UNIVERSITY OF DAR ES SALAAM

COLLEGE OF INFORMATION AND COMMUNICATION TECHNOLOGIES (CoICT).

DEPARTMENT OF ELECTRONICS AND TELECOMMUNICATION ENGINEERING.

ES 499: FINAL YEAR PROJECT

PROGRESS REPORT

PROJECT TITTLE:	SECURED WIRELESS USB FLASH DRIVE.
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ABSTRACT

In the current world as far as the current technology is concerned, there have been a lot of advancement of storage technologies. Since the early 2000s, as the microelectronics world rapidly changes from small scale integration to very large integration, the technology of storages has been simultaneously increasing toward higher scale of integration.

This increase in technology has allowed vasty increase in storage capacity over the time from several kilobytes that was stored in floppy disks and tapes to several Terabytes that can be stored in hard disks drives and solid-state drive.

Most of devices in the present time usually stores up to several gigabytes that can achieve up to 600 megabytes per second for reading and writing speed. These devices can be used for storage, data transfer or booting process.

Development of portable disk drives like USB flash drive, portable external hard disks and compact disks has been increasingly adopted over the years which lead to increasingly large number of flash disks in the market which does not satisfy the actual needs of the local market like compatibility, storage, costs and durability.

Furthermore, the increase adoption of the wireless radio communications protocols like Wi-Fi and Bluetooth has led to increase in reliability and flexibility to access data seamlessly over many applications like IoT systems, automation systems as well as industrial systems.

These wireless communications protocols have been used so far to transfer data and information over the internet and other subnetworks whereby some can even achieve up to 900 megabytes per second.

This project aims at utilizing this advancement in technology that we have achieved so far to develop a secured wireless system that can perform seamless data transfer to the client over different operating systems. The system tries to increase the mobility and freedom and provide more options to the user towards the access of information.

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LIST OF ABBREVIATIONS

Abbreviation	Long form/meaning
CUWB	Ciholas Ultra-wideband
SMB	Server Message Block
NAS	Network attached Storage
NFS	Network File system
USB	Universal Serial Bus
UWB	Ultra-wideband
Wi-Fi	Wireless Fidelity

CHAPTER ONE

INTRODUCTION

Majority of the storage technology have been largely improved in term of speed, capacity and reliability over the past 20 years. Some of the major discovery include

- discovery of Magnetic tape (1930) which uses a plastic tape containing magnetic material which creates a certain pattern of potential difference when passed through magnetic sensor. This pattern is the data stored in the tape (Bogart, 1995),
- discovery of Magnetic disk drive (1956) which uses a metallic circular disk with magnetic property rotating with high speed whereas data is stored within each circumference in the disk. The magnetic sensor then is placed with displacement of a varying disk radius to read the data. This data I is then analyzed to information [2] and
- discovery of semiconductor memory cell (1967) which uses a floating gate technology to store data in form of charging a capacitor where by the electrons a trapped within the floating layer (Bogart, 1995).
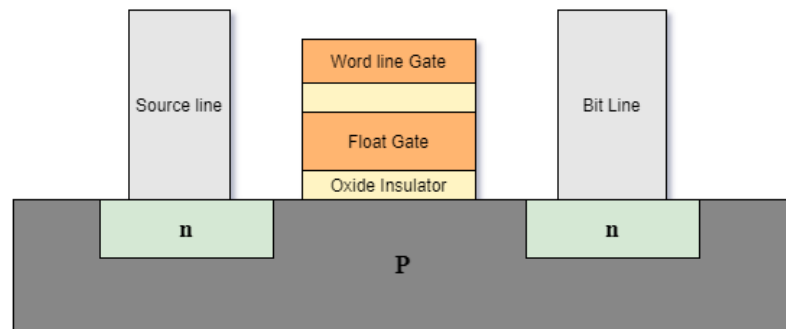

Figure 1 Basic Scheme of a semiconductor memory cell

This discovery has then led to two major discoveries based on the configuration involved:

1. Nand Memory: whereby the memory device is formed by parallel arrangement of semiconductor memory cells while
2. Nor Memory are formed by a serial arrangement of semiconductor memory cells (Hyperstone, 2020)

This project aims at reviewing and implement wireless storage system to the local market by using Nand memory since it is cheaper than the Nor memory based on the research results done at the previous practical training.

The main stakeholders for this project are the local market of Tanzania.

PROBLEM STATEMENT

Traditional memory storages rely on physical connections like wires which serves a great deal of disturbance when mobility is needed. Also, some wires tend to be bulk and heavy to carry. Some of the improved state-of-the-arts of today uses ports like Usb connectors which in spite of having a very high data transfer rate, sometimes are prone to fatigue after a long run of use.

Also, the security for this kind of existing storage connections is weak therefore there is a need for a better way of connecting the storage devices with and without physical connection. This will help in improving the portability, flexibility and security of the existing storage devices.

In spite of currently existing technology and advancement of wireless technology like the existence of

- Network Attached Storage (NAS) which are mainly served by the NAS server.
- SanDisk Connect wireless stick flash drive which offers storage capacity of up to 200GB and a good transfer speed but it is only supported on its software.
- Asus Travelair N a wireless SSD drive which can offers up to 1TB of storage.

As far as the current technology is concerned, the storage solutions fail short of simplicity, compatibility, flexibility and security. In some solutions like SanDisk wireless flash drive, some parameters like compatibility and security have been solved with highest priority while trading off other parameters like flexibility.

There is a need for research and development to bridge this gap and create a reliable, user-friendly, and secure wireless alternative that may ensure good and reliable data management accompanied with security.

OBJECTIVES

Main objective

To enhance flexibility and security in wireless flash storage devices.

Specific Objectives

1. To enable reliable wireless data transfer: by enabling data transfer and access with both physical and wireless connections. In this term portability and convenience are considered.
2. To implement secure ways of data transfer: To implement robust security measures to ensure data is protected during transfer.
3. To implement multipoint user-friendly interfaces: To develop an intuitive and user-friendly interface that can cope with at least more than 3 operating systems with windows and Linux included.

LITERATURE REVIEW

This project's literature review is categorized based on the findings and topics. The classification is as follows

- **Storage technologies:**
    1. Nand Memory technology: Based on the article published by Hyperstone on non-volatile memory, The author tries to explain theory behind the existence of NAND flash memory, characteristics, properties and different level of complexity they can achieve in term levels. (Hyperstone, 2020)
    2. USB Mass storage server: in the article the author has successfully create and implement a smart usb flash drive using Raspberry Pi zero. The Pi zero acts as

usb host and can be accessed wirelessly through SSH or Wi-Fi. The user can use these interfaces to manage files in the Pi zero. (Barnes, 2017)

- **Wi-Fi technology:**

  From an article "For Wireless USB, the Future Starts Now". The author has tried to explain the emergency of wireless USB which can be implemented over the internet. This rising technology implements the use of current advancement of radio communication and Wi-Fi protocol as the major tools. He also explained different protocols such as UWB, WUSB and CWUSB.

  By utilizing the full spectrum, UWB can achieve superior performance while consuming less energy. Essentially, UWB achieves bandwidth by using low-energy pulses across a wide frequency range. The majority of other wireless technologies accomplish performance at the expense of excessive energy consumption since they only use one designated band within a frequency spectrum. (IEEE, 2007)

- **Interface used:**

  1. This design aimed at implementing a storage device that can be accessed wirelessly though acting as a normal USB disk. The design is comprised of two separates modules, the adapter module for the interface to the PC and the storage module, which is made up of the flash memory, chip to be used as a mass storage device. These modules communicate wirelessly for as near as two meters. In this design there is no middleware needed for file transfer. Since the USB module act as a dongle, the computer treats the whole system a separate usb flash drive. (Czapor, Hartney , & Knight , 2006)

  2. On another article presenting Sandisk Connect in which the designer has used middleware to transfer data across different operating system. Sandisk wireless pen drive can transfer data in both physical channel through USB and wireless channel through Wi-Fi interfaced to specified Sandisk software for file transfer. Although the product has now been in production decline since 2022 (Digital, 2022)

METHODOLOGY

This project will follow the water-fall methodology whereas the bottom-up approach will be used to achieve the main objective. This system combines and adopts the works of other successfully works as sub modules or components responsible to accomplish a certain functionality which is then integrated to one system. The following are the key points that will be implemented to accomplish main objective of this project:

- To implementing mass storage server using the normal physical connection that is usb which will provide a user with choices that mostly fits comfortability. This is done by finishing up and utilize the existing design of flash disk drive that uses USB connector that was done as practical training III year 2023 that was done by myself with my colleague Neria I Rutashobya with registration number 2020-04-10739 as the base design for this project
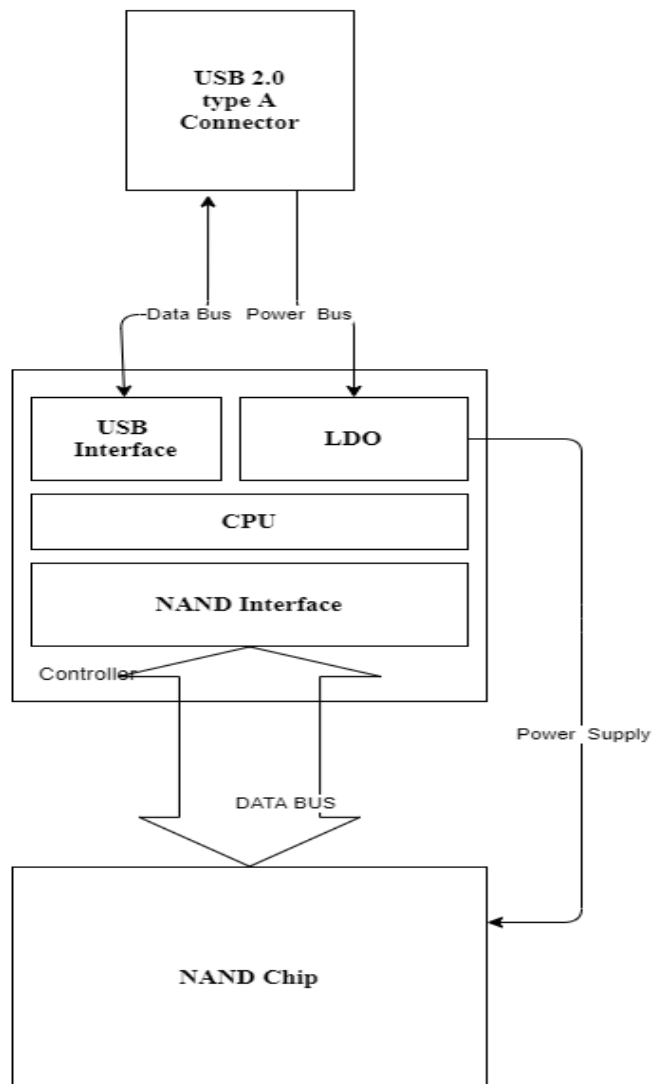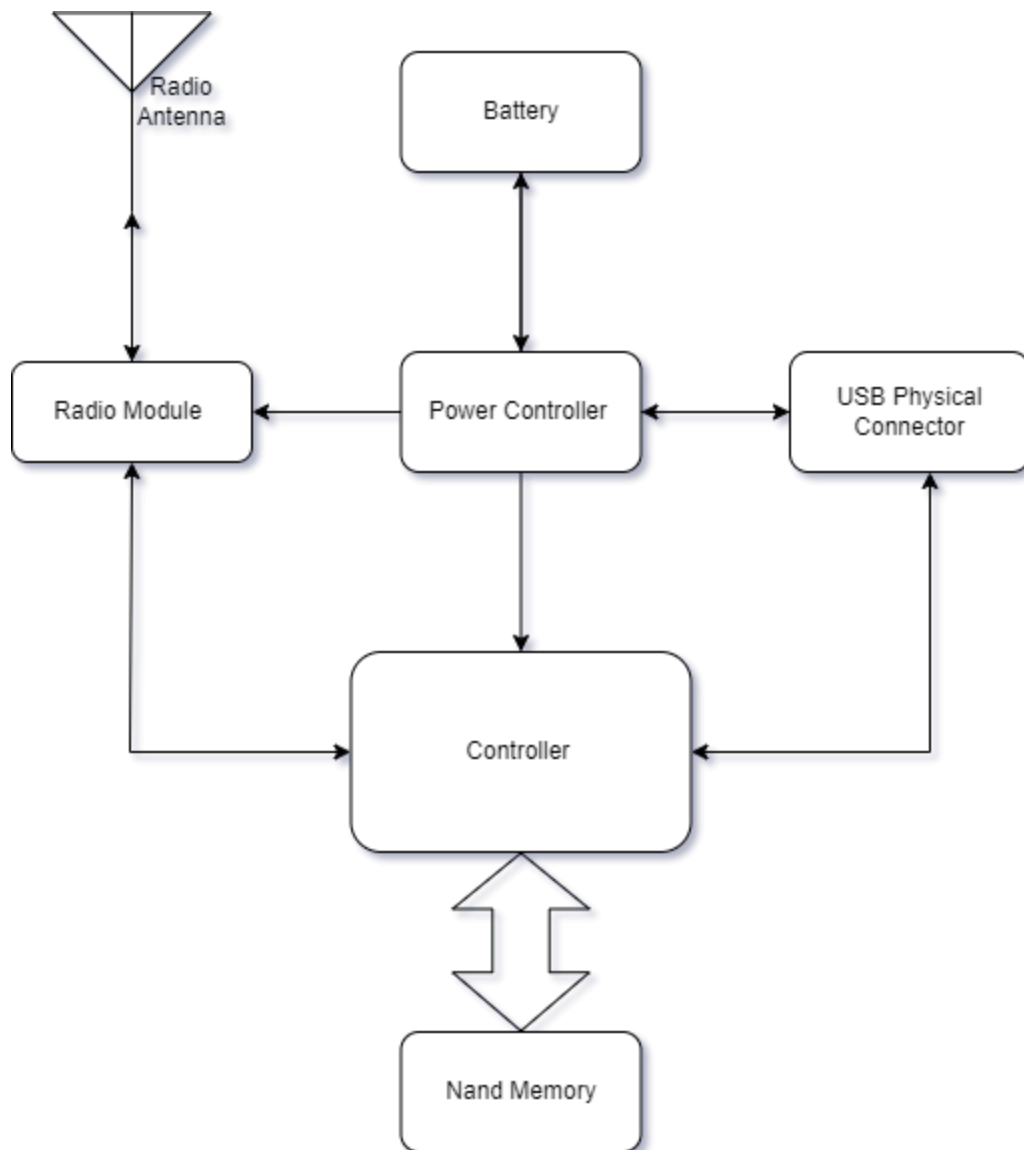
Figure 2 A typical USB Flash Drive

- To develop or utilizing the existing ways of creating a local area network wirelessly between the Host and the Client that involves the user with less handshaking process.
- To develop a robust way of data transfer between the host and the client which include using more than one data channels, modified session database to always remember session whenever there is a fluctuation/loss in connectivity.

- By utilizing the existing encryption technologies such as hybrid encryption technology which utilizes both symmetric and asymmetric encryption technology. A secured and a robust yet reliable system can be developed.

- By implement the in-built features for wireless file transfer that already exist in most of the operating systems like samba (SMB) protocol and network file sharing (NFS) protocol to reduce congestion of procedure that the user is supposed to consider in order to perform data transfer.

- By implementing a user-friendly encasing design, can provide user with a comfortability and enhanced mobility.

The base design of the wireless USB flash drive system

WORK DONE SO FAR

The typical USB flash drive as the base design of this project is at 80% requiring maintenance procedures for total accomplishment.
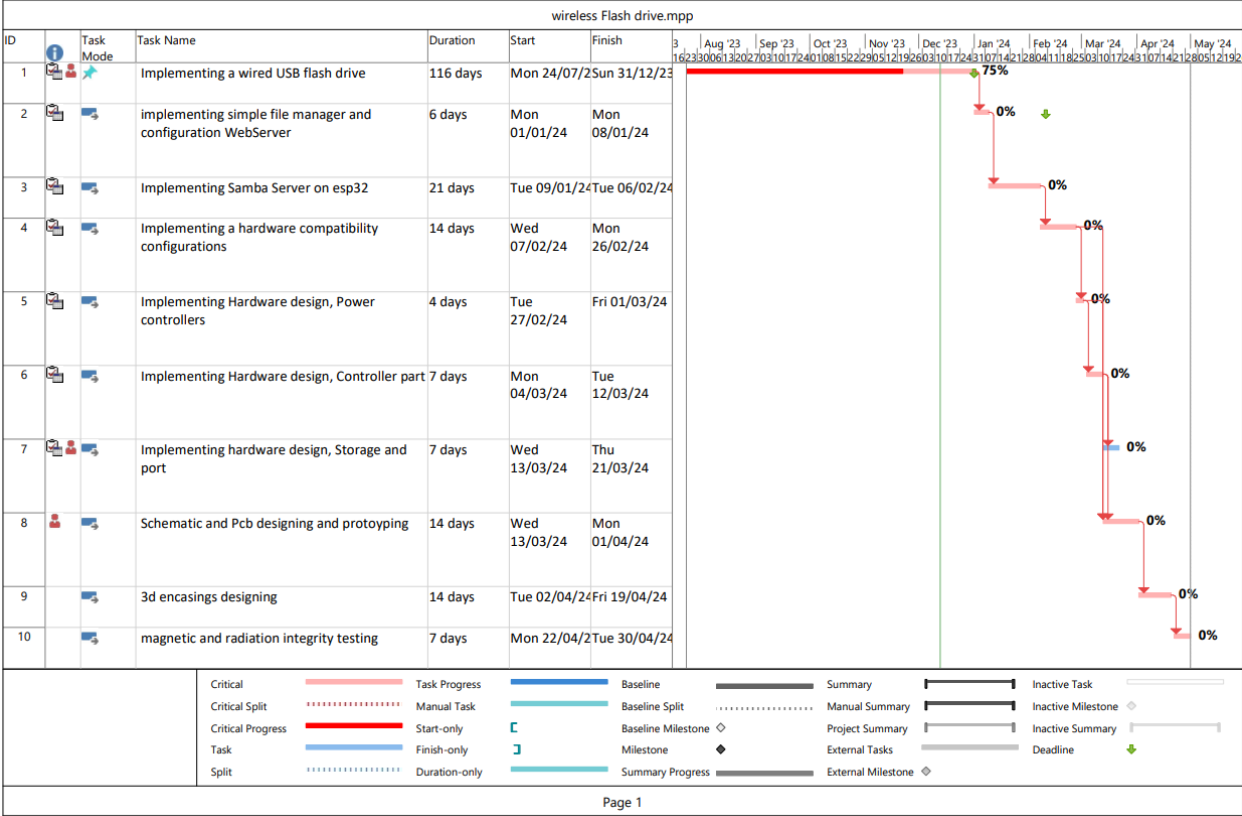
TIME SCHEDULE

Figure 3 Gantt chart

BUDGET

This table comprise of the cost that are expected to be used as per initial design and may change due to change in scope

Components	Cost (Tsh)
Esp8266 nodeMcu module	20000/=
Memory card	10000/=
Memory card module	8000/=
Esp32 s3	30000/=
Breadboard	15000/=
Lithium-ion Battery	20000/=
Battery controller (MP2731)	5000/=
Nand memory storage chip	5000/=
Connecting wires	10000/=
USB connector	1000/=
Internet Access	50000/=
3D encasing	40000/=
Total	214000/=

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