A REPORT ON AN INDUSTRIAL ATTACHMENT WITH GRIT SYSTEMS ENGINEERING, VICTORIA ISLAND, LAGOS

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02 02 1998

Abstract

Abstract goes here

Dedication

To mum and dad

Declaration

I declare that..

Acknowledgements

I want to thank...

Contents

Chapter 1

Introduction

This report is a short description of my six month internship carried out as a compulsory component of the BSc. Electronic and Electrical Engineering. The internship was carried out at Grit Systems Engineering, Victoria Island, Lagos. This internship report contains my activities that have contributed to achieving a successful program. In this chapter, a description of Students Work Experience Program (SWEP) and the Company is given. The second chapter contains the theoretical background of the activities carried out during the course of the training, followed by the third chapter which discusses the activities. The technical experience and skills acquired during the internship are described in the fourth chapter. Finally I give a conclusion on the internship experience.

1.1 Student Work Experience Scheme. *SWEP*

The SWEP is a program of Student Industrial Work Experience Scheme (SIWES) designed for students in their third and fourth year from the faculty of Technology and Environmental Design and Management. The program aims at inculcating practical, scientific, social, and entrepreneurship skills needed to face the challenges of modern day graduate while also contributing to the overall development of undergraduates in these faculties. SIWES is highly recognized by the Nigerian University Commission (NUC), National Board for Technical Education (NBTE) and National Commission for Colleges of Education (NCCE), which makes her join forces with

Industrial Training Fund (ITF) in making this program attainable.

1.2 Objective of SIWES

The goals that the SIWES seek to accomplish are as follows

- Bridge the gap between the theoretical work/knowledge acquired in the classroom and real practical experience offered in the industries. This enables the students to appreciate/value in so many ways, the theories learnt in class.
- To enlist and strengthens employers involvement in the entire educational process of preparing graduate for employment in the industry.
- To provide students with an opportunity to apply their theoretical knowledge in real work situation, thereby bridging the gap between university work and actual practice.
- To prepare the student for the challenges in the industries and prepare them psychologically for work after school.

1.3 GRIT Systems

GRIT Systems, formally DawnFuel Limited, was founded by Mr. Ifedayo Oladapo in 2011 after he identified the challenge of under electrification in Nigeria. He demonstrated that solar power costs less than running a generator does, demonstrated it and used it as economic reality and use it as the foundation for the case he made for DawnFuel. As well as in the company's marketing campaign. The company after a while settled for installation and maintenance of imported solar products, with its custom built components, as the market did not appreciate locally built inverters.

GRIT Systems got into consultancy and monitoring of energy utilization with its new line of products.These products include The GRIT Energy and Power Monitor (GEPM) and G1 (A utility metering device). The company started with just

2 members (including the founder) and grew into a multi-departmental company with more than 15 workers. The devices were tailored to the unique requirements of under electrified communities and requires a first-hand installation by a trained Grit System's personnel. Once installed, users can remotely view graphs, receive notifications and generate simple language reports about an arbitrarily complex power supply mix.

Some of the functions of the Grit meter are:

- Reduced energy cost - Ensuring generator only runs when it is really needed.
- Multisource energy optimization – Increase in the time spent on cost effective sources like inverter while reducing the time spent on expensive sources like your generator.
- Cost-Benefit Balance - Using data from the metering devices to run energy balance simulations to help determine if and how alternative power sources would save the user money.

Chapter 2

LITERATURE REVIEW.

2.1 Embedded Systems Design

An embedded system is a microprocessor-based system that is built to control a function or range of functions and is not designed to be programmed by the end user in the same way that a PC is. A user can make choices concerning functionality but cannot change the functionality of the system by adding/replacing software. With a PC, this is exactly what a user can do: one minute the PC is a word processor and the next it's a games machine simply by changing the software. An embedded system is designed to perform one particular task albeit with choices and different options.

The last point is important because it differentiates itself from the world of the PC where the end user does reprogram it whenever a different software package is bought and run. However, PCs have provided an easily accessible source of hardware and software for embedded systems and it should be no surprise that they form the basis of many embedded systems.

2.2 Printed Circuit Board

Printed Circuit Boards (PCBs) are thin, rigid, and usually rectangular, with components attached to one or both surfaces. The top and bottom are generally coloured in dark blue or green. Lines running between the components have a slightly dif-

ferent colour. In addition to the top and bottom sides, modern circuit boards have internal planes called layers. Internal layers don't have components but may contain metal lines that carry electricity to and from the components on the top and bottom. For example, the circuit board in the iPhone 4 handset has 10 layers. Layers are critically important in PCB design, so circuit boards are commonly divided into three categories: single-sided, double-sided, or multilayer.

At the very least, a circuit board serves two purposes:

1. Provides mechanical support for a set of components

2. Provides electrical connections between the components

A picture of an populated and unpopulated Printed Circuit Board are shown in Figures 2.1 and 2.2 respectively.

2.3 Electrical Components

An electronic component is any basic discrete device or physical entity in an electronic system used to affect electrons or their associated fields. Electronic components are mostly industrial products, available in a singular form and are not to be confused with electrical elements, which are conceptual abstractions representing idealized electronic components.

Electronic components have a number of electrical terminals or leads. These leads connect to other electrical components, often over wire, to create an electronic circuit with a particular function (for example an amplifier, radio receiver, or oscillator). Basic electronic components may be packaged discretely, as arrays or networks of like components, or integrated inside of packages such as semiconductor integrated circuits, hybrid integrated circuits, or thick film devices. The following list of electronic components focuses on the discrete version of these components, treating such packages as components in their own right.

Components can be classified as passive, active, or electromechanic. The definitions of each class of electrical components are as follows

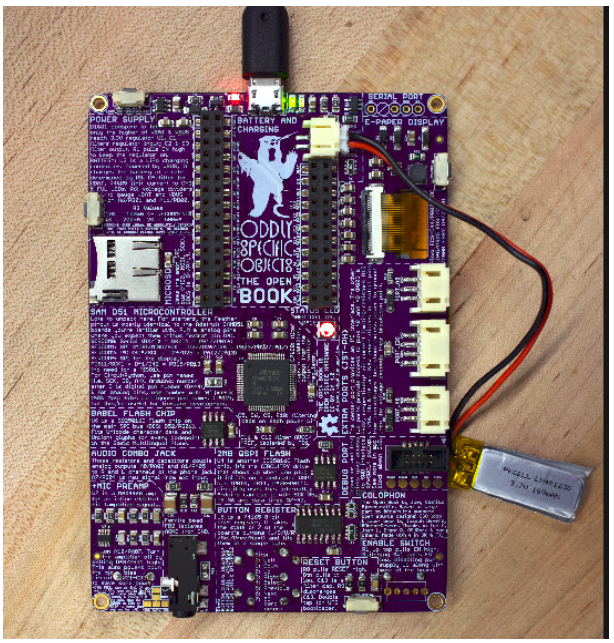

Figure 2.1: A Populated Printed Circuit Board.

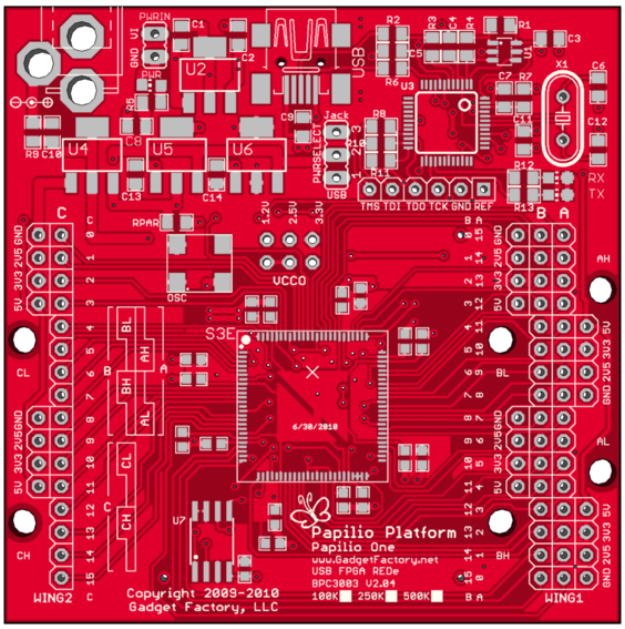

Figure 2.2: An Unpopulated Printed Circuit Board.

1. **Active :** These class of electrical components rely on a source of energy to function and usually can inject power into a circuit. Active components include amplifying components such as transistors, triode vacuum tubes (valves), and tunnel diodes.

2. **Passive :** These class of electrical components can't introduce net energy into the circuit. They also can't rely on a source of power, except for what is available from the circuit they are connected to. As a consequence they can't amplify (increase the power of a signal), although they may increase a voltage or current (such as is done by a transformer or resonant circuit). Passive components include two-terminal components such as resistors, capacitors, inductors, and transformers.

3. **Electromechanic :** can carry out electrical operations by using moving parts or by using electrical connections

A lead is an electrical connection consisting of a length of wire or a metal pad that is designed to connect two locations electrically. Electrical Components are available in three popular forms or technology. This form differ from one another by the form of their leads and method of mounting the Components. They include:

1. **Through Hole Technology:** This refers to the mounting scheme used for electronic components that involves the use of leads on the components that are inserted into holes drilled in printed circuit boards (PCB) and soldered to pads on the opposite side either by manual assembly (hand placement) or by the use of automated insertion mount machines. It is the oldest form of electrical components and is fast becoming obsolete with improving technology.

2. **Surface-mount technology (SMT):** is a method for producing electronic circuits in which the components are mounted or placed directly onto the surface of printed circuit boards (PCBs). An electronic device so made is called a surface-mount device (SMD). In industry, it has largely replaced the through-hole technology construction method of fitting components with wire leads into

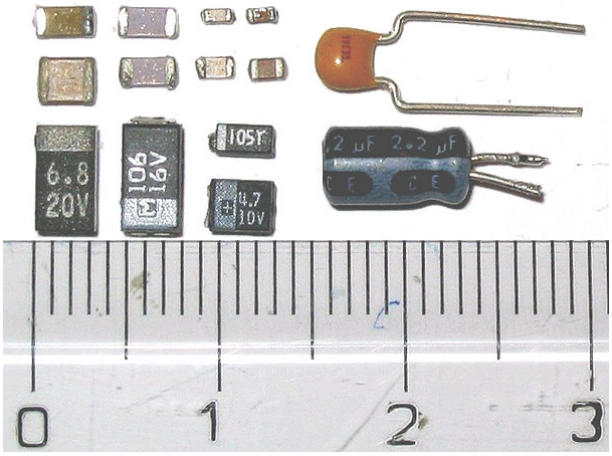

Figure 2.3: A collection of SMD Components.

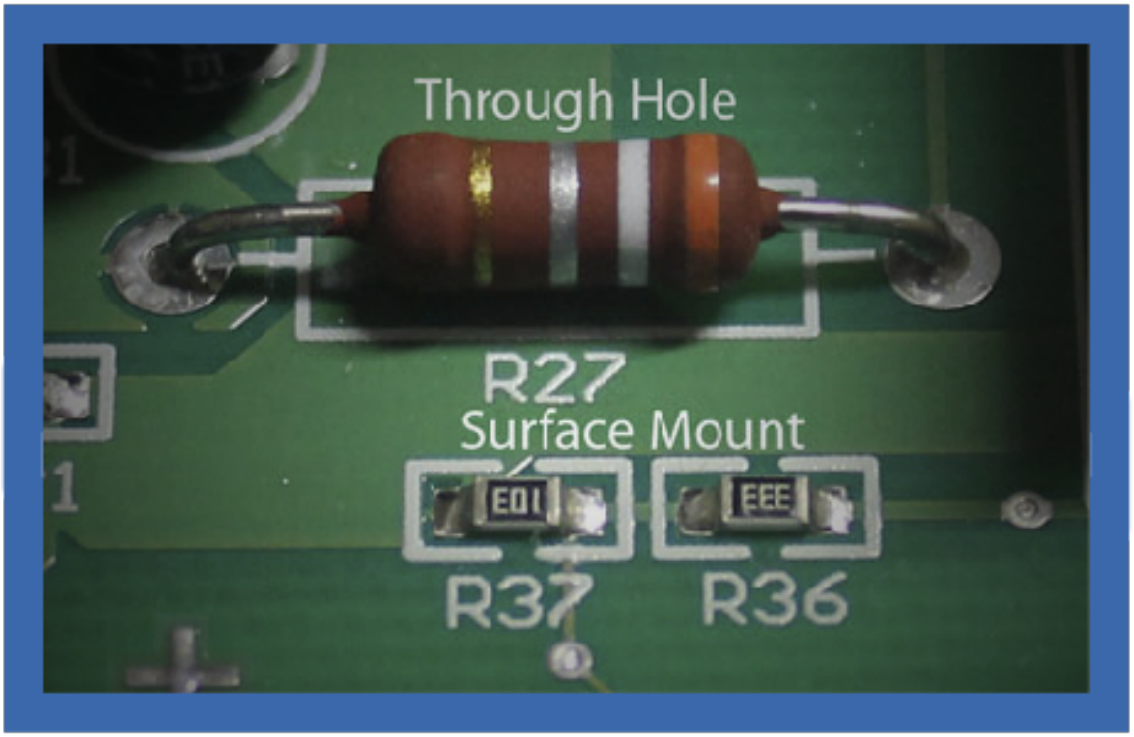

Figure 2.4: A board containing THT and SMD Components.

holes in the circuit board. Both technologies can be used on the same board, with the through-hole technology used for components not suitable for surface mounting such as large transformers and heat-sinked power semiconductors. An SMT component is usually smaller than its through-hole counterpart because it has either smaller leads or no leads at all. It may have short pins or leads of various styles, flat contacts, a matrix of solder balls (BGAs), or terminations on the body of the component.

2.4 LoRa (Long Range)

LoRa (**Lo**ng **Ra**nge) is a low-power wide-area network (LPWAN) technology. It is based on spread spectrum modulation techniques derived from chirp spread spectrum (CSS) technology.[1]It was developed by Cycleo of Grenoble, France and acquired by Semtech, the founding member of the LoRa Alliance. Semtech's LoRa devices and wireless radio frequency technology is a long range, low power wireless platform that has become the de facto technology for Internet of Things (IoT) networks worldwide.

LoRa uses license-free sub-gigahertz radio frequency bands like 433 MHz(Nigeria), 868 MHz (Europe) and 915 MHz (Australia and North America). LoRa enables long-range transmissions (more than 10 km in rural areas) with low power consumption. The technology covers the physical layer, while other technologies and protocols such as LoRaWAN (Long Range Wide Area Network) cover the upper layers.

Semtech's LoRa devices have amassed several hundred known uses cases for smart cities, smart homes and buildings, smart agriculture, smart metering, smart supply chain and logistics, and more. The technology can be utilized by public, private or hybrid networks and provides greater range than Cellular networks. LoRa Technology can easily plug into existing infrastructure and enables low-cost battery-operated IoT applications. The figur 2.5 shows how Lora compares to conventional form of data transmission.

2.4.1 Chirp Spread Spectrum (CSS)

Chirp Spread Spectrum (CSS) is a spread spectrum technique that uses wideband linear frequency modulated chirp pulses to encode information.[1] A chirp is a sinusoidal signal of frequency increase or decrease over time (often with a polynomial expression for the relationship between time and frequency). In 2.6 is an example of an upchirp in which the frequency increases linearly over time. Sometimes the frequency of upchirps increase exponentially over time.

As with other spread spectrum methods, chirp spread spectrum uses its entire allocated bandwidth to broadcast a signal, making it robust to channel noise. Further, because the chirps utilize a broad band of the spectrum, chirp spread spectrum is also resistant to multi-path fading even when operating at very low power. However, it is unlike direct-sequence spread spectrum (DSSS) or frequency-hopping spread spectrum (FHSS) in that it does not add any pseudo-random elements to the signal to help distinguish it from noise on the channel, instead relying on the linear nature of the chirp pulse. Additionally, chirp spread spectrum is resistant to the Doppler effect, which is typical in mobile radio applications.

Chirp spread spectrum was originally designed to compete with ultra-wideband for precision ranging and low-rate wireless networks in the 2.45 GHz band. However, since the release of IEEE 802.15.4a (also known as IEEE 802.15.4a-2007), it is no longer actively being considered by the IEEE for standardization in the area of precision ranging.

Chirp spread spectrum is ideal for applications requiring low power usage and needing relatively low data rates (1 Mbit/s or less). In particular, IEEE 802.15.4a specifies CSS as a technique for use in Low-Rate Wireless Personal Area Networks (LR-WPAN).

2.4.2 Advantages of LoRa (Long Range)

The advantages of LoRa includes the following

1. **Long Range :** LoRa devices are known to be able to transmit for very large distance. This makes them perfect for use in very remote and rural areas.

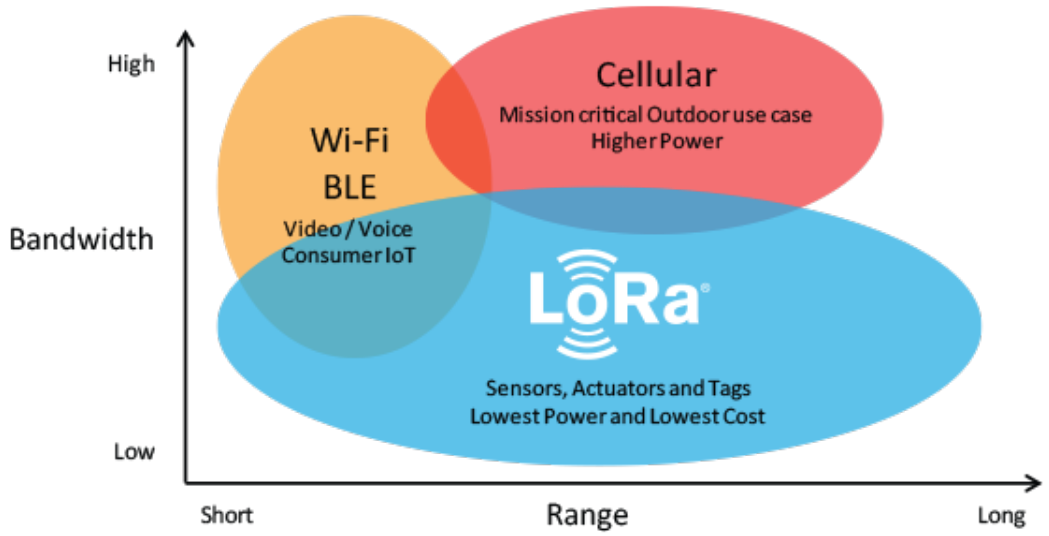

Figure 2.5: A dipiction of Lora compared to other networks.

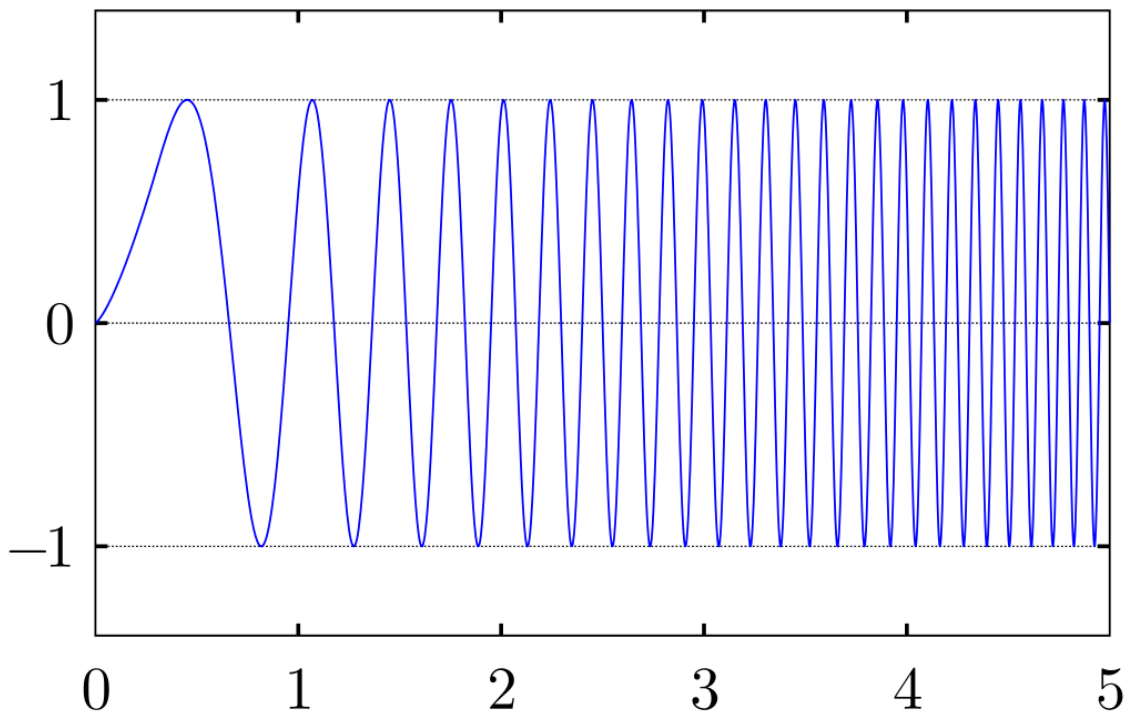

Figure 2.6: A linear frequency modulated upchirp in the time domain.

The maximum number of distance a LoRa device can transmit depends on its power requirement and presence or absence of a Low Noise Amplifier (LNA). Commercially available Lora modules are known to transmit for up to three to eight Kilometers depending on the surrounding.

2. **Low Power :** LoRA devices pride themselves with the abilty to last for a long time while running on batteries. This is due to their very low rate of power consumption. A Lora device requires minimal energy, with prolonged battery lifetime of up to 10 years, minimizing battery replacement costs

3. **License-free radio frequency bands :** Lora Devices make use of radio frequency bands like 433 MHz(Nigeria), 868 MHz (Europe) and 915 MHz (Australia and North America). These frequency bands are available in everywhere and free to be used without a transmitting license.

4. **GeoLocation :** Enables GPS-free tracking applications, offering unique low power benefits untouched by other technologies. Lora Devices can be located by certain triangularization techniques. This means that we can know what device sent a payload and where such device is stationed.

2.4.3 Disadvantages of LoRa (Long Range)

The disadvantages of LoRa includes the following

1. **Low bit Rate :** LoRa devices are unable to transmit data with high bit rate. This is a basic trade off for Low power and long range.The maximum bit rate you'll see is 50kpbs. This makes them useful in systems that dont require transmission of large data within a short period. An example of such system is a sensor mesh

2. **Latency :** Even though it is a low latency modulation it's not low enough for applications that demand very responsive real time communications.

Chapter 3

Chapter Three Title

Chapter 4

Chapter Four Title

Chapter 5

Conclusion

Appendix A

Appendix Title