

# Design and Implementation of a Small Scale Green Bus Model Powered by Solar, Wind & Human Planter Pressure

Mahfuzul Alam Molla

Dept. of Electrical & Electronic Engineering (EEE)  
American International University-Bangladesh (AIUB)  
Dhaka, Bangladesh  
mahfuzulamm@gmail.com

MD.Sadiqur Rahman

Dept. of Electrical & Electronic Engineering (EEE)  
American International University-Bangladesh (AIUB)  
Dhaka, Bangladesh  
sadiq.aiub@gmail.com

**Abstract**— In this modern era, people have become such dependent on motorised transportation that they want to have their private mode of transport for the convenience of their frequent movement. Currently, almost 2.7 million vehicles are running alone on the roads of Bangladesh and approximately 2.4 million are the type of vehicle which is used for personal means. Therefore, traffic jam becomes a usual phenomenon and it is also resulting air pollution, accidents, scarcity of fuels, sound pollution and etc. Because of this huge number of motorized vehicles, the fuel consumption is also very high and except gas, most of other fuels (octane, petrol, diesel etc.) are imported from abroad. Burning these fuels a huge amount of carbon dioxide (CO<sub>2</sub>) is emitting into our environment which causes greenhouse effect. Bangladesh an import-dependent country, with this high demand of fuel, is now counting loss. However, government of Bangladesh has taken initiative to discourage people from bringing car on the street by putting tax on the prices of motor vehicles and fuel. In this project, the idea of designing an ultimate green bus system is proposed which can be a remarkable aid to our recent traffic condition. In this regard a prototype of green bus system is implemented where resources such as wind and solar are employed. System also incorporates an alternative energy resource called piezoelectric system which converts human planter pressure into electricity. All the resources being used in this project are abundantly available which minimizes the high demand of fuel and hence Bangladesh will be economically benefited. By ensuring high quality services in such green bus system to attract a large number of car users to switch to public transport, this project can also help to minimize traffic jam on the road.

**Keywords**—Solar PV, wind turbine, piezoelectric transducer

## I. INTRODUCTION

Green technology is the technology which has a “green” purpose. It is environmentally friendly which doesn’t disturb our environment and conserves natural resources.

Green technology is also being referred to as environmental technology or clean technology. The types of green technology range from very simple tasks that can be performed in your home to highly specialized systems; one of them is Green Vehicle. A green vehicle or environmentally friendly vehicle is a road motor vehicle that produces less harmful to the society and the environment than comparable conventional internal combustion engine vehicles running on gasoline or diesel or one that uses certain alternative fuels. This project is actually proposing the idea of minimizing the demand for fossil and fuel in the transportation system by incorporating alternative resources such as renewable energies which are solar, wind and human planter pressure.

## II. SYSTEM DESCRIPTION

- A. The key components we have used in our project is 5W solar panel, vertical axis wind turbine, piezoelectric sensor, batteries, DC motor (24V & 12V) etc.
- B. The whole project is alienated into three parts. Every renewable sources we have used in our project charges individual battery. The wind and human planter pressure sensor system are connected with a voltage regulator (to prevent voltage fluctuation) circuit and then connected with the battery. Then we have connected the batteries in series then with a switching module after that we have given the output supply to our 24V dc motor to run the vehicle.
- C. The dc motor is connected into the rear wheels of the vehicle with a pulley and belt.

### III. SYSYEM DESIGN

Realizing the need of flawless inspection and measurement science has adapted various engineering ideas. Advantaged technologies are used to each and every matter in our today life. By ensuring high quality services in such green bus system to attract a large number of car users to switch to public transport, this project can also help to minimize traffic jam on the road, it is totally pollution less (emits 0% carbon) and most importantly it is cost effective.

**Flow chart:**

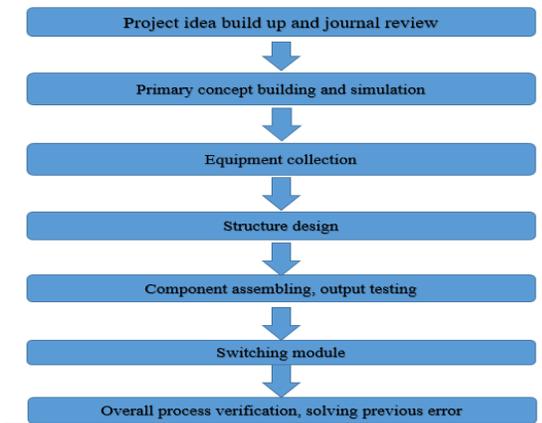


Fig 1: Flow chart of the whole process.

**D. Block diagram:**

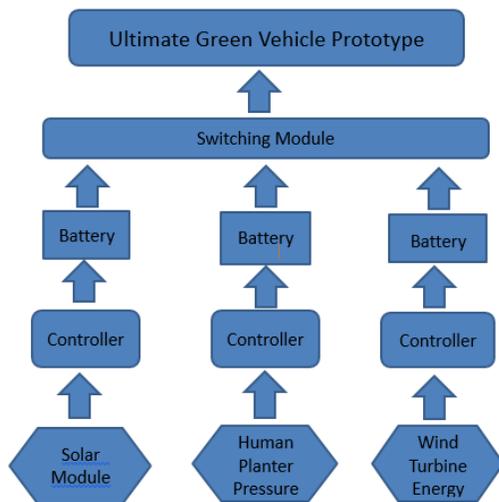


Fig 2: Block diagram of the vehicle

**E. Simulation:(Using MATLAB Code)**

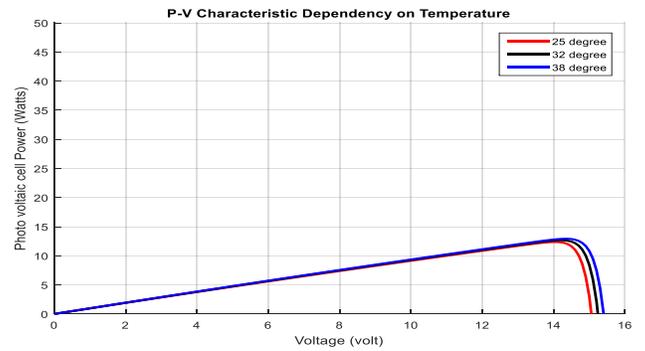


Fig 3: Dependency on Temperature

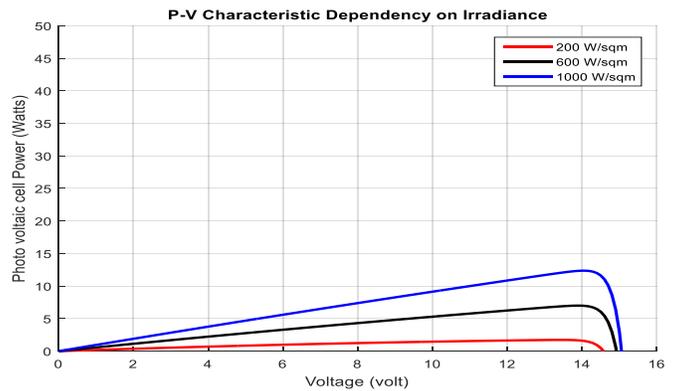


Fig 4: Dependency on Irradiance

**Output Table for P-V Characteristics**

Temperature Variation(°C)	Power Output(W)	Irradiance Variation(W/m <sup>2</sup> )	Power Output(W)
25	10.5	200	2.3
32	11	600	7.6
38	12.3	1000	12.6

### Wind Turbine Generation Output

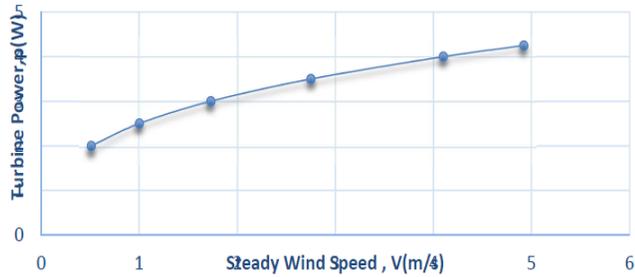


Fig 5: Graph Plot for Wind power system



Fig 7: Vertical axis wind turbine made by pvc materials .

#### F. Physical Construction:

This is the solar panel we used in our project .When it kept in sun light it gave output voltage 7.6V and current 0.9A.

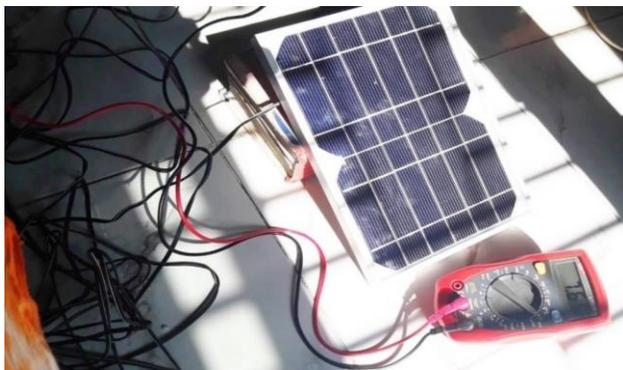


Fig 6.1 : Output voltage from solar PV



Fig 8: Output from wind turbine

We took the 6-piezo electric sensors and then attached them in series on hard board by using glue gun. After attached all components the human planter pressure looked like this.

Output of human planter pressure by applying human foot pressure force.



Fig 6.2 : Output current from solar PV



Fig 9: Attaching piezoelectric sensors on hard board

This is the vertical axis wind turbine, for testing this we kept it in front of a fan.it gives output voltage approximately (10V to 12V) and current 0.2A.



Fig 10: Output from human planter pressure system

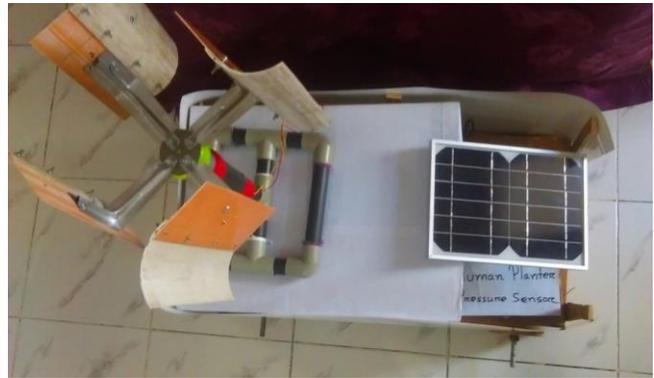


Fig 12: Prototype of green bus model top view

Here in below a average output table for all three sources is given.

Source	Output Voltage(V)	Output Current(I)	Output Power(W)
Solar	7.16	0.9	6.444
Wind	10.66	0.2	2.132
Human Planter Pressure	9.47	0.57	5.40

After assembling all parts our prototype vehicle it look like this. It is containing 24V DC motor, wheels, roof, side cover, wind turbine, solar panel, human planter pressure sensor, batteries etc.



Fig 11: Prototype of green bus model side view

#### IV. SUGGESTION FOR FUTURE WORK

In future, this project can be used for various types of vehicles and also could generate more energy through different kinds of modification. Some scope can be:

1. We can provide free Wi-Fi, USB port in the vehicle.
2. If any circumstances occurred when we do not get required power, we can keep back up system.
3. Automatic ticket system also can be installed.
4. The full vehicle can be fully air conditioned.
5. Thin film solar cell can be used in replace of solar PV.

#### V. DISCUSSIONS

Bangladesh is a small country but it has a huge number of populations that is why this types of project is perfect for Bangladesh because it is eco-friendly. Also, we know the economy state of Bangladesh is not sufficient that's why a developing country like Bangladesh can use this kind of project because it so much cost effective than any other project for renewable power used green vehicle. By using these types of project, we can decrease the dependence on natural resources. Moreover, such projects do not cause any harm to our environment it will emits 0% carbon to the air.

While examining the vertical axis wind turbine output energy we got noticeable voltage (10.6V-12.3V) but very low current (around 0.2A) because of some error. This error can be minimized in future by using suitable technologies but we are not able to do this solution in our project.

MATLAB code based simulation is done to get over all solar output and efficiency through the year in Bangladeshi condition. In solar panel, we didn't use any charge controller to charge up the battery because it is only a 5W solar panel and it gives constantly maximum output.

Two kinds of problem can be happened with this project. Firstly, in rainy season this type of project can be rusted because the solar

irradiance will be low at that time, so the solar output can be low. Secondly, during low wind speed period the power output should be low. So, to overcome these problems we can charge the batteries with grid electricity for few hours.

## VI. CONCLUSIONS

The main impartial of this project is to design a prototype vehicle which will run without using any fossil fuel (octane, petrol, diesel, gas). It will run through the renewable sources such as solar power and wind power and also with human planter pressure. Bangladesh is one of the most populated countries in the world. As a result, a large number of vehicles are needed for the transportation system. Most of the vehicles use petrol, octane, diesel, gas etc.to run on. These resources are costly and not very much available. Except gas all other fuels are imported from abroad, so every year Govt. is giving subsidies and counting loss. Moreover, burning these elements causes harm to our environment. So that in this project, we have decided to minimize the uses of those fuels to reduce pollution and cost and developed this ultimate green prototype vehicle. So, if we can use perfectly this project in Bangladesh it will be an infinite solution to the transportation system of our country.

The experimented result of this project shows that we are getting sufficient amount of voltage and current (7.61V & 0.9A) from the 5W solar panel. On the other hand in vertical axis wind turbine we got noticeable voltage (10.6V) but very low current (around 0.2A) because of some error. For constant output, we have used LM7805 voltage regulator. In this project, we have developed a system called piezoelectric sensor for generating electricity from human planter pressure. This system can be developed in many ways much more efficiently in future, we just try to show its application in this vehicle by a miniature version. For constant output, we have used LM7805 voltage regulator.

For low current output the battery charging time of wind turbine and piezoelectric pressure sensor are little longer but it can be reduced by fine tuning or adding new technology. For doing this project given conditions must be full filled:

- Turbine blade have to be vertical axis.
- The screw gap for all piezoelectric sensor must have to be same otherwise there will be an open circuit and no output will be generated.
- The last and most important thing is to set up the DC motor perfectly with the pulley by elastic belt.

At last we want to say that it was a great experience for all us working together in a complete work. We had a glimpse of the competitive team environment that we are going to face in our career work in this work. The guidance of our supervisor was constructive and at same time inspiring which gave us confidence in our forthcoming future career.

## ACKNOWLEDGMENT

At the very beginning we would like to express our heartiest gratefulness to Almighty Allah for His heavenly blessings. Without his blessings, it would not possible to complete our project successfully. We would like to express our greatest gratitude to the

people who helped and supported us throughout this project. First and foremost, we would like to thank our honorable supervisor, Nuzat Nuary Alam, Assist. Prof. Department of EEE, Faculty of Engineering, American International University-Bangladesh (AIUB), for giving us enormous support, advices and valued guidance concerning this project.

We are grateful to Prof. Dr. ABM Siddique Hossain, Dean Faculty of Engineering, American International University-Bangladesh (AIUB) for his vital encouragement and support. We would like to appreciate Dr. Carmen Z. Lamagna, honorable Vice Chancellor, American International University-Bangladesh (AIUB), who exceptionally inspire our growth as a student.

Last but not the least we would like to thank our family and friends for their valuable support to complete this project.

## REFERENCES

- [1] U. EPA and Environmental Protection Agency, "Green vehicle guide," in [www.epa.gov](http://www.epa.gov), 2016. [Online]. Available: <https://www.epa.gov/greenvehicles>. Accessed: Nov. 11, 2016
- [2] A. Point, "Problems of transport system of Bangladesh," in [www.assignmentpoint.com](http://www.assignmentpoint.com), Assignment Point, 2015. [Online]. Available: <http://www.assignmentpoint.com/arts/law/problems-transport-system-bangladesh.html>. Accessed: Nov. 03, 2016.
- [3] A. W. Brunskill, "Brunskill. Feasibility of Electric Cars Powered by Renewable Energy. Guelph Engineering Journal, (2), 1 - 13. ISSN: 1916-1107," in <http://www.soe.uoguelph.ca>, 2009. [Journal]. Available: [http://www.soe.uoguelph.ca/webfiles/gej/articles/GEJ\\_002-001-013\\_Brunskill\\_Electric\\_Cars\\_and\\_Renewables.pdf](http://www.soe.uoguelph.ca/webfiles/gej/articles/GEJ_002-001-013_Brunskill_Electric_Cars_and_Renewables.pdf). Accessed: Sep. 28, 2016.
- [4] Green, Martin. "Thin-film solar cells: review of materials, technologies and commercial status." *Journal of Materials Science: Materials in Electronics* . [Journal] 18 (October 1, 2007): 15–19. Accessed: Nov. 11, 2016
- [5] Wali, R Paul (October 2012). "An electronic nose to differentiate aromatic flowers using a real-time information-rich piezoelectric resonance measurement". *Procedia Chemistry*: 194–202. doi:10.1016/j.proche.2012.10.146. N.p., 2016. Web. 5 Nov. 2016.
- [6] Wind and Solar System (2nd edition) [Book], Mukund R.Patel,CRC press,USA.Chppter 4.1.2 Page 65-70 N.p., 2016. Web. 5 Nov. 2016.
- [7] "Wind Energy Variability and Intermittency in the UK". [Claverton-energy.com](http://Claverton-energy.com). Archived from the original on 25 August 2011.
- [8] "Whole Bangladesh Up To October 2016 – Bangladesh Road
- [9] Transport Authority(BRTA)". [Brta.gov.bd](http://Brta.gov.bd). N.p., 2016. Web. 29 Nov. 2016.