

Captain Elechi Amadi Polytechnic, Rumuola Port Harcourt. Water Powered Generator

ENGR. F.O.C. NWADUWA

Abstract

This is a system where originally fabricated gasoline engine, is redesigned to run on electrolytic gas obtained from water. This is not so strange in itself as it is well known that Hydrogen is a fuel. The benefit of using electrolytic gas from water is that, the Hydrogen has with it, its own oxidiser – Oxygen. Already perfectly proportioned by nature, no gas mixing is required and so complete combustion is accomplished without the need for additional air. The engine drives an alternator rated 1.0kVA at 240V which is stepped down to 12V, rectified and fed into three electrolysis cells. Beginning at 12 Volts the cells are heated partly by hot exhaust gas and partly by way of voltage on the plates within, acting as heating elements. When the cells get up to temperature (about 75° C), the rectifier supply is reduced to a range between 1.24 to 2.00 volts which then serves to increase electrolysis efficiency in accordance with Faraday's Law(s) of electrolysis and thus efficiency in the order of 97.5% are achieved. The cells consume current of 25 Amps. The process is endothermic and provides gas more than sufficient to fuel the engine.

Keywords: Water; Hydrogen gas; Combustion; Alternator; electrolysis, Arduino microcontroller.

Date of Submission: 10-04-2021

Date of Acceptance: 26-04-2021

I. Introduction

Finding solution to power problem has become a recurrent decimal in Nigeria. Both people living in urban and rural areas are constantly in short supply of power or no supply at all and the constant search for electrical power production without fossil fuel burning leading to carbon II oxide pollution and causing more ozone layer depletion. Problems such as high electricity tariff, PPMS and AGO, carbon fuel utilized generator just to mention a few led to this effort and the justification to this project research. The aim/objectives of this research project is to achieve an electrical generating system with a cheap running cost, necessary for improving life in rural areas and avoid the use of hydrocarbon burning generator which leads to carbon mono-oxide pollution and high running cost.

How can we therefore achieve a low cost electricity generator for Urban and Rural dwellers in Nigeria with the current high cost of PPMS and AGO? This could be done by designing a water powered generator with a very high capacity of HHO gas. Water is fully oxidized hydrogen in a low energy state. It is an extremely thermodynamically stable molecule; hence its abundance on Earth and the fact that it is the product of many oxidation reactions, including the burning of hydrocarbon fuels which suggest it's a viable alternative fuel. Water powered engines are a recurrent theme amongst free energy advocates. The appeal of the idea is rooted in the fact that water is much more common and cheaper than oil, especially during an energy crisis.

Purpose

With such high demand for more efficient engines, our mission is to design and create a device that will increase engine efficiency without jeopardizing its performance. Such device is a hydrogen-oxygen (HHO) Generator. This generator uses electric current (electrolysis) to yield hydrogen from water. There are two different ways to run the hydrogen into the engine. The first and most ambitious way to this is to send it through the carburetor, while shutting off the fuel line. This will only be done if the system is self-sustained, meaning the engine is able to run on hydrogen only. If this is not accomplished due to thermodynamic restrictions, then the hydrogen will be introduced into the combustion chamber of the engine through the intake manifold. We will attempt to make the generator compact and affordable, in order for it to be appealing to customers. Building this generator comes with some challenges. We need to make sure that the amount of energy put into the cell to split the water molecules is less than the amount of output energy of the generator. In order to overcome this challenge we will need to make it as efficient as possible. This includes coming up with a creative design to get as much hydrogen out, with the least amount of current running through the cell. More concerns include implementing very conductive wires and metals into our system. Taking these aspects into consideration will make the HHO generator a productive addition to any internal combustion engine.

Part list/Materials used

1. HHO generator(development cost)
2. 1kva Japanese gasoline generator
3. Battery
4. Plumbing
5. HHO safety flash arrestors
6. Controlled air choke system
7. One-way check valves (4)
8. Arduino microcontroller
9. Pressure sensor
10. Heavy duty wires
11. Ultrasonic humidifier
12. Miscellaneous
13. Water pump
14. New frame/ chassis and fiberglass casing

DESIGN METHODOLOGY

This project research and development is made up of the hardware structures and software codes working together to achieve the basic hypothesis.

Hardware Design Methodology

Figure 1 below shows the hardware block diagram of this project design

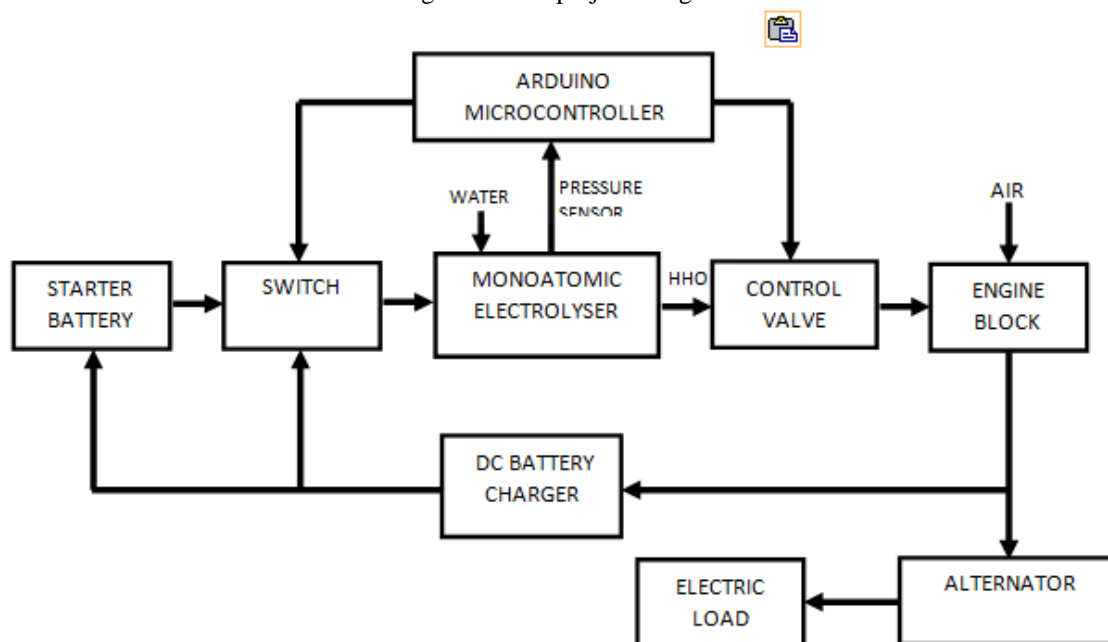


Figure 1: Block Diagram of a Water Powered Generator

The procedure of how this was achieved is illustrated in the stages below:

Stage 1: Starter Battery

The starter battery is a 12V DC 55AH battery which serves as an initial source of electric energy to the system. Its function is to power the system for the electrolyser to kick-off its operation. Once the system is at full operation, the DC power source from the starter battery is replaced by that of the DC battery charger to power the electrolyser and the battery being charged by the battery charger.

Stage 2: Switch

To achieve the switching of the electrolyser power source between the starter battery and that of the battery charger is with the aid of a change over switching device. This is an electromechanical 5V DC relay which when activated switches the starter battery supply (normally close) to that of the battery charger (normally open).

Stage 3: Monoatomic Electron (HHO) Electrolyser

The monoatomic electrolyser is a system that generates the HHO gas which serves as fuel to this project. Figure 2 show the circuit diagram on how the electrolyser was fabricated. The circuit main consists of two standard 555 timer chips. These are wired to give an output waveform which switches very rapidly between a high voltage and a low voltage. This produces a square wave output and its frequency can be adjusted by the user with the aid of turning a knob. Also, the length of the ON time to the OFF time can be adjustable.

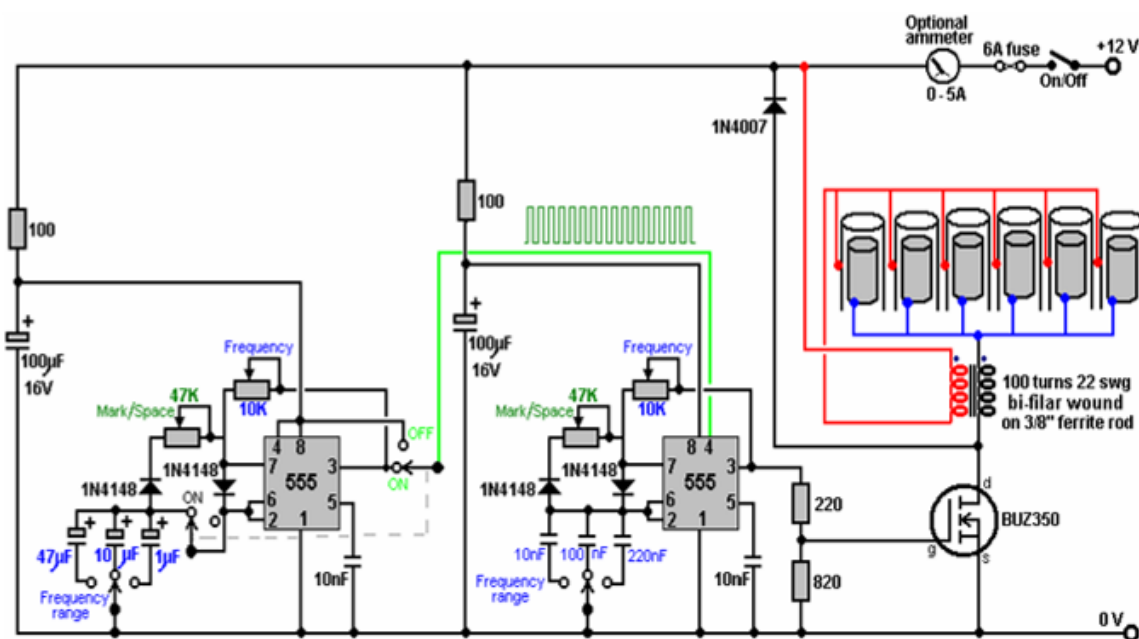
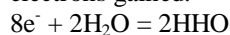


Figure 2: Circuit Diagram of a Monoatomic Electrolyser (Stan M., 2014)

The fabricated HHO generator (advanced electrolyser) is used to break the water molecules into its principal components which is basically a high energy fuel, the products are mono-atomic gasses because of the extra electrons gained.



The hydrogen gas released is compressed and stored in a cylinder used to power the engine later.

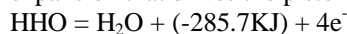
Stage 4: Control valve

The control valve function is to control the amount of HHO gas going into the engine block as controlled by the microcontroller. This serves as a safety measure implemented in the design of the project.

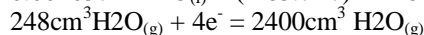
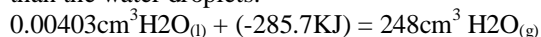
Stage 5: Engine Block

The engine block is simply described as the combustion engine where combustion of the HHO gas takes place. This is done in two different cycles, the intake cycle and the exhaust cycle.

During the intake cycle, hydrogen, air and fine water droplets drawn into the engine which is compressed during the compression cycle. The compressed mixture is exploded during the expansion cycle to produce powerful expansion that drives the piston downward.



The electrons are converted to heat in order to heat up the expanding gas in engine to create more power. Most of the power is drawn from the fine water droplets that are converted to flash steam that occupies higher volume than the water droplets.



The residual product is driven out in the exhaust cycle. The cycle repeats itself to keep the engine running.

Stage 6: Alternator

The alternator used in this project is a 1 kilo watts capacity alternator which capable of generating 220V/50Hz alternating current to the load.

Stage 7: DC Battery Charger

Rectification of the output AC supply of the alternation to generate a DC output is achieved with the DC battery charger. It converts the AC signal into DC signal to a voltage capable of charging the 12V battery and to power the electrolyser.

Stage 8: Arduino Microcontroller

System Automation and control is archived using an Arduino Microcontroller board as shown in figure 4. The Arduino Microcontroller helps the system to achieve the following:

- ❖ It activates the DC relay to effective switch between the battery and the battery charger the power supply of the electrolyser
- ❖ With the aid of a pressure sensor, senses the pressure of HHO gas in the electrolyser
- ❖ It also controls/ regulates the amount of HHO gas going into the engine block.
- ❖

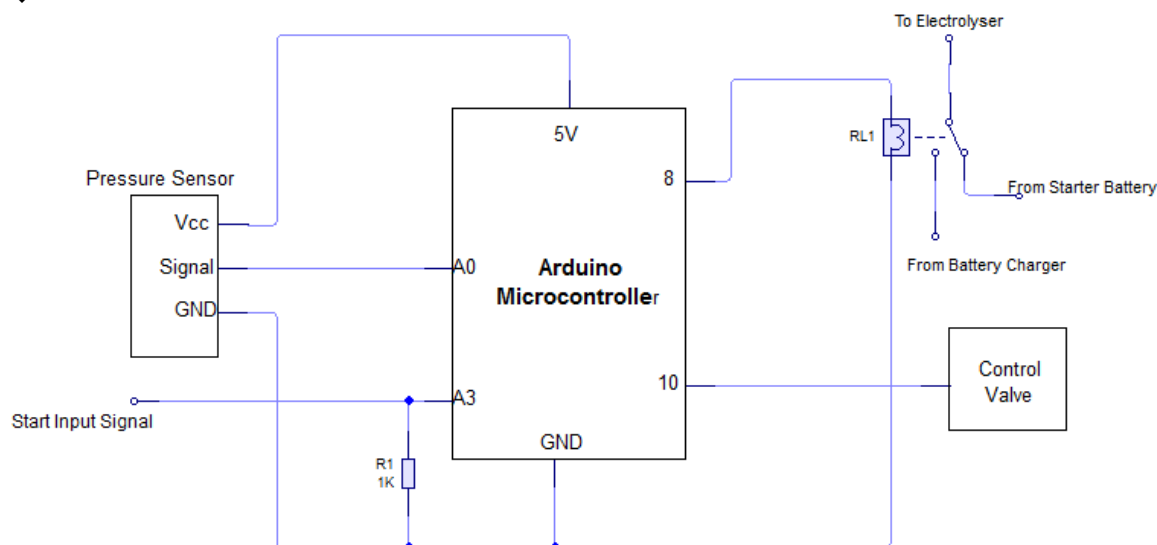


Figure 4: Arduino Microcontroller circuit. (Tutorial- Circuit Wizard, 2015)

The actual working diagram for a water powered generator is as shown in figure 5.

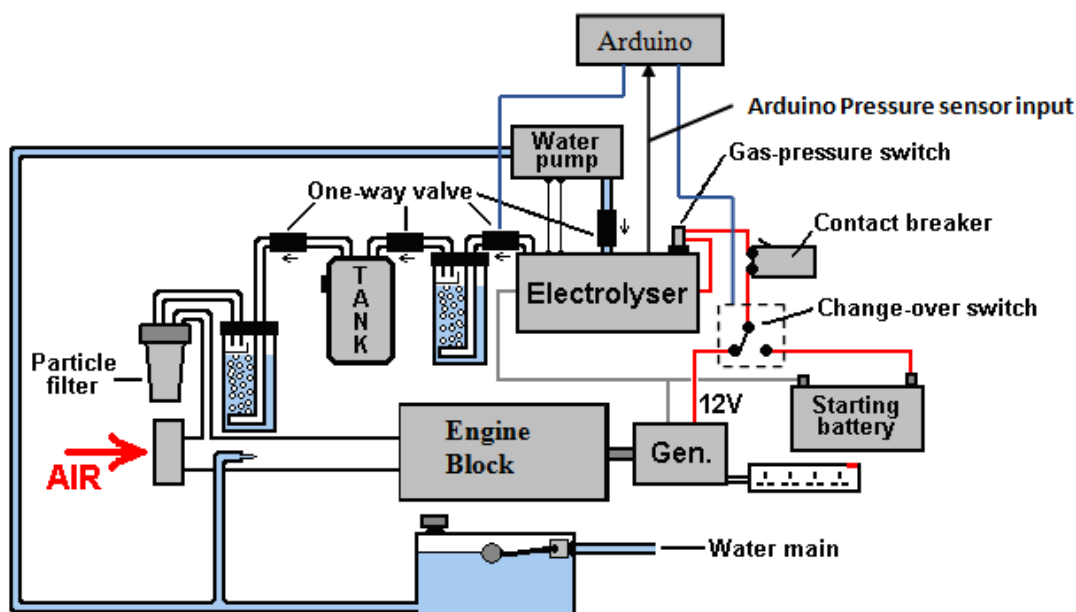


Figure 5: Water Powered Generator Actual Working Diagram

Software Design Methodology

The figure below shows the software flow chart of the project as controlled by the Arduino microcontroller.

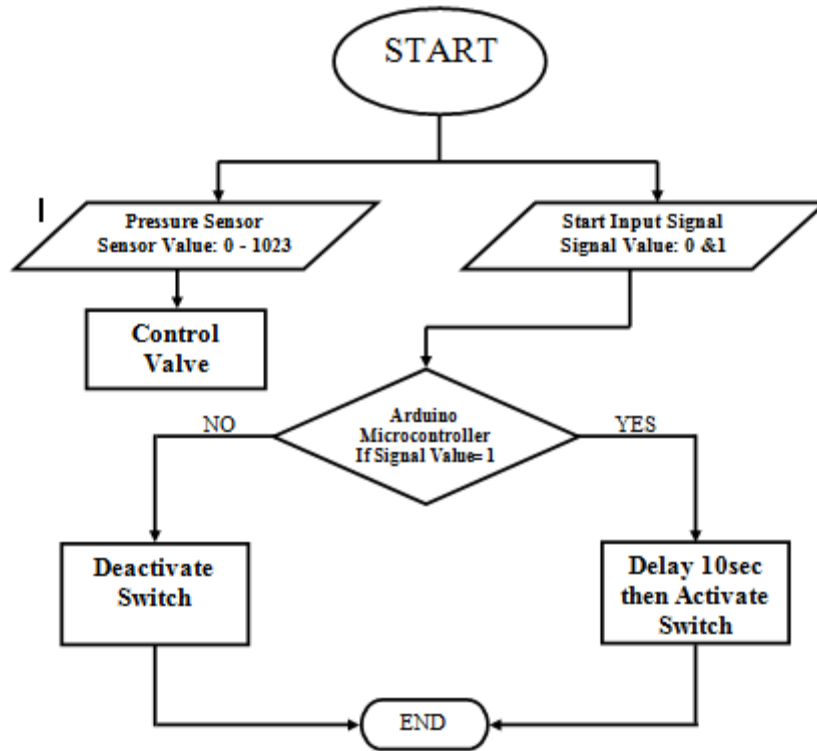


Figure 6: Software Flow Chart

From START, the Pressure Sensor senses the pressure of the HHO gas in values between 0-1023, this same value is used by the Arduino microcontroller to control the operation of the control valve. The Arduino also receives a digital signal when the system is powered by the battery in 0 and 1. If the signal value is 1, then the Arduino waits for 10 seconds before activating the change over switch and when the signal is 0, it deactivates it.

The sketch program code of the Arduino is shown in figure 8

```

const int electrolyserSwitch = 12;
int controlValve = 10;
int pressureSensor = A0;
int pressureSensorValue = 0;
int startSwitch = A3;
int startSwitchValue = 0;

void setup() {
  // put your setup code here, to run once:
  Serial.begin(9600);
  pinMode(electrolyserSwitch, OUTPUT);
  pinMode(controlValve, OUTPUT);
  pinMode(pressureSensor, INPUT);
  pinMode(startSwitch, INPUT);
}
void loop() {
  // put your main code here, to run repeatedly:
  startSwitchValue = digitalRead(startSwitch);

  if (startSwitchValue == 1){
    delay(10000);
    digitalWrite(electrolyserSwitch, HIGH);
  }
  else {
    digitalWrite(electrolyserSwitch, LOW);
  }
  pressureSensorValue = analogRead(pressureSensor);
  analogWrite(controlValve, pressureSensorValue);

  Serial.print(startSwitchValue);
  Serial.print(pressureSensorValue);
  Serial.println(controlValve);
}

```

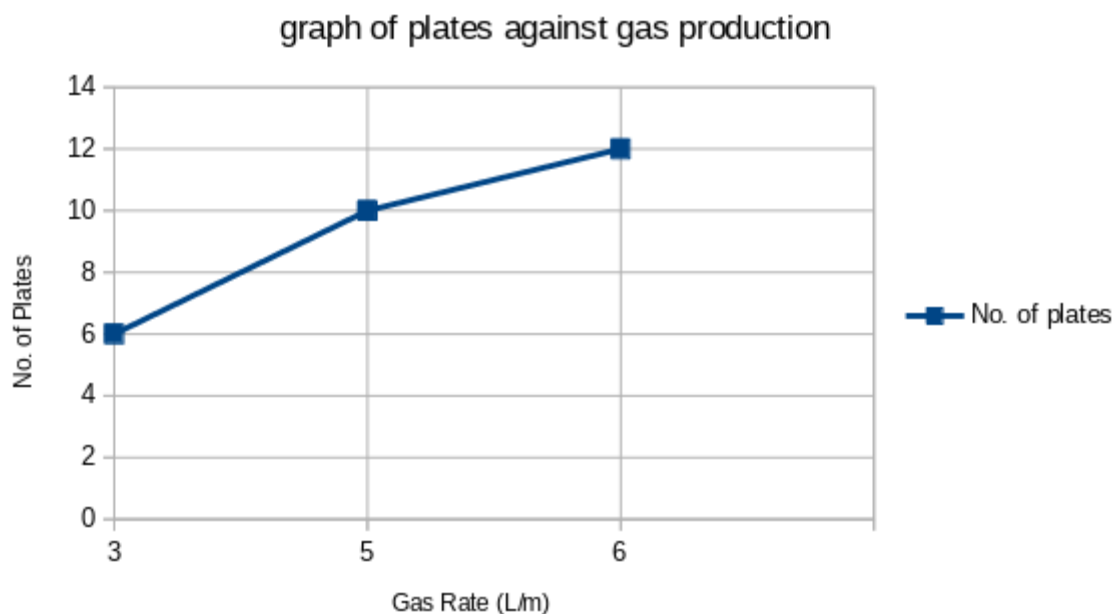
Figure 7: Arduino Microcontroller Sketch codes (Arduino – Learn the Basics, 2015)

TEST RESULTS

Test result for 10 Litre of water and 600 watt load is as show in the table below

Table 1: Test Result/Analysis

No. Electrolyser Plate	Volume of HHO gas Produced per minute	Generator Run Time	Electrolyser power consumption	Generator Power Output
6	3Litre	4 hours	0.15KW	0.85KW
10	5Litre	4 hours	0.25KW	0.75KW
12	6Litre	4 hours	0.30KW	0.70KW



A graph of Electrode Plates against Gas production Rate

From the table above, and graph it is clearly seen that the more the electrolyser plate, the more volume of HHO gas produced per minute. This increase in electrolyser plate also affects the output power generated by the generator by reducing its value in kilo watt. From simple arithmetic, the amount of power consumed by each electrolyser plate is 25 watt and the volume of HHO gas produced by each plate per minute is approximately 0.5 Litre.

II. Conclusion

This project uses HHO obtained from water sources as against hydrocarbons to generate electrical power. Hence no fossil fuel burning which leads to carbon mono-oxide pollution and ozone layer depletion. Therefore it is highly environmentally friendly.

III. Recommendation

Data should be collected through measurement and testing of individual blocks and total project assembled. Computer data analysis and documentation should be employed for easy assessment by all stakeholders.

Reference

- [1]. Arduino – Learn the Basics (2015) Retrieved from <https://www.arduino.cc/en/Tutorial/Homepage>
- [2]. Stan M. (2014), Water as Fuel.
- [3]. Retrieved from <http://www.free-energy-info.tuks.nl/P9>
- [4]. Tutorial – Circuit Wizard (2015) Retrieved from https://www.new-wave-concepts.com/ed/cw_tutor.html

ENGR. F.O.C. NWADUWA. “Captain Elechi Amadi Polytechnic, Rumuola Port Harcourt. Water Powered Generator.” *IOSR Journal of Computer Engineering (IOSR-JCE)*, 23(2), 2021, pp. 22-28.