Electrification Through Renewable Energy Kiosks With Hybrid Generation In Rural Indian Setting:

Solutions For An Energy Crisis in Developing Nations

Anand B.[1], Antony Venus A.J. [2], Arun Noel Victor [3], Mukundhan Srinivasan [4] & Freddy Simon P [5]
[1,2,3,4] Special Interest Group on Humanitarian Technology (SIGHT)
IEEE Madras Section, Chennai, India
[5] Department of Electrical & Computer Science Engineering,
Wichita State University, Wichita, KS

The problem

About 4,000,000 people in India are deprived of the privilege of access to energy

Access to energy to in an Indian setting is very complex due to its geographical vastness.

Reaching out to many of the rural locations in India is almost impossible due to the lack of infrastructure and remoteness.

A rural household is forced to spend 10% of their monthly income in acquiring fuel and lighting.

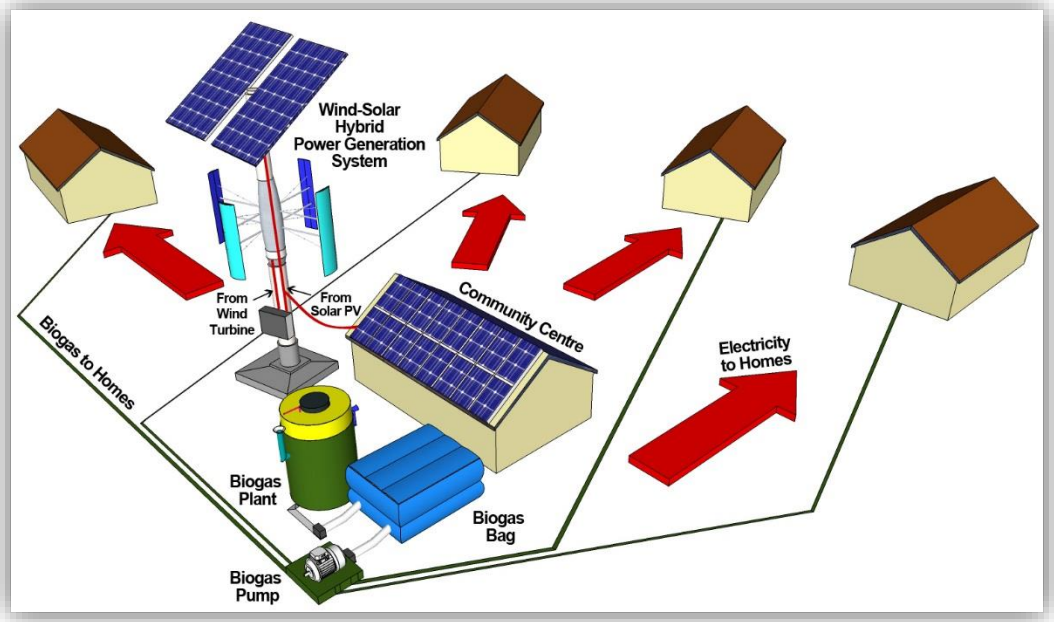
Consequently, economical access is essential to service this rural parts of the nation.

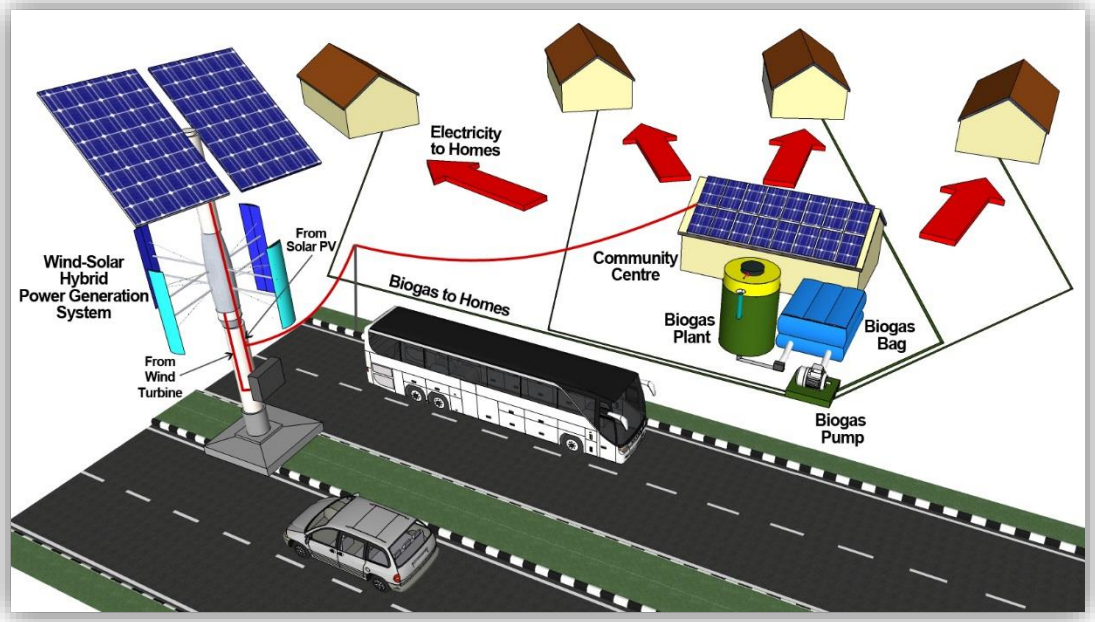
Solution and Objective

The prime objective is to Design a standalone Renewable Energy Kiosks (REK) to economically distribute energy with generation from hybrid sources.

Schematic of the proposed system

- Renewable Energy Kiosks (REK) makes remote locations self-sustainable.
- This standalone hybrid generation system can also be grid-connected.





Locally centralized generation and distribution

Using roadways to additionally generate power

Drawbacks of the Existing System

Individual resource

- Seasonal availability
- Non-complementary

Paralleling Method

- Identical Voltage & frequency is required
- Highest available resource is only utilized

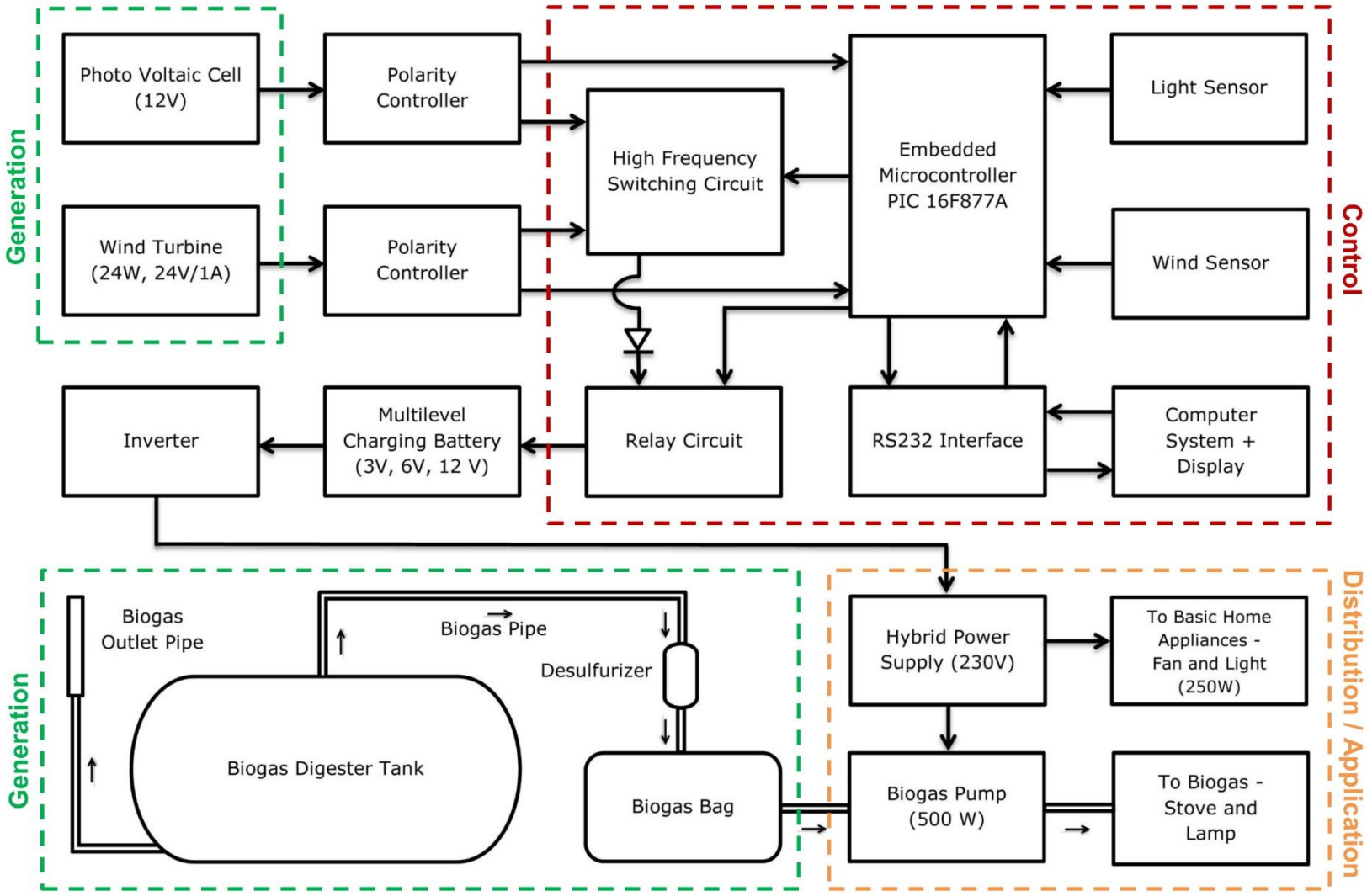
Storage device

- Reduced life span
- Due to continuous charging

High mounted windmills

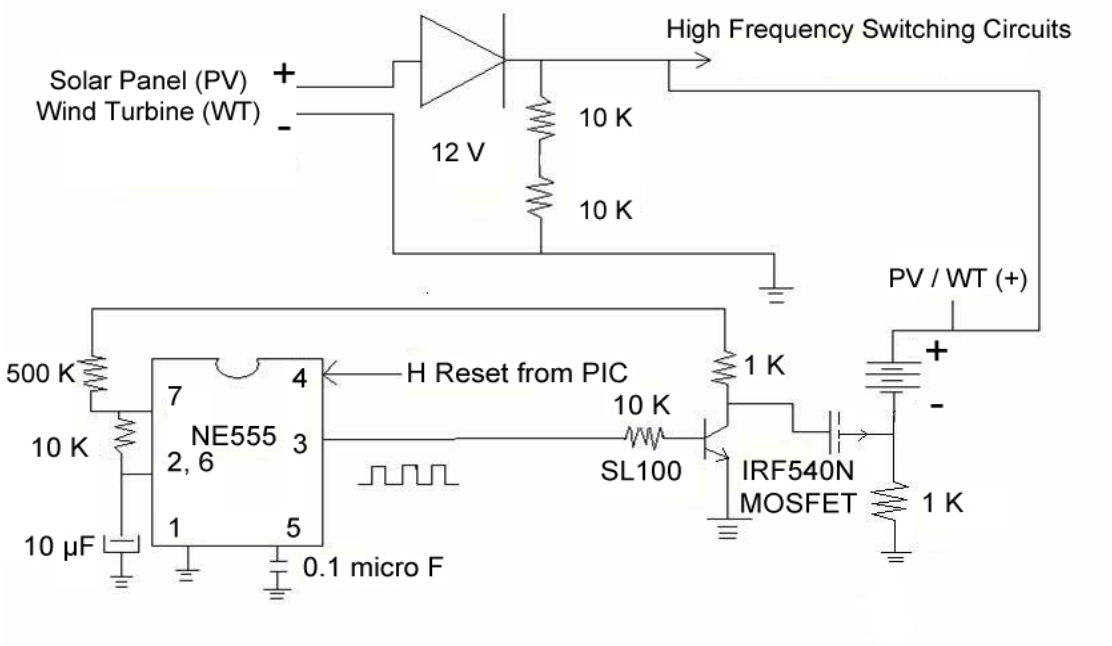
- High cost
- Atmospheric pressure of air is only utilized

Overview of the proposed system

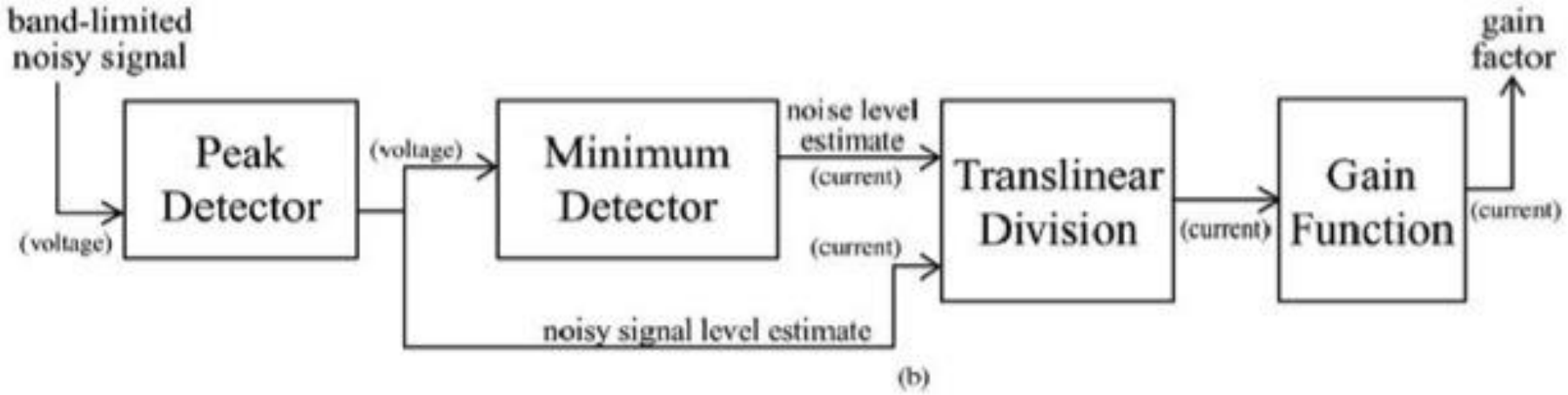


Generation - Solar + Wind

Schematic for acquiring Solar & Wind energy

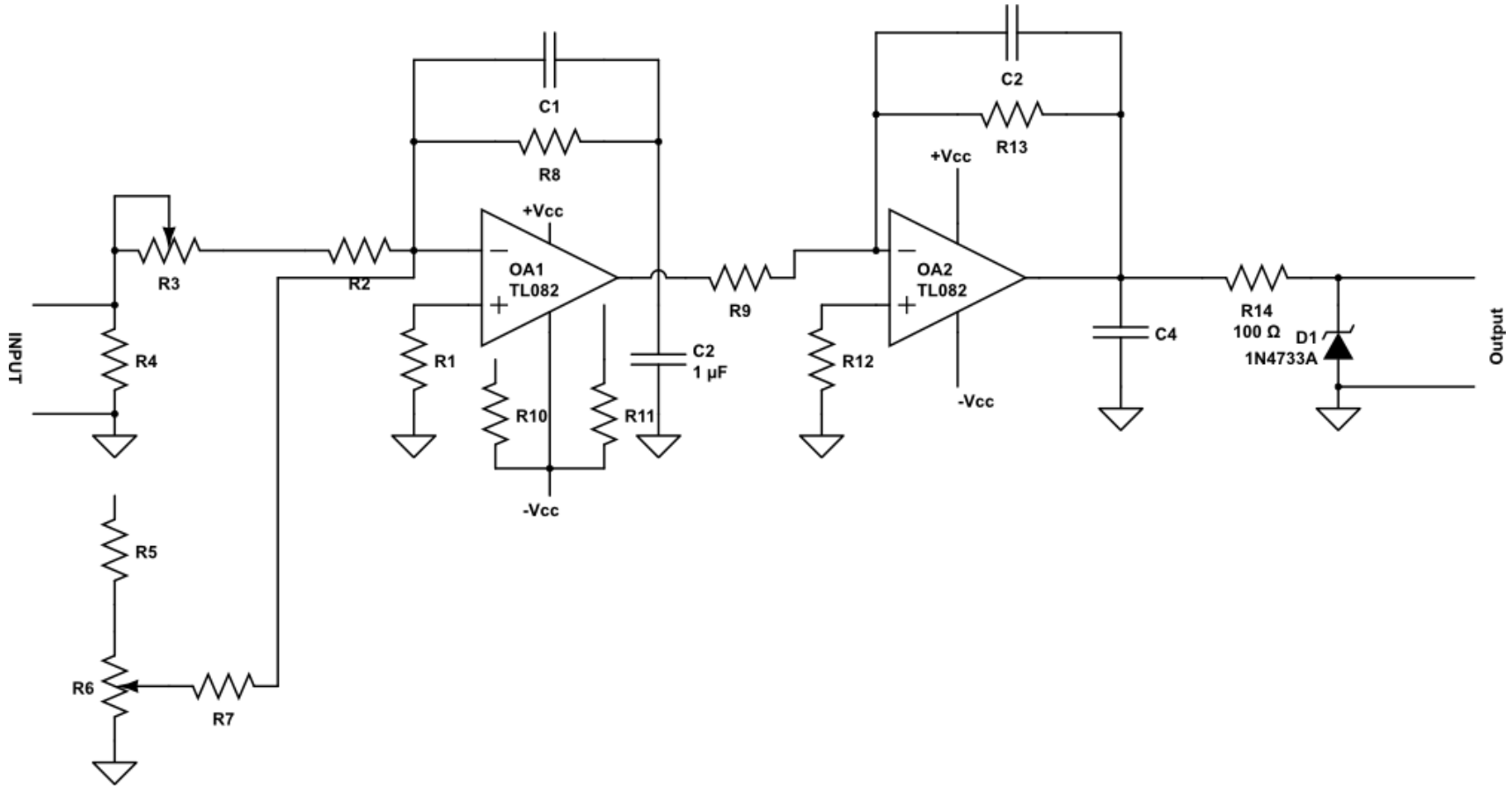


Signal conditioning

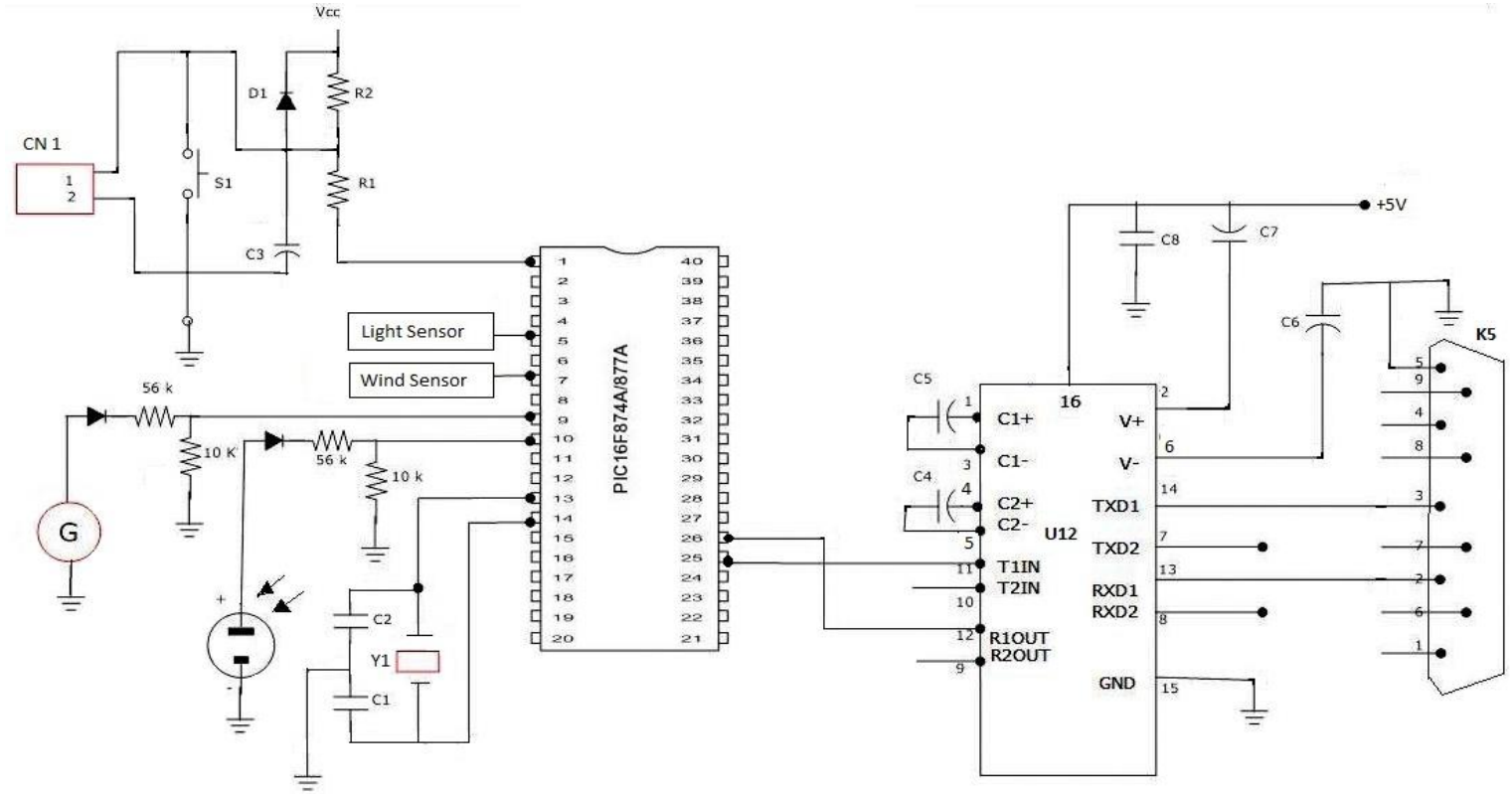


(b)

Amplification

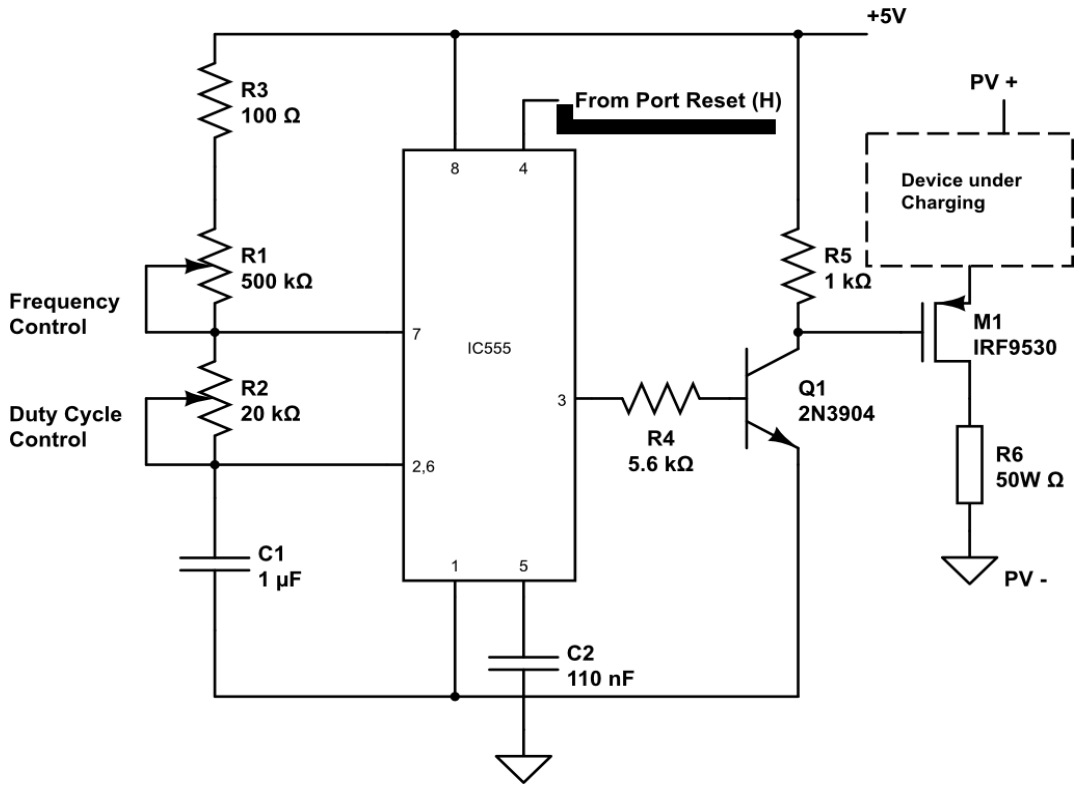


Control Circuit



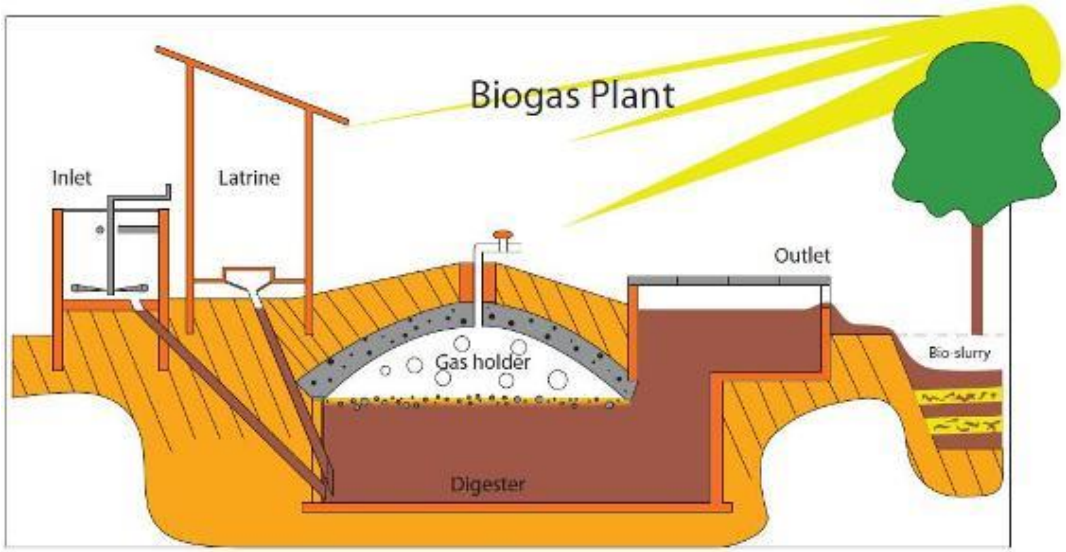
PIC Controller

Multilevel Charging



Circuit for Multi-level charging

Biogas Section



The output of the Inverter is fed to the power supply, which in turn is used to pump the biogas from the biogas bag to nearby community homes, thus aiding in production of energy from an alternate source

Thus the hybrid power obtained from wind-solar sources are used to power both the biogas pump and also the excess of power is supplied to nearby community homes for their basic home application needs

Benefits

Hybrid model

- Solar and Wind.
- Free available resource utilized.
- Raw material Imports not required for the country.
- Saves 30 billion dollars for a country.
- No fossil fuel emission.
- One time investment.
- Less labour charge.

Uninterrupted System

- 4 Resources (Solar, Wind, DC Generator, Power Supply).
- Factories – No loss due to sudden power cut.

Hybridising Technique

- What ever source available utilized.
- No wastage of resources that are available less.

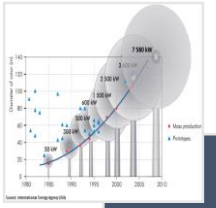
Benefits

Accessibility

- Can be deployed at the remotest of location
- Has the ability to standalone
- Economical access to clean energy.

System Operation and maintenance

- Complementary in functioning.
- Improves the quality and availability of power.
- Both DC as well as AC can be acquired as needed.
- Easily and cheap.
- Less surveillance required.



Generation Capacity

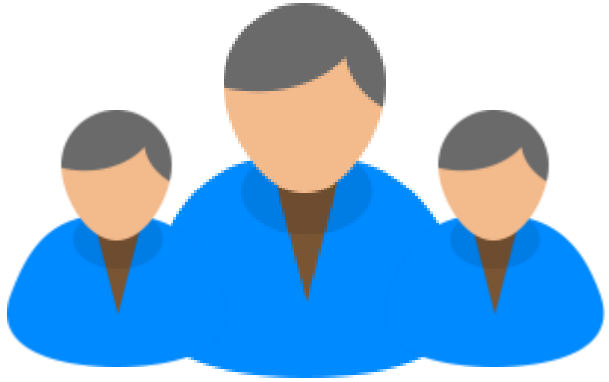
- Reduced because the load is shared by the resources.
- Low cost of implementing smaller units.

Conclusion

We propose a sustainable engineering solution for underserved locations where meeting day-to-day energy requirements is not possible.

We infer that, this proposed system can be implemented as:

A source of energy for group of houses.



A source of energy for a kiosk

A source of energy to a house

Thank you !!