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IOT Based Monitoring of Kitchen-Waste Biogas Plant

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ABSTRACT

The biogas generator system put into practice has the deficiencies of poor stability, robustness and real-time, which has impacted the promotion and development of biogas power generation technology greatly. Anaerobic digestion (AD) systems are extremely sensitive to changes in environmental variables. The efficiency of biogas production during anaerobic digestion depends heavily on optimal dosing ratios and stable operations which cannot be achieved without accurate and reliable monitoring and control of the dry matter (DM) and organic dry matter (oDM) content. Correct design and control of the system's parameters are essential to maximize process efficiency, increase stability, and prevent system failure. Monitoring systems can help both raise plant availability and help meet the transparency requirements of the process. The project is a prototype of a system that makes use of sensors and micro-controller. It can be used in the biogas system as an external hardware. The prototype is controlled by the ESP8266 controller, which can be programmed and constructed as required by the user. By monitoring the system, the result gives an accurate condition of the biogas unit which can be monitored and corrected in future.

I. INTRODUCTION

Renewable energy source are expected to provide between 5% and 10% of the world's energy within 25years perhaps rising to 50% by 2050. They exist over wide geographical area, in contrast to other energy sources which are concentrated in limited number of countries. Adopting active biogas collection procedure in major landfills of main cities can produce 319989.36KWh of electricity. The unhygienic dumping zones in every city could be turned into a potential source of renewable energy. As a kind of clean energy, biogas has wide application in rural areas of developing countries. Biogas is one of the most common renewable energies in our rural areas. Anaerobic digestion for treatment of organic waste and biogas production is an environmentally attractive technology. It has environmental benefits with regard to waste treatment, pollution reduction, production of CO2-neutral renewable energy and improvement of agricultural practices by recycling of plant nutrients.

The cost of biogas is relatively low. Besides, the technical requirement is not high. So gas generation is economic and has huge market potential. Additionally, biogas generation can relieve rural power electricity peak pressure and increase available power for rural users. Currently, our biogas power generation equipment mainly applies to modified gas engines, but there are still deficiencies of poor stability and reliability. In particular, the bad stability of power generation will directly impact power quality of biogas generation and even obstruct its wide application. Anaerobic digestion comprises several groups of microorganisms in a complex process. Some microbial groups are slow growing and sensitive to change in operating conditions.

Therefore, special knowledge and process sensors are required for optimal operation. Under-loading

enables stable operation, but this results in relatively low productivity, and consequently low economic profit. Additionally, very low loaded anaerobic digesters operate with low conversion rates. Increasing loading increases biogas production rate but risks overloading, which can lead to extended recovery times, consequent loss of production, and restart expenses. Often the process fails before the operators can take action due to lack of responsive sensors to provide an early warning. Better monitoring and control is an important tool to achieve process stability and optimized biogas production, without the risk of process failure. This contributes to a better economy of the biogas plants.Biogas mainly consists of methane (CH_4), carbon-di-oxide (CO_2) and small amount of H_2S and moisture. Our main objective is to provide technical assistance to biogas plant by interfacing some SENSORS like temperature, humidity and flowrate with microcontroller so that the system can be monitored easily & systematically. This will increase the efficiency and quality of Biogas which in turn increase demand for environmentally responsible energy

II. RELATED WORK

Ding Tan, Liu Hui "Research of Biogas Generator Monitoring System Model Based on Probability Petri Nets". In this paper, the monitoring model has fault diagnosis subsystems, according to the
procedure of gas power generation based on probability Petri nets, along this addition of proposed monitoring unit can further enhance the growth of biogas production.Vishwamitra Oree, Veeneet Anand Maudhoo "A microcontroller-based household anaerobic food digester". In this paper, A microcontroller is used to process all the signals received from the sensors used to optimally control the anaerobic digestion. As the controller used here is to control the digester addition of an controller to detect the health of biogas digester to increase its production is
proposed in this paper.

III. METHODS AND MATERIALS

The entire system is controlled using NODE MCU (ESP8266) microcontroller which is interfaced using sensors like DHT11 (temperature and humidity sensor), Flowrate sensor, GSM 900 module . The controller has 802.11 b/g/n support (2.4Ghz) operation voltage of 2.6V to 3.2V which is compatible with all the sensors which have around 3V operating voltage. The DHT11 and flowrate sensor are connected to the GPIO pins of controller which accesses the data from the gas which flows from the biogas balloon (BALLOON is the storage part of biogas system). The accessed data is monitored systematically so that any changes in the values which has a drastic variation from threshold limit can be easily detected and rectified by changing the slurry (wet waste fed into the biogas system).

IV.RESULTS AND DISCUSSIONS

A. COMPOSITION AND PROPERTIES OF BIOGAS

The composition of biogas depends upon the origin of anaerobic digestion. Many institutions undergoes research and development in the field of designing the biogas plants to handle and process any organic feed stock to produce high purity combustible gas containing 75% of methane and hydrogen sulphide less than 100ppm in the crude gas.

Typical composition of biogas:

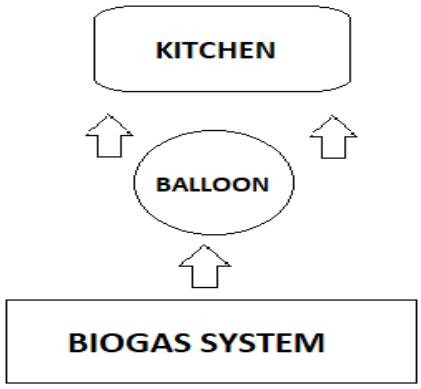
Table 1

Compound	Formula	[vol%]
Methane	CH4	55-70
Carbon dioxide	CO2	30-45
Nitrogen	N2	0-2
Hydrogen	H2	0-1
Hydrogen sulphide	H2S	0-3
Oxygen	O2	0-0.5

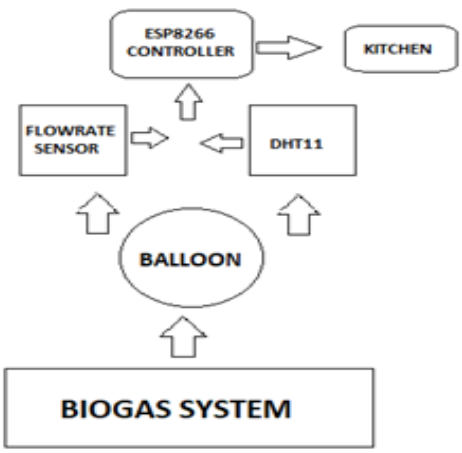
B. FLOWRATE SENSOR AND TEMPERATURE - HUMIDITY SENSOR

The Flowrate sensor is to measure the flow of the biogas from the plant. This sensor works on the principle of hall effect which states that when electric and magnetic fields comes in perpendicular to each other the sensor will produce a pulse which will be used to calculate the amount of flow. By knowing the flow we will be able to know whether there is sufficient amount of gas available or not and through this we can alter the composition of slurry into the system. DHT11 sensor is used in order to get the temperature and humidity of the gas and by knowing these values we will be able to provide the optimum conditions for the anaerobic digester for the maximum production of the biogas as in biogas we have to maintain some temperature (37%) for the optimum condition for anaerobic reaction.

GENERAL SETUP



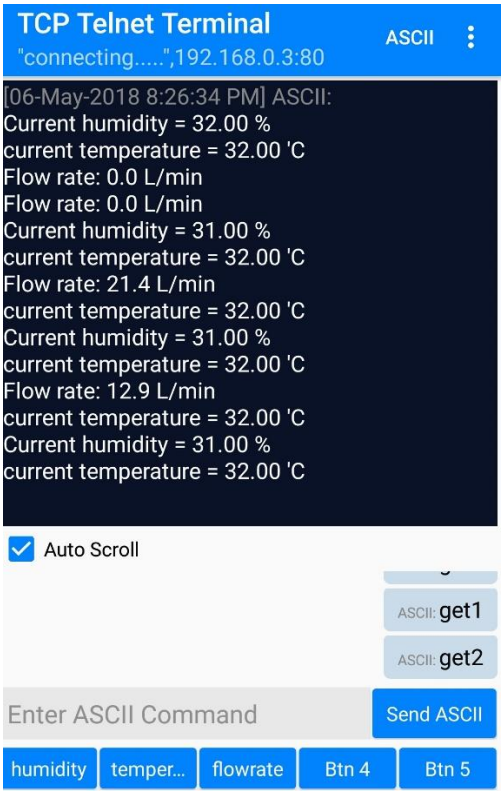
PROPOSED SETUP



C. SOFTWARE

The software of the project is written in embedded C programming language. The Node MCU is programmed using Arduino IDE.. The Arduino IDE consists of pre-installed set of programs for one's reference.

D. OUTPUT OF THE SYSTEM



V. APPLICATIONS

1. This can be used for better monitoring of the system by which health of the entire system can be monitored and rectified.
2. Further enhancement in the system like addition of sensors like methane & CO_2 sensor can increase the performance of system.
3. The system can be Wi-Fi enabled so that they can broadcast the information to computer or smartphone.

VI. CONCLUSION

As each sensor used in this system has its own importance in proper modelling of biogas plant, the above principle can be effectively used at every

system so that they can be monitored in a easier way. Further addition of sensors like methane & CO_2 sensor may further enhance the system performance.

IV. REFERENCES

[1]. International Journal of Current Engineering and Technology E-ISSN 2277 – 4106, P-ISSN 2347 – 5161[12:31, 5/15/2018] .....: Biofuel Research Journal 10 (2016) 394-402

[2]. ieeexplore.ieee.org/document/6109094/

[3]. Ding Tan, Liu Hui "Research of Biogas Generator Monitoring System Model Based on Probability Petri Nets", Published in: Image Analysis and Signal Processing (IASP), 2011 International Conference on 21-23 Oct. 2011, Accession Number: 12443630 in Hubei, China

[4]. Vishwamitra Oree, Veeneet Anand Maudhoo "A microcontroller-based household anaerobic food digester", Published in: Smart Instrumentation, Measurement and Applications (ICSIMA), 2015 IEEE 3rd International Conference on 24-25 Nov. 2015, Accession Number: 16284473 in Kuala Lumpur, Malaysia