A model to produce combined clean energy at any scale maintained by hi-tech artificial intelligence (AI) and internet of things (IOT)

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Abstract— It is unquestionable that we have a few limited sources of natural energies around the world and so we need to move toward producing and using renewable energies as much as we can. Now it's important to focus on discovering more efficient ways to produce clean energy as well as enable hi-technologies like IOT, AI, ML in the renewable energy production systems. In this context scientists have discovered many individual methods to produce clean energy but to produce clean energies more efficiently with limited resources is really a big challenge for end users. This is where this model comes with simple yet significant solution to produce clean energies combined and more efficiently even with conventional methods. This model will not only be used to produce combined clean energies but also to erase unemployment problem from developing countries because it also includes dairy farming and vermicompost fertilizer production in it.

Index Terms— Combined clean energy, Hi-tech combined clean energy production model, Renewable energy, Artificial Intelligence, Vermi-compost fertilizer, Biogas, Solar energy management, Hi-tech agriculture, Sustainable development.

1 INTRODUCTION

According to recent researches apart from the industrial usages if we consider only household usages then it's average more than 16% of natural energies that are consumed every year. And natural resources are not unlimited! A reliable, affordable and secure supply of energy is important for socio-economic development. In these circumstances any developing country should be looking forward to develop its renewable energy sources in addition to its traditional sources of fossil fuel. The following research paper will propose a more sustainable and affordable way to produce combined clean energy at any scale as a model for end level users of any country around the world. The paper will describe a new term as combined clean energy which is able to impact on the growth of economy as well as the unemployment problem of any country. This model will be more focused on creating a new way to produce 100% clean energy which will be maintained by hi-technology like IOT and AI to predict the production and usage of the energy. In this model solar energy, biogas and vermicompost will be produced together as they are dependent and maintained in a combined way to reduce maintenance costs and use resources more efficiently.

A brief overview of the research addressing the problem and answering the question WHY, objective of WHY not WHAT and method of solving it through this study has been presented.

1.1 Problem Statement

This paper intends to propose a more sustainable and affordable way to produce combined clean energy at any scale as a model for root level users of any developing country like Bangladesh. The paper will describe a new term as combined clean energy which is able to impact on the growth of economy as well as the unemployment problem of the country. More importantly it will demonstrate how in recent years, the world is moving towards green electricity generation to reduce carbon-dioxide (CO2) and greenhouse gas emissions. As it is a matter of concern that traditional electricity production is the primary source (29%) of greenhouse gas emission. At present, greenhouse gas emission affects the climate directly by raising the global temperature. This model will be more focused on creating a new way to produce 100% clean energy which will be maintained by hi-tech artificial intelligence to predict the production and usage of the energy.

1.2 Starting with WHY

The global warming due to greenhouse gas emission and the energy scarcity worldwide are prompting almost all the countries in the world to look for alternative sources of energy such as nuclear and renewable such as solar, wind, geo-thermal and wave energies, which do not cause carbon emissions. Whereas developed countries can tap into nuclear energy, a developing country like Bangladesh is not fortunate enough to have that option available. Consequently, the only option that is open to Bangladesh at the moment is renewable energy such as solar and hydro-electric.

According to **SDG** (Sustainable Development Goal) the **7th** and most important goal is defined as **Affordable and clean energy** which shows us a very prominent cause to work for affordable

and clean energy. As stated by SDG, **between 1990 and 2010, the number of people with access to electricity has increased by 1.7 billion**, and as the global population continues to increase so will the demand for cheap energy. **A global economy reliant on fossil fuels and the increase of greenhouse gas emissions is creating drastic changes to our climate system.** This is impacting every continent.

An effort to encourage clean energy has resulted in more than 20 percent of global power being generated by renewable sources as of 2011. Still one in seven people lack access to electricity and as the demand continues to rise there needs to be a substantial increase in the production of renewable energy across the world.

Ensuring universal access to affordable electricity by 2030 means investing in clean energy sources such as solar, wind and thermal. Adopting cost-effective standards for a wider range of technologies could also reduce global electricity consumption by buildings and industry by 14 percent. This means avoiding roughly 1,300 mid-size power plants. Expanding infrastructure and upgrading technology to provide clean energy in all developing countries is a crucial goal that can both encourage growth and help the environment.

2.2 Facts and figures from SDG

1.7 billion

Between 1990 and 2010, the number of people with access to electricity increased by 1.7 billion.

1 in 7

One in seven people still lacks access to electricity; most of them live in rural areas of the developing world.

60%

Energy is the dominant contributor to climate change, accounting for around 60 percent of global greenhouse gas emissions.

14%

Adopting stronger efficiency standards could reduce global electricity consumption by buildings and industry by 14 percent.

3 billion

More than 40 percent of the world's population, 3 billion people, relies on polluting and unhealthy fuels for cooking.

20%

Globally, as of 2011, more than 20 percent of power is generated through renewable sources.

These are the numbers which inspired me to work on this research field and to improve the lives of people all around the world.

2 Proposed Model

A brief description on the very revolutionary model to produce combined clean energy which is uniquely effective in many ways. It's revolutionary because of its design compatibility and the way it consumes resources and produces energy is wholly new in this context. It's unique because its operational methodology has never been revised and or used in any existing models. The model will effectively generate combined renewable energies with smart monitoring system in it.

2.1 Working hypothesis

According to Wikipedia a working hypothesis is a hypothesis that is provisionally accepted as a basis for further research in the hope that a tenable theory will be produced, even if the hypothesis ultimately fails. Like all hypotheses, a working hypothesis is constructed as a statement of expectations, which can be linked to the exploratory research purpose in empirical investigation. Working hypotheses are often used as a conceptual framework in qualitative research.

This model is one of them working hypothesis that is based on previous research works and or making something new out of them. This model is based on questions like:

1. **How to produce renewable energies combinedly and more efficiently?**
2. **Is it possible to make standard model for producing renewable energies for any business scale?**
3. **How renewable energy production can eradicate unemployment from developing countries like Bangladesh?**

The model with working hypothesis will answer these questions as well as show how smart technology like IoT and artificial intelligence can be added to the model to produce combined clean energy at any scale.

2.2 Model in action

The model described as working hypothesis is a 3 storied unusual building, separated with layers of blocks holding predefined standard processes to produce clean

energy. Again let me clear with my statement that this model will not show any way to produce biogas, solar energy and vermicompost, this model will demonstrate the most efficient way to produce all these energies combinedly with minimum resources.

A unit measurement for the building will give proper idea for the whole model. Measurements of the unit building:

Height: 20ft

Width: 15ft

Length: 30ft

So totally we need 450 square feet land to make it happen and It's a model of 3 storied unusual building which will generate not only its own but also the power for minimum a family of 8 people. The house is divided into 3 layers and 7 blocks.

3 layer's overview:

As per the height of the building, each floor will not be the same.

Ground floor: 7ft (1st layer)

1st floor: 8ft (2nd layer)

2nd floor: 5ft (3rd layer)

Isn't it strange? Yes, let me explain why this model is like this. As per design the building is having 7 blocks which are oriented as it can have maximum usage.

Blocks orientation:

1st layer contains 3 blocks:

Biogas plant (20ft * 15ft)

Vermicompost plant (10ft * 15ft)

2nd layer contains 2 blocks:

Dairy farm (20ft * 15ft for minimum 2 cows with calves)

Maintenance room for dairy farm (10ft * 15ft)

3rd layer contains 2 blocks:

Control and maintenance room block (10ft * 15ft)

Solar power house block (20ft * 15ft)

A very intuitive look for the model can be like this:

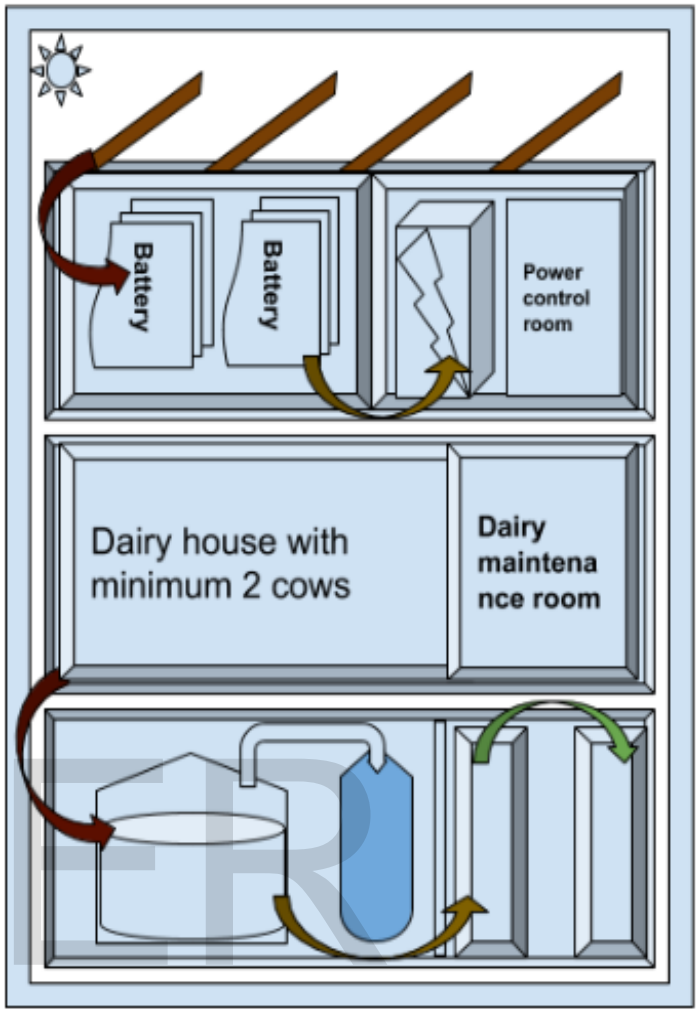
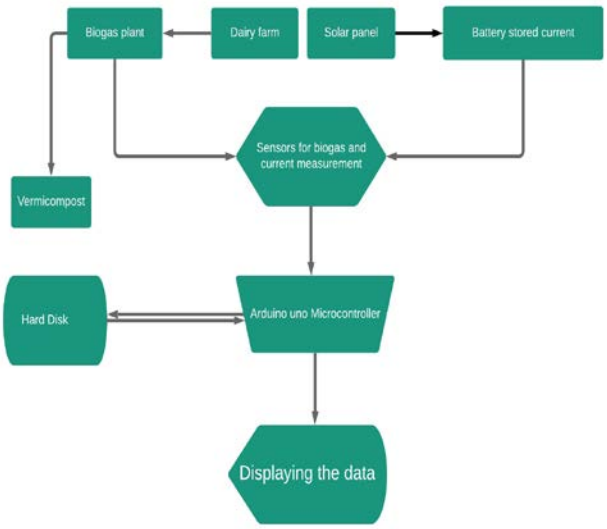


Fig: A model to produce combined clean energy.

2.3 Model activity in flowchart

An activity diagram visually presents a series of actions or flow of control in a system similar to a flowchart or a data flow diagram. Activity diagrams are often used in business process modeling. They can also describe the steps in a use case diagram. Activities modeled can be sequential and concurrent. In both cases an activity diagram will have a beginning (the initial state) and an end (a final state).



3 System Explained to Monitor the Production of the Model

A brief description on the very revolutionary model to produce combined clean energy which is uniquely The model will effectively generate combined renewable energies with smart monitoring system in it.

3.1 System to control and maintain the biogas production

Biogas plants are slowly becoming popular due to the benefits associated with them like non-polluting and renewable energy source, reduces landfill and cheaper. They are already being used for public transport, industrial heating and many more applications. The demand for monitoring and control process is increasing. Better monitoring and control system can improve process stability and enhance process performance for better economy of the biogas plants. Biogas plant monitoring system gives an overall picture of the biogas generation process. It will be used to predict the current level of biogas so as to manage the input accordingly. Alerts will be displayed to monitor the input slurry. It will help to identify upcoming instabilities in anaerobic digesters before a crash happens. It can also accompany a successful start-up or re-start of a plant. All the data will be stored for quick reference and data mining algorithms can be applied in order to predict the behavior of the plant in different conditions. An attempt has been made to find the different ways to improve the overall performance of biogas plant. The objective is to develop a method for assessing and improving the efficiency of agricultural and household biogas plant operation.

3.2 Monitoring system explained

One of the most focused topics in anaerobic digestion currently is online monitoring and control. The increase in the number of large-scale biogas plants also increases the demand for proper monitoring and control of these systems (Ahring and Angelidaki, 1997). Monitoring and control systems are applied differently depending on the applications (Batstone et al., 2004b). With online monitoring and control, process optimisation is possible through maximising the utilization of process capacity and minimising the lost from process failure. According to Switzenbaum et al. (1990), while much progress has been made in anaerobic treatment technology, only through the development of better monitoring and control strategies will the anaerobic treatment process reach its full potential for waste management(Isbn 87-91855-101).

The cost of basic monitoring is often much lower than the cost and lost revenue associated with re-establishing a biologically established plant (Bernhard Drosg,2012). The monitoring of parameters is concerned with stability of the anaerobic degradation process. These parameters are mainly driven by biological interactions and as a result, the monitoring of a biogas plant is very different from many other industrial processes. Apart from the off-line analysis of parameters, which means analysis of samples in a laboratory, a minimum of on-line process monitoring equipment will have to be installed in every biogas plant. The most important parameters for process monitoring and control can be put into the following groups (Isbn 87-91855-101)

Parameters characterising the process

Early indicators of process imbalance

Variable process parameters.

3.3 System requirements

The model representing a system which will monitor as well as provide a visualization of the output data in local and or remote server. So that end user can monitor and take important decisions as per the output and to avoid unnecessary incidents.

The whole model requires 3 principal things which is mentioned below:

1. People
2. Land
3. Capital

Although every year a plenty of unemployed people around the world but most of them are not willing to or capable of taking this kind of unusual jobs as their career to go forward. On the other hand land and capital are the two most important required things to go with the model to get a satisfactory result.

If these three requirements get fulfilled then there are some technical hardware and software requirements to meet. Like,

1. Arduino mega
2. Some sensors to measure the conditions of the model
3. Ethernet shield to transfer data from arduino mega to local server
4. Computer to get the visualized data
5. Setting biogas plant beside with vermicompost shed

The proposed system is for monitoring the whole system which will combinedly generate renewable energy as of biogas using IoT. Biogas sensors are connected to the store house of biogas produced. These gas sensors are attached out of the biogas plant so that the sensors become unaffected from extra materials like water vapor and other things. To get the accurate result and gas detection this is important to note. Another sensor for determining the pressure in the storehouse so that actual quantity of stored gas can be determined. Arduino is a microcontroller which is used to read the sensor values. Gas detect sensor, gas pressure sensor are connected to different Arduino to check the conditions and store the data in a predefined time interval. These data will be stored in a local server and so the data can be visualized using proper logic.

3.4 System workflow architecture

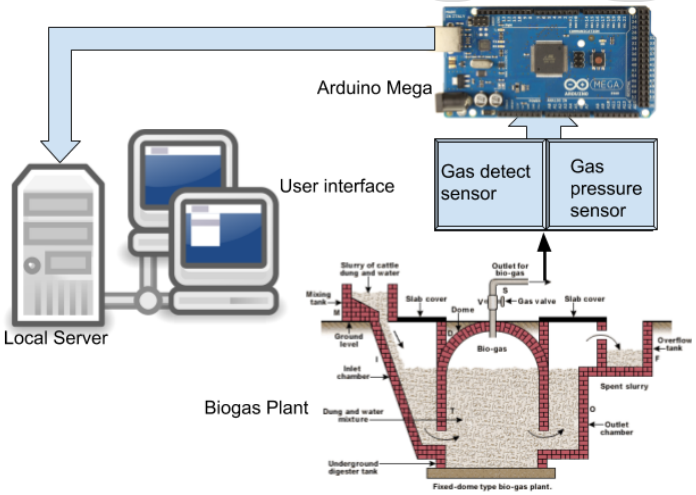
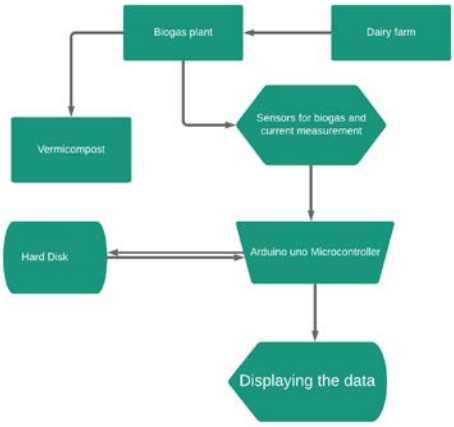


Fig: Workflow for the control system for Biogas Plant.

3.5 System data flow diagram



3.6 System to control and maintain the solar energy production

The Internet of Things has a vision in which the internet extends into the real world embracing everyday objects. The IoT allows objects to be sensed and/or controlled remotely over existing network infrastructure, creating opportunities for pure integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. This technology has many applications like Solar cities, Smart villages, Micro grids and Solar Street lights and so on. As Renewable energy grew at a rate faster than any other time in history during this period. The proposed system refers to the model which produce combinedly renewable energies and display of the power usage of solar energy as a renewable energy. This monitoring is done through IOT using Arduino.

3.7 System requirements

There are some technical hardware and software requirements to meet. Like,

1. Solar panels to produce solar energy
2. Maximum batteries to store solar energy

The proposed system is for monitoring the whole system which will combinedly generate renewable energy as of solar energy using IoT. Solar panel helps to store the energy in the battery. Battery has the energy which is useful for the electrical appliances. Battery is connected to the Arduino UNO.

Arduino UNO is a microcontroller which is used to read the sensor values. Current sensor, voltage divider sensor are connected to different Arduino to check the conditions and store the data in a predefined time interval. These data will be

stored in a local server and so the data can be visualized using proper logic.

3.8 System workflow architecture

The main objective of this proposed work is to Power of the system can be monitored using the current and voltage value sensed by the arduino. The monitor of the solar energy system shows the power and energy usage. This system helps to implement in smart grid for efficient usage.

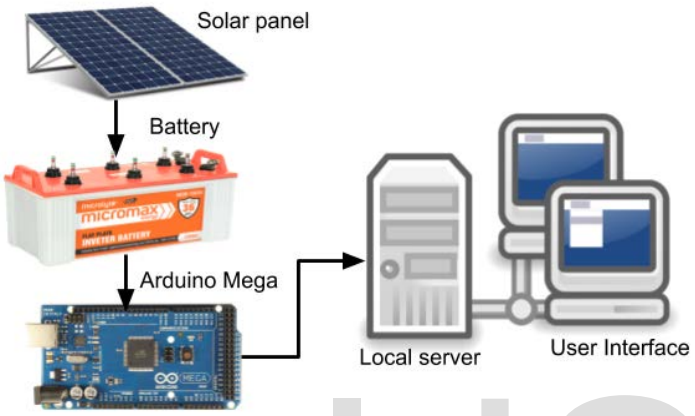
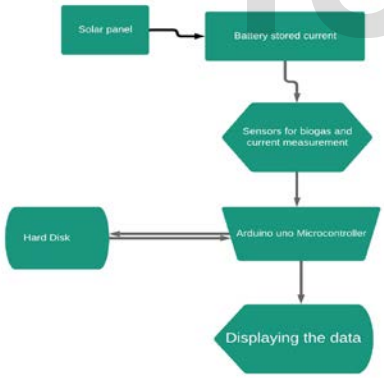


Fig: Workflow for the control system for solar energy.

3.9 System data flow diagram



4 Helpful Proofs

Why to use this model

As this model will produce all renewable energy in an efficient way to reuse and reduce the active resources in use, we need not worry about this point below listed:

1. Higher upfront cost

While you can save money by using renewable energy, the technologies are typically more expensive upfront than traditional energy generators. To combat this, there are often financial incentives, such as tax credits and rebates, available to help alleviate your initial costs of renewable technology.

2. Intermittency

Though renewable energy resources are available around the world, many of these resources aren't available 24/7, year-round. Some days may be windier than others, the sun doesn't shine at night, and droughts may occur for periods of time. There can be unpredictable weather events that disrupt these technologies. Fossil fuels are not intermittent and can be turned on or off at any given time.

3. Storage capabilities

Because of the intermittency of some renewable energy sources, there's a high need for energy storage. While there are storage technologies available today, they can be expensive, especially for large-scale renewable energy plants. It's worth noting that energy storage capacity is growing as the technology progresses, and batteries are becoming more affordable as time goes on.

6.3 Footnotes

Number footnotes separately in superscripts (Insert | Footnote)[1]. Place the actual footnote at the bottom of the column in which it is cited; do not put footnotes in the reference list (endnotes). Use letters for table footnotes (see Table 1). Please do not include footnotes in the abstract and avoid using a footnote in the first column of the article. This will cause it to appear of the affiliation box, making the layout look confusing.

5 End Sections

5.1 DECLARATION

This is to certify that this thesis report is submitted by Partha Sarathi Kundu (ID: 1612020216) for the degree of Bachelor of Science in Computer Science and Engineering to the Department of Computer Science and Engineering, Faculty of Modern Science, Leading University, Sylhet. I hereby declare that this thesis titled, "**A model to produce combined clean energy at any scale maintained by hi-tech artificial**

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intelligence (AI) and internet of things (IOT)" and the work presented in it are my own. I confirm that:

This work was done wholly or mainly while in candidature for a research degree at this University.

Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated.

Where I have consulted the published work of others, this is always clearly attributed.

Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work.

I have acknowledged all main sources of help.

Where the thesis is based on work done by myself, I have made clear exactly what I have contributed my-self.

5.2 Acknowledgments

At first I express my sincere gratitude to almighty god then to all my teachers. I thank all who in one way or another contributed in the completion of this thesis.

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I would never have been here without constant support and encouragement from my parents and my sisters.

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IMPORTANT LINKS

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2. https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-7-affordable-and-clean-energy.html
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