OFF GRID SOLAR ELECTRIFICATION HOUSE

Mr.T.Jayanth Kumar,
Professor[2,] Assistant Professor
Mail.Id : jayanth0524@gmail.com,
EEE Department,
G.Pallavi, K.Sai kumar, Seema Tabassum, V.Pavan Kumar,
Mail id: pallavigoud2001@gmail.com, Mail id : kakkunurisaikumar@gmail.com,
UG Students,
EEE Department,
Vignan Institute of Science and Technology, Telengana.

Abstract

The world's most populous areas — the United States, Europe, and China — account for the majority of global power consumption. There was an average rise of 3.3%, 2.2%, and 1.6% in the population of each country during the previous decade in China, India, and Brazil [1]. The current rate of global warming may be a result of our reliance on fossil fuels. A rising number of people are keeping lights, heaters, and TVs on all day, even when they aren't home, in an attempt to make their homes more pleasant. Homeowners can now keep tabs on their energy use and maybe save money with a new technology that has been developed to assist them. For micro-grids in Morocco using renewable energy, design and implement a home energy management system that provides customers with significant information about their energy consumption, as well as sensing, control, and smart algorithms for micro-grids. The topic of renewable energy is now a hot button issue in Morocco. One of the most often asked questions is how photovoltaics will be integrated into the world's distribution and transmission network. The theoretical and technical potential of Moroccan solar energy is enormous because of the country's high levels of solar radiation and plenty of open space. An Arduino-based network was used to connect two Smart Plugs in a microgrid and demonstrate the usage of eliable.

Introduction

The development of renewable energy and the expansion of the electrical system has led to an increase in demand for power. In addition to heating and cooling, new applications such as hybrid electric cars and heat pumps are increasing and using more electricity. Energy consumption peaks and troughs are making power networks more difficult to manage because of seasonal fluctuations in demand. Renewable energy sources are getting increasingly diversified in their methods of generation. As a last consideration, distributed computing is becoming increasingly widespread.

The increased output of distribution networks that were intended to provide rather than gather electricity has resulted in an increase in energy injection.
To make an electrical system smart, it must be able to interact with itself via gadgets. Currently, the only mode of public transit accessible is the vehicle designed largely for the goal of maintaining the supply chain's continuance. Distribution networks are woefully under-equipped in terms of communication tools due to the vast number of businesses (stations, lines, etc.) and customers they serve. With smart grids, the most important problem is how they are distributed to customers. Using the following table, we can see how a smart grid may outperform current electricity grids (table 1). Two-way communication is improved, power systems are managed depending on consumption, and customers are active participants in the smart grid's implementation.

Literature Review

Between 2010 and 2030, the world's energy consumption is projected to grow by a factor of four. However, global energy consumption is expected to expand faster than carbon dioxide emissions. Climate change is mostly caused by CO2 emissions from energy generation. We need a massive overhaul of our electrical infrastructure to fix this problem.

As one of the most adaptable and in-demand energy sources, electricity is in great demand all around the globe. Rising temperatures are mostly due to an increase in carbon dioxide emissions from energy output. Climate change will need major changes to the present electricity grid. Industry, commerce, and homes all benefit from the electrical power system's capacity to meet their ever-increasing demands. Fossil fuel-based energy generation has a lot of negative environmental and social repercussions today. [3]

In order to meet the increasing demand for energy, the use of fuel cells and other renewable sources of power is necessary. Renewable energy sources need a redesign of the power grid's ageing infrastructure and architecture. Traditional power systems should be more dependable, environmentally friendly, and smarter than present systems at this point in time. [4]

As the need for power grows, so does the need to reduce carbon dioxide emissions in an ecologically acceptable, reliable, and cost-effective way.
As a consequence, a new concept known as "smart grid" has emerged.

Asa consequencethe maindrivers for thesmart grid:

Reliability : Providing high-quality energy whenever and wherever it is required.

Capacity: supplying the world's ever-increasing need for power

Efficiency: Power production efficiency and reductions in distribution, transmission and usage losses.

Sustainability: Using and integrating renewable energy sources.

SmartGridDefinition

The "Smart Grid" uses computer technology to manage the market's supply and demand of electricity by maximising energy production, distribution, and consumption. Keeping track of network state in smart grids ensures that production, distribution, and consumption are all in balance.

Because of brand-new problems with electrical infrastructure, an idea for a smart grid was hatched.
In order to enhance the grid's overall efficiency, communication, sensors, control, and processing components all work together in the smart grid [6].
Smart grid efforts will enhance grid maintenance.
Reducing energy usage by using current technology for operational and planning purposes.

Self-healing capabilities, user engagement, fending off attacks, delivering higher power quality and supporting a wide range of producing and storage options are all key qualities for smart grids, as outlined in [7] by the US Department of Energy. Alternatively, "the next generation of distribution and consumption" may be used to define the smart grid. [8]

Smart Grid in History

The "smart grid" concept has been used on a broad scale since the late 1990s[9], but it is still a new and unproven theory. Electric power systems are ill-equipped to meet the problems of the twenty-first century since they are based on outdated ideas and outdated infrastructure.

Italian energy giant Enel S.p.A. began implementing the country's first Smart Grid technology as early as 2000.There are now 30 million smart metres in use throughout the country[9].

In 2003, the U.S. started the process of creating its Smart Grid infrastructure. As of right now, the network has 200,000 connected devices and is expected to reach 300,000 within the next few months. Boulder, Colorado[9] is the second most popular city in the United States after Austin. As the first Smart Grid city in the United States, Boulder has more over 23,000 Smart Meters.

Early progress has been made in many other countries and regions, including parts of the United States, toward the Smart Grid and the transition from one-way to completely bi-directional networks.

.

Implementation of a Smart plug in a Home Energy Management System

Both qualitative and quantitative findings are anticipated from this capstone project. The early twentieth century's considerable research has much to teach us about the smart grid. Because we drew on previous student work, we were able to add two-way communication to the gateway and a data flow to a central database that allows sensors to be read. This was an important step forward.

Remotely transferring sensor data from one location to another utilising the X bee protocol and a star topology is the primary goal of this test If there are any signals that could interfere with each other, a test will be conducted. Since the previous research team used the Arduino Yun in the gateway, there has been no reliable wireless connectivity. This problem will be solved using an Aduino Uno and Ethernet shields.

RESULTS

It is possible to control the appliance while it is being detected. Both smart plugs' data is collected by the gateway, which may also communicate with the smart plugs simultaneously. Figure.... shows the Serial Arduino display on both smart plugs.

```
void loop() {
String pageValue = connectAndRead(); //connect to the server and read the output
Serial.println("\nSimple Xbee Communication-Receiver");
xbee.readPacket();
//Reads all available serial bytes until a packet is parsed,
if (xbee.getResponse().isAvailable()) {
//something available?
if (xbee.getResponse().getApiId() == ZB_RX_RESPONSE) {
//is it rx
// now get the payload
xbee.getResponse().getZBRxResponse(rx);
Serial.print("Receive packet from (64-bits address)-> ");
//type:XBeeAddress64
Serial.print(rx.getRemoteAddress64().getMsb(), HEX);
Serial.print(":");
Serial.println(rx.getRemoteAddress64().getLsb(), HEX);
```

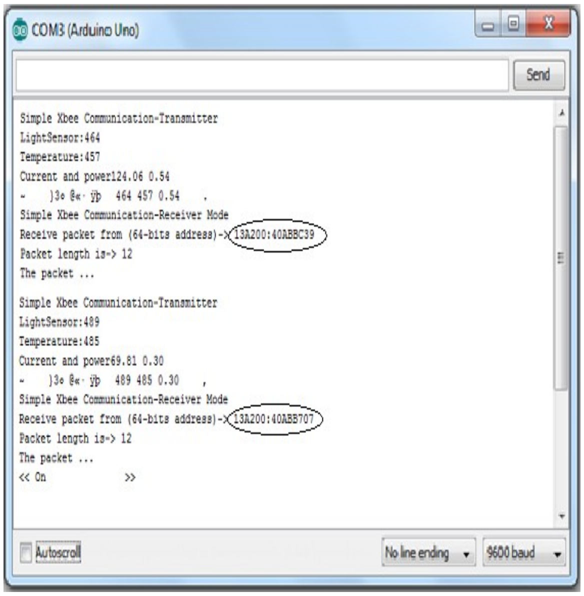


Figure 1 .Serial Arduino display

Theserialmonitorboxofthecoordinatornoderetrievedthedatainfigure22. It transmits the 64-bit sourceaddress every time it delivers data to the gateway (ex:13A200-40ABBC39).

CORDINATORNODE

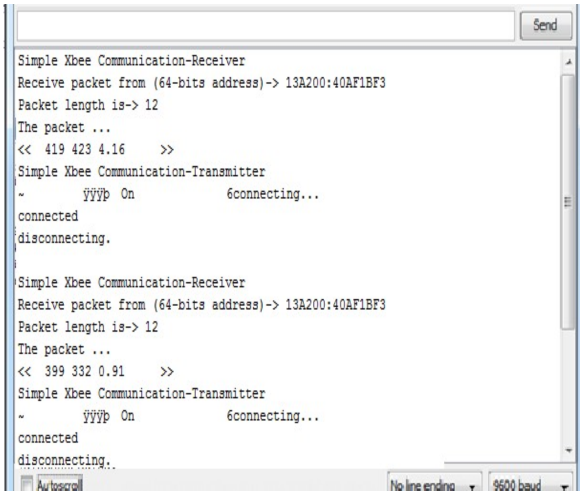
This code was uploaded through the Arduino Uno on the gateway. Both Smart plugs send data to the gateway. We use the Mac addresses of responding smart plugs to sort the data into several categories..

```
#include <XBee.h> //include Header File
#include <SPI.h>
#include <Ethernet.h>

#define MSG_LEN 18 //Message Length
// Enter a MAC address for your controller below.
// Newer Ethernet shields have a MAC address printed on a sticker on the shield
byte mac[] = { 0x90, 0xA2, 0xDA, 0x0F, 0x98, 0x3F };
// if you don't want to use DNS (and reduce your sketch size)
// use the numeric IP instead of the name for the server:
//IPAddress server(74,125,232,128);  // numeric IP for Google (no DNS)
char server[] = "www.caprealty.ma";
char inString[32]; // string for incoming serial data
int stringPos = 0; // string index counter
boolean startRead = false; // is reading?
// Set the static IP address to use if the DHCP fails to assign
IPAddress ip(192, 168, 0, 177);
//String sensedData;
uint8_t payload[MSG_LEN];
//XBeeAddress64 addr64 = XBeeAddress64(0x0013A200,0x409022C7);
//define 64-Bit Xbee Adress of the Remote Host
XBeeAddress64 addr64 = XBeeAddress64(0x0013A200,0x40AF1BF3);
//XBeeAddress64 addr64 = XBeeAddress64(0x0013A200,0x408CC72B);
ZBTxRequest zbTx = ZBTxRequest(addr64, payload, sizeof(payload)); //Makea Xbee Packet


//#define MSG_LEN 15 //Message Length
XBee xbee = XBee();


Serial.print("Packet length is-> ");
Serial.println(rx.getDataLength(), HEX); //getDataLength() type:uint8_t, Returns the length of the payload.
//rx.getData();
//print the payload
Serial.println("The packet ...");
Serial.print("<< ");
for (byte i=0;i<rx.getDataLength();i++){
Serial.print(char(rx.getData(i)));
//sensedData[i] = char(rx.getData(i)) ;
}
//connectAndWrite(sensedData);
Serial.println(" >>");


}
}


Serial.println("Simple Xbee Communication-Transmitter");
for (byte i=0;i<=2;i++)
payload[i]=pageValue[i];
xbee.send(zbTx);


}
```

Figure 2 .Gateway Arduino code

RESULTS

Data received and presented in the gateway may be shown using a serial Arduino display (Figure 24).



A serial Arduinodisplay is shown in Figure 3 of the gateway.

The serial monitor box on the coordinator node provided the data displayed in Figure..... It is no longer possible to send data to the gateway using the 64-bit source address (ex:13A200-40ABBC39). Make use of it to communicate your message.

Conclusion

Microgrid SHEMS have as their primary goals improving energy efficiency, increasing the return on investment in solar panels, increasing the amount of renewable energy they use and lowering their reliance on utility company electricity.
This capstone project met its primary goal. For this research, real hardware prototypes were also developed, rather than just theoretical models of SHEMS.

Initially, we investigated whether or not a solar power system would be advantageous to our home's energy supply. A case study was conducted on a typical home at this period. According to a cost study, renewable energy consumption in Morocco is still difficult to execute because of a scarcity of resources. We then developed a Household Energy Management System (HEMS), which enables customers to monitor and control different home appliances. Sensor data was gathered in the first phase of the investigation. This data may be sent to the gateway via the X bee communication protocol. Check that the smart plugs and gateway are communicating with each other before proceeding. The last step is to use Ethernet to send data to the database.
All Mohammed BakrSikal's application development work was included into the final section of the project.

The project's first constraint is the system's high implementation costs. A second problem exists in the control delay. This isn't the only problem: There aren't enough sensors in the lab to compensate for the lack of precision. The light sensor couldn't be calibrated since the lab didn't have a Lux metre. There were no more issues to be had.

References

[1]Laconsommationdcitéchiffres, Retrieved from:http://jeunes.edf.com/article/la-consommation-d-electricite-dans-le-monde,273

[2]SmartGrid–CRE.Retrievedfrom: http://www.smartgrids-cre.fr/

[3]Whatissmartgrid.Retrievedfrom:]http://new.abb.com/smartgrids/what-is-a-smart-grid

[4] Energy Management Algorithm for SmartHome with Renewable Energy Sources

[5] GN.C. Batistaetal./Energy 49(2013)306-315

[6] Gungor VC, Lu B, Hancke GP. Opportunities and challenges of wireless sensor networksinsmart grid. IEEE Trans Ind Electron 2010;57:3557e64.

[7] Markovica D, Cvetkovica D, Zivkovicb D, Popovic R. Challenges and communicationtechnologyinenergy efficient smarthomes. Energ Rev 2012;16:1210e6.

[8] A.Tascikaraogluet al./Energy and Buildings80 (2014) 309-320

[9] Smart Grid:TheFuturef the Electric Power System :An Introduction to the SmartGrid.(2011)ENBALAPower Networks. Pearce,Joshua (2002). open access"Photovoltaics–APath toSustainable Futures".

[10] Futures34(7):663–674.doi:10.1016/S0016-3287(02)00008-3.)fromWikipedia.

[11 Crystalline Silicon Photovoltaics .Retrieved from :http://www.pilkington.com/products/bp/bybenefit/solarenergy/applications/crystallin e+silicon+photovoltaics.html

[12]WhatAmous Silicon? Why is it so Interesting Now? . Retrieved from :http://www.solar-facts-and-advice.com/amorphous-silicon.html

[13] Thin film photovoltaics. Retrieved from :http://www.pilkington.com/products/bp/bybenefit/solarenergy/applications/thin+film +photovoltaics.htm

[14] How does an inverter work . Retrieved from :www.solar-is-future.com/faq-glossary/faq/photovoltaic-technology-and-how-it-works/how-does-an-inverter-work/index.html

[15] DavidV.Keyson et al. / Procedia Computer Science 19 (2013)646-653