the engine is running on the most efficient fuel possible, which can help to reduce fuel consumption and reduce the amount of fuel being wasted.

Overall, fuel grade measurement is a cost-effective process that can have a variety of benefits. It can help to increase engine efficiency and reduce fuel consumption, which can help to save money on fuel costs. Additionally, it can help to reduce the risk of a fuel-related incident and can help to reduce the environmental impact of fuel usage. By measuring the fuel grade, it is possible to ensure that the engine is running on the most efficient fuel possible. This can help to ensure that the engine is running properly and efficiently and that the risk of a fuel-related incident is minimized.

8.4 Evaluate economic and financial aspects

The economic and financial aspects of fuel grade measurement are important considerations for companies involved in the production, distribution, and sale of fuels. Fuel grade measurement is a process that involves the use of physical and chemical tests to determine the type, quality, and composition of a fuel. This process is essential in ensuring that fuel is of the highest quality and meets regulatory standards. Fuel is a highly valuable commodity and the accuracy of fuel grade measurement is critical for ensuring its safety and performance. Fuel grade measurement must be precise in order to identify any potential contaminants or variations in the fuel, as these can have a direct impact on the performance and cost of the fuel. Inaccurate measurements can result in costly production delays, repairs, or even product recalls.

Furthermore, fuel grade measurement can also have a financial impact on businesses in the form of taxes, fees, and other regulatory costs. Fuel grade measurements are used to determine the taxation of fuel, including taxes on gasoline, diesel, and other fuels, as well as fees for hazardous materials and environmental protection. Inaccurate fuel grade measurements can result in overpayment of taxes or fees, or underpayment, which can lead to costly fines and penalties.

In addition, fuel grade measurement is also used to determine the cost of insurance for fuel storage and transportation. Accurate fuel grade measurements are necessary to determine the level of risk associated with a particular fuel, as different grades of fuel can have different levels of volatility, flammability, and other safety and environmental risks. Inaccurate fuel grade measurements can lead to higher insurance premiums, which can be a significant financial burden for businesses in the fuel industry. Finally, fuel grade measurement is also used to ensure the quality of fuel, which can have a direct impact on the performance and reliability of vehicles. Poor quality fuel can lead to engine damage, reduced performance, and higher maintenance costs. Accurate fuel grade measurements are therefore important for automotive companies to ensure that their vehicles are running optimally and that their customers are receiving a high-quality product.

In conclusion, fuel grade measurement is an important process that has a direct impact on the economic and financial aspects of the fuel industry. Accurate fuel grade measurements are essential for ensuring the safety, performance, and quality of fuel, while also helping to minimize costs associated with taxes, fees, and insurance premiums. As such, fuel grade measurement is an essential component of any successful fuel business.

8.5 Conclusion

In conclusion, fuel grade measurement is an essential part of the modern economy. It helps to ensure that the fuel used in cars and other vehicles is of the highest quality and meets the standards set by the government. The use of fuel grade measurement also helps to ensure that the fuel used is safe and efficient, resulting in lower costs and fewer emissions. Overall, fuel grade measurement is an important part of economic analysis. It helps to ensure that fuel is of the highest quality and meets the standards set by the government, while also helping to reduce the cost of fuel and emissions. By using fuel grade measurement, businesses can reduce their costs and improve their efficiency, while also helping to protect the environment.

Chapter 9: Ethics and Professional Responsibilities

9.1 Introduction

The purpose of ethics is to offer codes of ethics and behavior that can assist people in determining what is right and wrong, as well as how to act and behave. Frequently, ethical standards are higher than the legal minimum. According to the PMI (Project Management Institute), “Ethics is about making the best possible decisions concerning people, resources, and the environment. There are various ethical lines that might be crossed in project management.[10] The greater the project, the more likely staff will be willing to compromise their ethics in order to do it on time and on budget. Ethical consideration is a major sector in project management as it is a part of scientific integrity, human rights and dignity, and collaboration between science and society. This ethic ensures that research is safe run. If the project idea is valuable to society but violates people's rights, In that case, the idea is ethically untenable. There are many types of ethics

Problems for different cases. According to the Code of Ethics and Professional Conduct Behavioral and ethical values include trust, integrity, responsibility, respect and fairness. next to, Maintaining Confidentiality, Ensuring Risk of Harm, Avoiding Plagiarism, Accuracy, Analysis and reporting, etc. It is also part of research ethics [10]. Additionally, I have some code Actions stipulated by various international bodies in various fields. Please follow these protocols and standards when conducting research. violation Ethical concerns can also result in rejection of project submissions. even keep them

Logs also ensure the sustainability of the project. As for our project, we have to follow the code and IEEE standards, a government protocol for flying UAVs, guarantees public maintaining safety and professional integrity.

9.2 Identify ethical issues and professional responsibility

Our task is to build a device for Fuel monitoring by assembling different sensors that are capable of identifying temperature density and flow rate of the fuel and compare with standard measurement of Bangladesh Petroleum Corporation. In that case, we have to follow and maintain ethics and professional responsibility both while making the device and while conducting our survey. We have identified those areas where we need to face ethical issues and maintain professional integrity.

9.3 Ethical Issues

Electronics:

We use various types of electrical devices to monitor and for fuel grading in our proposed model. This is an era of new inventions, and we can easily locate any electronic component in our hands; however, quality is an issue. As we are using IoT (Internet of Things) in our system; these technologies solve many real-life problems but they create serious ethical concerns and legal challenges; Protection of privacy, data security, Data usability, Data user experience, Trust, and Safety [14]. The extensive use of Fuel monitoring raises many new questions regarding ethics and morality [15].

People Privacy:

As the Fuel monitoring system will operate manually for now till we can make it a car part. Its task is to collect information and to send it in mobile phones through Bluetooth. Therefore, we made sure no personal data can be transferred. It is a one-way transfer system. As we have a lot of personal data on our phones, it is an important concern.

Safety issue:

When fossil fuels are burned, they release large amounts of carbon dioxide, a greenhouse gas, into the air. Greenhouse gasses trap heat in our atmosphere, causing global warming. Already the average global temperature has increased by 1C. Moreover, unrefined fuel are more dangerous so for saving our environment we should be able to test our fuels more easily.

9.4 Professional Responsibility

Budget:

Since nations like ours cannot invest substantial sums of money for fuel monitoring, one of our worries was how to do this study on a shoestring budget. Therefore, we made every effort to carry out our research on a moderate budget. Similarly, several hardware components became unavailable as a result of the epidemic. We awaited delivery in order to prevent purchasing things of poor quality. Because it would be immoral to utilize inferior goods in an effort to save money. As a result, despite our limited resources, we produced high-quality goods.

Conflicts of Interest:

In this phase many people are involved including from fuel importers, distributors and fuel station owners as well as people who work there. So, we made sure everyone feels the same about testing their fuel.

Applicable standards and codes

Table 9.1: Applicable standards and codes

Required Technology	Standard/ Code Number	Definition	Solution through codes
Machine learning model	IEEE 3652.1-2020	It refers to the machine learning to compare the findings and framework to use it, to propose the project to its identification.	It is an algorithm to use it to find out the grading of the fuel. We use OKTIS-2 as standard of the machine learning.
Data supplier	Android app google play store software: V1.8 IEEE 7005-2021	It is used for notifying the data analysis and show its output.	It will show the ethanol percentage and temperature and grading rate to the device.
Battery (Rechargeable)	IEEE 1013-1990	It is for the power supply certification, quality checking and to run the devices to get the updates.	Here, we will use battery to run the mode of microcontroller and other devices.

9.5 Apply ethical issues and professional responsibility

One of the obstacles for research/project management is the application of ethical considerations and professional accountability. Since we can run into several practical problems when carrying out the research. First, we have determined the parts of our project or survey where we could run into ethical problems. Then, it is our responsibility to uphold these duties and guarantee the highest ethical standards while carrying out the research. We have thus highlighted those regions.

International codes and standards:

We followed all the IEEE codes and standards while making the device, assembling the sensors, and conducting our survey. Even we maintained those codes and conducts in terms of data collection and data receiving data from the server with high integrity.

Risk management:

To run the project, we must deal with various ordeals. In our project, we have identified some of the problems which might arise. These mainly include

Table 9.2: Risk Management

Problem	**Analysis**	**Contingency Plan**
Short circuit may create a massive fire blast.	If a short circuit happens in our system, it will create a massive fire blast as we are working on gasoline.	For ensuring safety, we will use high quality wires and connect it properly. After the connection, we will add some cover over them for extra safety.
Excessive amount of heat sources.	Excessive amounts of heat may damage the device and will fail to show the result.	Need to use all the heat proof materials as much as possible.
Charging issue of the battery.	When the battery goes out of charge, the system will not be able to work. The whole system will be dead.	We need to add a safety system like cloud backup data storage system or take power from the source battery.

Safety Consideration (CO3)

We need to design our PCB very carefully. The device should be water resistant so that we need to design the device in such a way. Otherwise, fuel can damage the device after a few tests, and it will not be able to work anymore. We need to use approved mini containers or tanks, away from heat sources and in well-ventilated areas. Heat sources can easily damage our devices. So, we need to keep that in mind. [15] To prevent the chance of damage from wires, we must not use low quality wires to compress the budget. To avoid wire related issues, we need to use good quality wires and ensure that there are no loose connections. The LEDs should be bright, and they need to be attached very carefully with the PCB. We may use multiple LEDs of the same color for brightness purposes.

9.6. Conclusion:

To run vehicle fuel is unavoidable. We also use it for generators and for other machines as well. Standard fuel is a must to keep our belongings and environment safe. Mixed fuel damages nature greatly. It also harms volumetric efficiency of vehicles [26].

Maintaining both Business & Social parts: This device can make some business opportunity as well as common people can justify what kind of fuel they are getting assuring that no personal information will be bleached & uncropped: As this thing is connected with phones we want to take sure no personal data is exposed or manipulated. Selling bad quality fuel can be prevented to some extent.

Minimizing Environment Pollution: with the development of society and bad quality fuel is harming nature at an alarming rate in our country. [37] We can see many reports that our health and nature is being destroyed because of unpurified fuels [28].

Chapter 10: Conclusion and Future Work

10.1 Project summary/Conclusion

We ran across the non-transparency of the gasoline market in our nation while working on this project. In order to do that, we looked for a simple solution. We exploited the physical qualities of fuel, which are closely connected to the variation of chemical properties of fuel, rather than focusing on the chemical properties of fuel. We uncovered the fuel's delicate physical characteristics, which are readily disregarded for changes in the fuel's good and bad health. We have taken into account variables like temperature, density, fuel flow, and ethanol content. Our prototype is attached to a beaker. When several fuel samples are added to the beaker, the system determines the quality of the fuel by comparing it to predetermined standards. Later, the fuel values and the determination of whether the fuel is good or bad are then shown.

10.2 Future work

Since this product is not yet on the market, there are many potential futures uses for it. The most crucial aspect is that chemical fuel calibration may significantly improve the system. But it takes time for the chemical calibration to take effect before the test results are visible. Alternative methods can be considered.

Chapter 11: Identification of Complex Engineering Problems and Activities.

11.1: Identify the attribute of complex engineering problem (EP)

P1: Depth of knowledge:

We selected a few papers and undertook a thorough evaluation of them. We gained knowledge of our project's requirements and specifications. Additionally, by assessing those publications, we discovered that there would be some drawbacks to the project's implementation, and that we should anticipate them. We will be able to reach an optimal solution more quickly and reasonably. Additionally, we extensively investigated the mechanism of several components (sensor, fuel injector, etc.) to ascertain the component's beneficial functionality in our project. To approach the design portion, we also studied several systems in detail (i.e.: WIFI module, Arduino etc.). Contents taught in previous courses and knowledge gathered from those courses helped us to better understand all the articles and paper, though some of the theoretical knowledge needed to get brushed up. Finally, by acquiring the breadth of knowledge from the journals, we can envision the project's outcomes which we have examined. As a consequence, we will be able to select the most appropriate answer for the complicated situation that may arrive for the complex engineering problem that we are working on.

P3: Depth of analysis required:

To determine the depth of analysis in this project, we conducted a breakdown analysis of papers. Then, we assessed various alternatives based on their efficiency, cost, and feasibility. We have been tasked with the task of distinguishing various design approaches. We have spent time experimenting with various design techniques. Then we sought for reasonable components to add into the architecture of our system, which resulted in three distinct design methods. Furthermore, we learned how efficient it is to create the gasoline grading system affordable by studying the research publications.

P4: Familiarity of the issue:

The burning of fossil fuel releases black carbon. Black carbon causes cancer. Moreover, black carbon in the air absorbs ultraviolet rays and increases the atmospheric temperature. Hence, its also responsible for global warming. [15]. Now as gasoline is also a part of fossil fuel this also concerns the fact. In these recent times, if we look widely then we can clearly observe the issue of the quality of gasoline in fuel stations. The rate of dirty fuel, mixed fuel and lower graded fuel are becoming a threat to the consumers and vehicles alarmingly. In 2021, from a statement, it has been stated from BSTI that the institute has lowered the specifications of gasoline by using the dirty fuel. Moreover, there is no such a system there to easily know the grading number of fuels. It can only be used by the manufacturing companies. So, it is not that easy to know for the consumers or users or general people and even due to the use of the bad grading point of fuel, the engines of vehicles are getting hampered and the longevity of the engine is

decreasing [9]. Furthermore, there is no other option to know the parameters in the vehicles. But in this project for the above reasons, we are conducting a sort of process to solve this complex problem.

P5: Extent of applicable codes:

The project we will be working on has a variety of components, modules, and other elements. Here, we will consider all applicable codes, rules, and limitations from the authorities of various organizations that are involved in our project. As a result, we shall use appropriate components to avoid any possible conflicts with the applicable codes.

P6: Extent of stakeholder involvement and needs:

Our primary objective is to make gasoline grading affordable to its users. To begin, vehicle owners are the primary stakeholders in this endeavor. This group of stakeholders is particularly in need of high-quality gasoline to maintain the longevity of their cars. Then, as a student group, we take responsibility for the project, which places us on the list of stakeholders. Another category of stakeholders includes gasoline supply firms, owners of petrol pumps, and gasoline dealers, all of which have a vested interest in the industry since their businesses revolve around gasoline. Finally, our supervisor, the faculty members who guide us, and our department are all indirect stakeholders in our project.

P7: Interdependence:

Interdependence means that an issue is related to another issue, hence, the problem should be solved to get the final solution of the above attributes, some of them are used in our project. They are shown in the table below,

	Attributes	**Put tick (√) as appropriate**
P1	Depth of knowledge required	☑
P2	Range of conflicting requirements	☑
P3	Depth of analysis required	☑
P4	Familiarity of issues	
P5	Extent of applicable codes	☑
P6	Extent of stakeholder involvement and needs	☑
P7	Interdependence	

11.2: Provide reasoning how the project address selected attribute (EP)

Some of the aforementioned qualities have been met by our project. We are now describing their qualities. We had to undertake a lot of preliminary research before we could begin our project. Thus, we may choose the best option that offers the greatest number of advantages at the lowest possible price. Step by step, we completed the full process. We read several earlier articles that were relevant to our study topic before beginning this project, which helped us to gain a sense of what we would be doing. Additionally, we learn about pertinent fields from this, which assists us in deciding how to proceed with the project. We have selected the device and its parts taking into account the latest technology. We made sure the fuel monitoring system does not violate any related codes or does no harm around the research. We didn't use off-the-shelf components that provide Lee's efficiency. A detailed analysis was done for each step of the project. We briefly discussed the pros and cons of each solution when choosing different designs. Helped me choose the best. In the software field, sensor data was easily analyzed to provide a clearer picture of the state of the forest plot. We have presented all the detailed results of the data analysis that could show the correct results of our study. This established the necessary depth of analysis for the project. Conflicting requirement attributes were identified in the project during multiple design analysis runs. We have selected her three solutions for surveillance systems. Then analyze each one to find which meets your desired requirements more efficiently and effectively. They all have pluses and minuses. I categorized them and found the best one needed to get the desired performance. On the other hand, the scope attribute of the apply code is well maintained. Because we comply with all national and international norms and standards. First, we identified these rules and regulations and applied them to our project execution. We also ensure that public property and life are protected from all kinds of harm through surveillance systems.

11.3: Identify the attribute of complex engineering activities (EA)

A1: Range of resources:

With the help of certain research papers and journals, we came up with a plan for our endeavor. After reading these papers, we were able to come up with three different design approaches for our project, from which we were able to select the best one. As a result, we were able to draw down the project's details and breakdown with the help of theoretical knowledge of prior classes. In addition to books, we have used videos on YouTube and pieces from the mainstream media. We value our supervisors and faculty members as a reliable resource because they represent a melting pot of expertise, experience, and education.

A4: Consequences for society and the environment:

Our project will ensure good quality gasoline distribution amongst the consumers. It will ease consumers' continuous pain regarding gasoline. Moreover, the fossil fuel we burn has already

had some negative impact on the environment. On top of that, if we burn contaminated fossil fuel, that will have an even worse impact on our environment because of the existence of additional pollutant particles in the vapor of less graded gasoline. In a nutshell, the closer the fuel is to the standard parameter the less harm it will do to the environment.

A5: Familiarity:

Being bound to buy bad graded gasoline is a problem of regular basis. Even if we concise the user boundary to Dhaka city only we will see that 6.5 barrels of gasoline are used per day by a bulk number of vehicles. So, this problem is well known and frequently faced by a huge number of consumers.

	Attributes	**Put tick (√) as appropriate**
A1	Range of resource	☑
A2	Level of interaction	☑
A3	Innovation	
A4	Consequences for society and the environment	☑
A5	Familiarity	

11.4 Provide reasoning how the project address selected attribute (EA)

A1 (Range of resource):

The necessary products are on hand, allowing us to practically construct the prototype and achieve our major objective. We will buy certain items for our prototype design, and if necessary, we will collect additional items from the EEE department. With the right tools, we also performed software simulation.

A2(Level of interaction):

We are making sure that all engineering problems are resolved through this project. This is to conduct the complex engineering problem and by completing all the process we are at the stage that it can resolve more problems regarding the project.

A3(Consequences for society and the environment):

It has a crucial impact on the society. As it has been one of the major issues in our society and to create awareness

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Appendix

Logbook

Date/Time/Place	Absent	Summary of Meeting Minutes	Responsible	Comment by ATC
12-Feb-22	none	Introductory meeting- Topic choice 1.medical equipment 2.Air charging system	All	
15-Feb-22	none	introduction class with ACT		
27-Feb-22	Nafiz Nazafi	Topic processing and concising to 3 topic	Topic 1(Rickshaw) -Afsana, Takeea,Rawnak ,Emon Topic 2(Air charging)- Ekramul Topic 3(Transformer)- Rawnak, Afsana Topic 4(Medical Equipment)- Takeea, Afsana	
1-Mar-22	Nafiz Nazafi	Meeting with ATC and Topic selection Finalizing among 2 topics 1.Fuel Grading 2. smart switching system	[All]	
5-Mar-22	none	Finding design approaches	Topic 1 Design approach - Rawnak , Afsana ,Nafiz Topic 2 Design approach Takia , Ekramul	
8-Mar-22	Takia Rawnak	To work on Fuel grading	-	

	Ekramul Nafiz			
12-Mar-22		Discussion on Concept note	Problem Statement Rawnak Objective Afsana Design 1 Approach: Rawnak Design 2 Approach: Rawnak Design 3 Approach: Rawnak Advantage/disadvantage : Ekramul Specification, Requirements, and Constraints :Rawnak Functional requirements: Afsana Non-functional requirements Rawnak Technical Specification: Rawnak Conclusion: Rawnak	
19-Mar -22				
22-Mar-22	Afsana Nafiz	Review on concept note		
26-March-22	None	Brain storming on project proposal		
1-April-22	None	Discussion on the project proposal and work distribution	1. Project Title 2. Problem Statement and Background Research - 3. Scope and Objective (CO1) 4. Multiple Design Approaches - 4.1 Design-1 4.2 Design-2 [Rawnak] 4.3 Design-3 [Rawnak] 4.4 Design Comparison 5. Specifications, Requirement and Constrains (CO2) - 5.1 Specification and Requirements - 5.2 Constraints- 6. Methodology - Afsana 7. Project plan (CO11) - [Takia]	

			8. Budget (CO11) [Everyone] 8.1 Tentative budget for Design-1 [Nafiz] 8.2 Tentative budget for Design-2 [Nafiz] 8.3 Tentative budget for Design-3 [Nafiz] 9. Expected Outcome [Emon] 10. Impact (CO3) [Emon] 11. Sustainability (CO4) [Afsana] 12. Applicable Standard and Codes (CO2) [Takia] 13. Ethical Consideration (CO13) [Takia] 14. Risk Management and Analysis [Emon] 15. Safety Consideration (CO3) [Emon] 16. Attributes of complex Engineering Problems (EP) [Nafiz] 17. Attributes of complex Engineering Activities (EA) [Rawnak] 18. References [Rawnak]	
5- April-22	Ekramul, Nafiz	Second review on concept note		1)Improve fonts, spacing and grammatical errors. 2)Review the necessity of machine learning in the design approach. 3)Search for more papers
07-April-22	None	Discussion on proposal updates		
15-April -22		Proposal updates		
25-April -22		Draft Proposal		
26-April		Slides		

Date/Time/Place	Absent	Summary of Meeting Minutes	Responsible	Comment by ATC
12-Sep-22	none	Sumup of FYDP D	All	
15-Sep-22	none	Discussion about components	All	
27-sep-22	none	Discussion about budget	All	
1-oct-22	Rawnak	Finding components and others	All	
5-Oct-22	none	Design emplication	All	
8-Oct-22	Takia Rawnak	Design discussion		
12-Oct-22		Design problem	All	
19-Oct -22				
22-Oct-22	Afsana Nafiz	Problem solving		
26-Oct-22	None	Problem solving		
5- Nov-22	Ekramul, Nafiz	Design	All	
07-NOv-22	None	Design	All	
15-Nov -22	AFsana	Design	All	
25-Nov -22	None	Design	All	
26-Nov	none	Design	All	
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Design 1 Approach: Fuel grade analysis using temperature and density

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Design 3 Approach: Fuel Grading through Fuel Flow

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