

IOT BASED MONITORING AND CONTROLLING OF SMART MICRO GRID

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Abstract— Smart Micro-Grid is a modern electrical grid system designed to enhance performance, reliability and safety with a seamless integration of renewable and alternative energy sources through automated control and digital communication technologies. This small automated grid is the vital component of the smart grid. Here, real-time information becomes the main factor in ensuring efficient power supply from the generating units to end users. Embedded system can be found everywhere in today's life, ranging from electrical devices to nonlinear compensation, complex automation and adaptive control. The microcontroller is the main component of the embedded system. The microcontrollers monitor the entire system in accordance with the instructions provided during the installation stage. A control system is designed and implemented in this thesis work which allows communication between different micro-grid components and also controls the micro-grid in a reliable and efficient manner.

1. INTRODUCTION

Natural or manmade disasters have a profound effect on society as they affect vital infrastructures. At these incidents, significant portions of the centralized power grid are compromised. Thus, these incidents are accompanied by reduced efficiency in the power supply. Besides the immediate inconvenience caused by these incidents, and the cost of the outage, It also affects restoration efforts. The new paradigm known as smart micro grid can solve these problems. Micro-grids are small-scale versions of traditional large centralized power grids. These meet goals such as higher efficiency, lower carbon emissions, energy resource diversification and overall cost reduction. Smart micro-grids generate, distribute and control the flow of electricity to consumers, as in large power grids, but locally, they do. So far, the smart micro-grids are the best way to incorporate distributed generation at community level and also

enable the involvement of consumers in electricity companies. The smart microgrid includes renewable energy resource distributed, automated control system, load management system, Energy storage system and modern communication networks for managing the use of electricity. These systems are capable of operating in both grid connected mode and isolated mode. Fig.1.1 shows a smart micro grid system.



Fig. 1.1 Smart micro grid

1.2 MICRO GRID OPERATING MODES

Here, the micro grid can operate in two modes they are as follows

1. Grid connected mode
2. Island mode

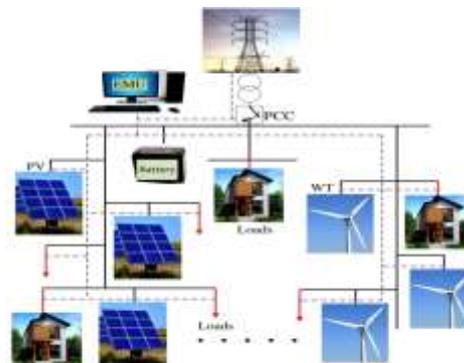


Fig. 1.2 operating modes of micro grid

1.3 GRID CONNECTED MODE

The micro grid is running in grid connected mode at the point of the common connection the switch is closed. In this mode, in this mode the micro grid can supply excess power to the utility grid as well as taken power from grid when the micro grid couldn't meet the load demand. This mode of operation is very effective when compared with island mode in emergency conditions.

1.4 ISLAND MODE

In this micro grid mode of operation only renewable energy resources are used. The micro grid is not a part of the utility grid. That form of mode is commonly used in forest or remote areas because we are unable to have remote area power transmission lines, which is why the micro grid island mode is commonly used in remote areas.

The micro grids are classified into different types they are as follows

1. DC micro grid
2. AC micro grid
3. Hybrid AC/DC micro grid

Dc micro grid is nothing but generating and delivering power is dc power. This type of grid only useful in remote areas nothing but it is only possible to working in island mode. Ac micro grid is a conventional grid so it can work in grid connected mode as well as island mode. Another type is Hybrid AC/DC micro grid in this type micro grid has a ac and dc power generation and delivering. It can operate grid connected mode as well as island mode.

2. HARDWARE IMPLEMENTATION

Here, we developed a prototype DC micro grid. The block diagram of prototype DC micro grid as shown in fig. 3.1

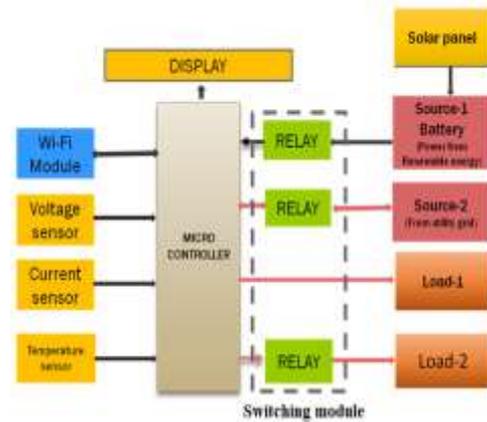


Fig. 2.1 smart micro grid block diagram

In prototype DC micro grid, the microcontroller plays vital role. Microcontroller can monitor and controls the entire grid. The micro controller used in this circuit is Arduino Uno. It is a one of advanced microcontroller. The dc micro grid is combination of two energy sources they are one is solar power and another is power from utility grid. The main aim of this project is to main better controlling, reliability, maintain low electricity bill and also real time monitoring of the entire grid nothing but monitoring and controlling of loads and energy sources

2.1 WORKING

The circuit consists of Arduino Uno it is one of the modern microcontroller, switching modules nothing but relays for switching purpose, Wi-Fi module it place communication between user interface and grid. Here two energy resources one is solar and another is utility grid. By using solar we can store the energy in batteries. When the solar energy is available the microcontrollers shift the loads from the utility grid to solar or renewable energy. It can shift by automatically or manually by remotely. Here the availability of power can read by digital meters and then real time data will available in user inter face and could storage. Here we are using voltage and current sensors for measuring voltage and current for grid monitoring and controlling purpose. This is very useful for load scheduling because of when availability of renewable energy, consumers can shift to renewable source because of avoiding more electricity bill. From this data the conventional power plants can decrease the their generation So, pollution will decrease greatly and also nowadays we are choosing e-cars and bikes so, it can charge by using micro grids.

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16M0V53-R0), a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started..

The microcontroller shifts the sources by giving instructions remotely by using communication module and it is a full duplex network with a bidirectional flow of information and electricity. Here excess power of solar can sell to utility grid that's why it is call it as a duplex network. By using this circuit we can switch ON/OFF the loads by remotely. One of the main aspect is when the solar generation doesn't meet the demand it automatically shift to utility grid and another main objective is this circuit is can also used to control the smart home appliances.



Fig.2.1 prototype smart micro grid

By using communication module we can go to particular web page, there the real time data of micro grid is available so, we can monitor and if need to control the grid. we can give a particular instruction from corresponding webpage and then the grid can controlled respect to particular instructions.

3. CONCLUSION

Technology's true meaning is accomplished only when it reaches the grassroots level and makes a difference in community lives. In the present world the smart grid is the most revolutionary technology. One crucial element of this revolution is the convergence of information and communication technologies with an existing passive power grid. It is an intelligent power grid that uses automated monitoring, data collection, control, and evolving communication technologies to combine various alternative and renewable energy resources. A smart grid is envisaged as an enabling and evolving technology. Power is the most important element for empowerment. In the present era electricity is an integral commodity. A smart grid ensures secure and safe power, which involves distinguishing elements from tiny sensor nodes to the vast network of things Reading electricity usage and through real-time monitoring indicating demand forecasting, peak load control and complex tariff control. Enabling of remote connect or disconnect that facilitate the enabling of partial rather than feeder level outage remotely.it improves the power quality, reliability of power supply, network control management

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