IOT BASED MONITORING OF COMMUNITY BIOGAS PLANT FOR SMART CITY APPLICATION

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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.

***Index Terms* – IOT systems, Bio Gas system, Smart City, Sensors & Microcontroller.**

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.

II. LITERATURE REVIEW

Ashwini D S et.al [1]: Studied 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.

Rushikesh Ravindra Pansari et.al :[2]:have Developed the IoT based Monitoring of Biogas Plant is successive in the project everyone know that management of one biogas plant is done perfectly but when they are several biogas plants then management of these biogas plants are critical. To reduce complexity of manual management of plants IoT platform with cloud server of Raspberry Pi, ThingSpeak or any other can be used where data of the several plants will be collected on a server in the form of temperature, humidity and pressure of the biogas plants. In this system temperature, humidity and pressure sensors are connected from one side to biogas plant to measure respective parameters and sensors are connected to the other side using NodeMCU(ESP8266) where NodeMCU uploads the data of unit(plant) to the cloud server using IoT. This helps to deploy this system in industry where the biogas management of several plants can be done.

III. OBJECTIVES:

The objectives of our project work are as follows:

1. The anaerobic bacteria's in the system are active only in certain temperature and PH level. If the temperature is very low or very high, the bacteria's will become inactive and biogas cannot be produced. Similarly if waste mixture inside the digester becomes acidic then also the biogas cannot be produced.
2. It is necessary to know the temperature level inside the biogas digester for continuous production of biogas. Therefore, Temperature sensor is used to monitor the production of biogas. If moisture get trapped inside the pipeline, then it is not possible to supply the biogas continuously for burning so, Humidity sensor is used at different points along the pipeline. Flow sensor is used measure the amount of biogas flows through the pipeline.

IV. METHODOLOGY

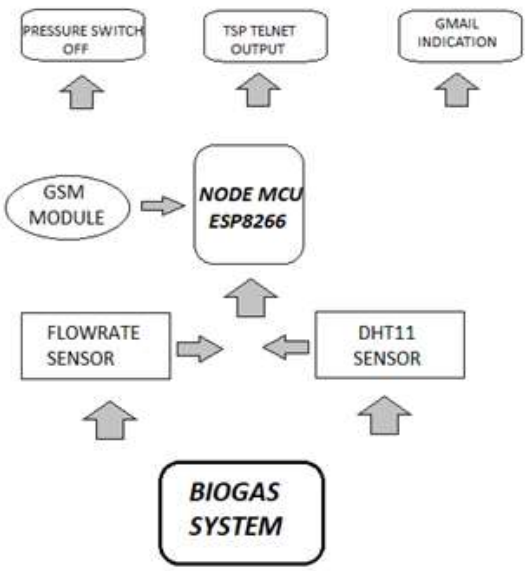

Figure.1 Methodology

After all the reactions inside the biogas Digester, the gas flows into the sensors i.e Flowrate sensor and Dht11 sensor.

Flowrate & DHT11 sensors -

These sensors access the data i.e flow of the gas as well as humidity and tempeature of gas. Accessed data is sent to the micro controller ESP8266.

ESP8266 -

Node MCU senses the signal from sensors connected to GPIO pins.The sensed signal in obtained as output in form of L/min for flowrate sensor and 'C for temperature,

%vol for humidity sensor.

TCP TELNET -

This application is used to access the data output from ESP8266 in easier way. The output data in accessed anywhere inside a LAN which eliminates the user to be near the system to access data. Working of this application is explained in chapter 4.

TCP-TELNET disconnection -

Whenever the user gets disconnected for that particular client connection, an automated mail is sent to the user regarding the last output of the system before disconnection. By this, user has a updated information about the system.

Pressure switch control -

Pressure switch in BIOGAS system is used to get the pressurized gas to the kitchen in order to burn the fuel. Use of pressure switch is unnecessary when there is no gas production inside the system. This also reduces the life and efficiency of pressure switch. So, by the data of FLOWRATE sensor, we can know whether there is production of gas or not. From that accessed data and by use of GSM module we can control the ON & OFF of pressure switch system.

GSM module –

As above in order to control pressure switch, we use GSM module which in turn controls the relay. So, pressure switch can be used safely and efficiently whenever required.

V.RESULTS & DISCUSSIONS

- A user is logged in to the local system, and invokes a TELNET program (the TELNET client) by typing

  telnet xxx.xxx.xxx

  where xxx.xxx.xxx is either a host name or an IP address.

- The TELNET client is started on the local machine (if it isn't already running). That client establishes a TCP connection with the TELNET server on the destination system.
- Once the connection has been established, the client program accepts keystrokes from the user and relays them, generally **one character at a time**, to the TELNET server.
- The server on the destination machine accepts the characters sent to it by the client, and passes them to a terminal server.
- A "terminal server" is just some facility provided by the operating system for entering keystrokes from a user's keyboard.
- The terminal server passes outputs back to the TELNET server, which relays them to the client, which displays them on the user's screen.
- In general, a TELNET server is implemented as a master server with some number of slave servers. The master server listens for service requests from clients. When it hears one, it spawns a slave server to handle that specific request, while the master goes back to listening for more requests.
- The only thing that makes TELNET hard to implement is the heterogeneity of the terminals and operating systems that must be supported. Not all of them use the same control characters for the same purposes.

- To accommodate this heterogeneity, TELNET defines a Network Virtual Terminal (NVT). Any user TELNETting in to a remote site is deemed to be on an NVT, regardless of the actual terminal type being used.
- It is the responsibility of the client program to translate user keystrokes from the actual terminal type into NVT format, and of the server program to translate NVT characters into the format needed by the destination host. For data sent back from the destination host, the translation is the reverse.

5.1 Operation

- The two hosts begin by verifying their mutual understanding. Once this initial negotiation is complete, they are capable of working on the minimum level implemented by the NVT.
- After this minimum understanding is achieved, they can negotiate additional options to extend the capabilities of the NVT to reflect more accurately the capabilities of the real hardware in use.
- Because of the symmetric model used by TELNET, both the host and the client may propose additional options to be used.
- The set of options is not part of the TELNET protocol, so that new terminal features can be incorporated without changing the TELNET protocol.
- All TELNET commands and data flow through the same TCP connection.
- Commands start with a special character called the Interpret as Command escape character (IAC).
- The IAC code is 255.
- If a 255 is sent as data - it must be followed by another 255.

5.2 Application Development

TCP Telnet Terminal works based on TCP/IP protocol, using this app we can create TCP Client that communicate with Server. To start a Telnet terminal, we must provide IP address and PORT number of the server. After connection is established with server, we can easily access and communicate with your server. Some of the main features of this application are:

- Separate panels for sending and receiving data.
- Custom your own buttons for frequent sending of same data.
- Selection for \r \n at the end of sending data.
- Monitoring receiving data as HEX or ASCII.
- Simple copy option in sent data just long press on data.

Fig 2 TCP TELNET input terminal

The TCP Telnet terminal application provides a very good user interface for the users to access it and use it to connect to the server to fetch data from the server and also to send data to the server.

Fig 3 TCP TELNET output terminal

5.3 Generated output

Using this node MCU we can send the e-Mail to the subscribed mail id whenever the login occurs to the system. This helps us in maintaining the system security because whenever the user tries to login to the system the owner will get the mail telling that somebody is accessing the data that will help us in providing the system security. The mail format which we will get is shown below in the diagram.

Here we are using the owner as NIE crest and this mail id is subscribed to the system and the data will be sent to this mail address and the details we will get are which plant we are accessing and the values of temperature and humidity and the flow rate. This will add another feature to the system in parallel with the security we will also get the values of the sensor output.

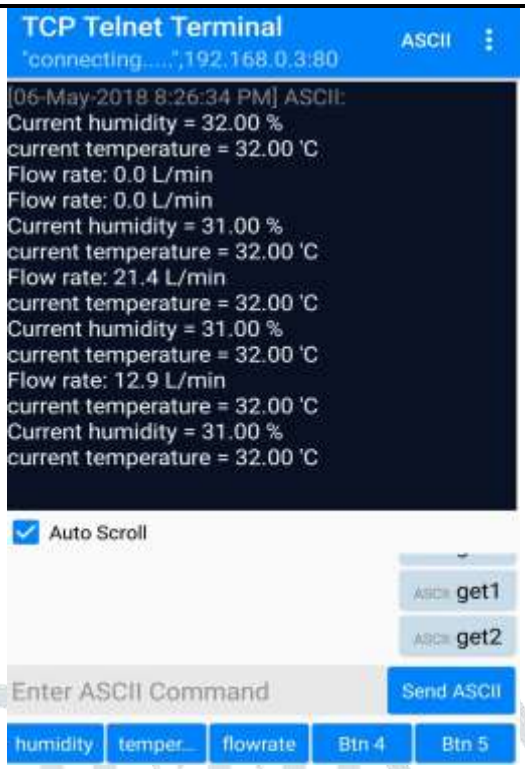

Fig 4 Application window

VI. CONCLUSION

In this paper efficient Biogas management using IoT is presented through by development of such monitoring system, this is novel system as compared to traditional which monitors parameters of Biogas plant viz temperature, pressure and humidity using sensors and IoT. Several plants also can be managed using Node MCUs and one Thing Speak server where user can able to create more channels for manage several plants from one area. User can also use one Raspberry Pi where Raspberry Pi helps to create self-cloud server and from using Raspberry Pi data stored online and there is no need to subscribe other cloud servers which are based on premium. Due to use of self cloud server, this system is more protective in terms of data security.

VII. FUTURE SCOPE

Interface of MQ135 and MQ4 i.e., CO2 and methane sensors can be used to further detect the impurities of purified gas obtained from SCRUBBER of BIOGAS system, by which system can be further controlled and monitored for its efficiency.

* GSM module can be further used to get the data of sensors connected to it.

* Addition of pressure sensor can be used to monitor the pressure of system.

* H2S sensor can be used to further know the impurities present in the gas by which we can know the efficiency of SCRUBBER unit in BIOGAS system.

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