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FACULTY OF ENGINEERING

Group 3

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Gig-E Wi-fi

Client: Mr. Emerich R. Winkler Jr.

Introduction

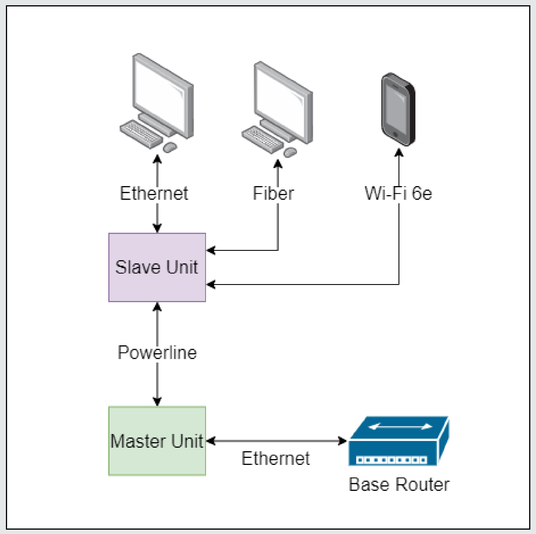
- A common issue in many homes today is poor internet coverage. Most don't have wired ethernet and Wi-Fi can have zones with no connection. There are methods to counter this such as Wi-Fi extenders, but they still suffer from low speeds.
- The solution to this with the help of NCS Managed Services Inc. is to send the internet signal over the powerlines within the house.

Idea

- The goal of the project is to design a prototype of a powerline internet module that can provide a fast and stable internet connection that can be accessed via Ethernet, a fiber optic connection, and Wi-Fi 6.

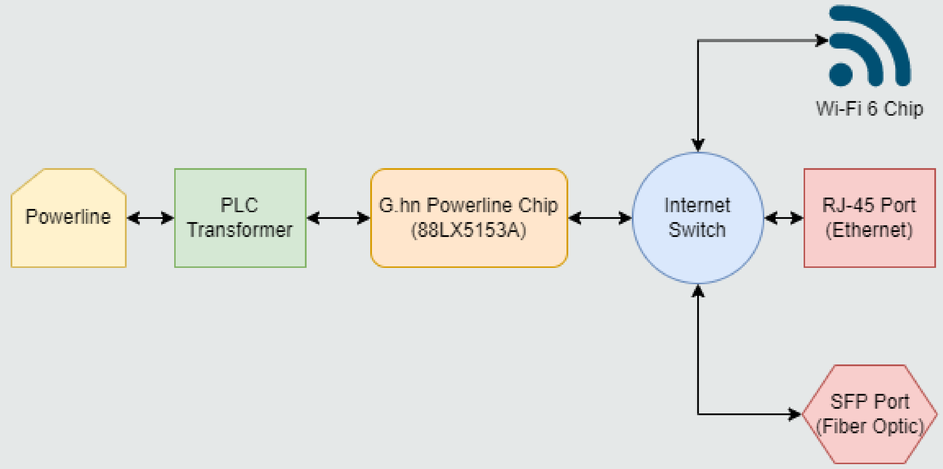
Deliverables

- The prototype that is being designed will consist of two wall adapters, a master unit, and a slave unit.
- The master unit will connect directly to the main internet router. The slave unit will then be plugged in where an internet connection is required.
- The slave unit must support Ethernet via an RJ-45 connector, Fiber optics via an SFP connector, and Wi-Fi via a built-in Wi-Fi 6e chip.
- The desired internet speeds reached by the device are 1 Gbps, however, to surpass the competition, speeds upwards of 400 Mbps are required.



Details of Design

- The design of the device consists of 6 major components. The first is the PLC transformer which allows for the signal to be sent over the powerline. The next is the main G.hn chip. This is the brain that communicates over the powerline. The next part is the internet switch which allows for multiple communication types. The next three are the different ways the device will communicate with other devices. These are the Wi-Fi 6e chip, an RJ-45 Ethernet connection, and an SFP fiber optic port.



Testing Results

- Testing was performed using two existing devices similar to the one being designed which are already on the market, the Comtrend powerline adapter and Maxlinear powerline adapter.
- The devices were tested through their wired connections on both the first floor and the basement to test the speeds reached over multiple distances.
- The Comtrend device was also tested using its 5 GHz and 2.4 GHz Wi-Fi connection
- To ensure the safety of the testing, when testing is to be performed on the prototype, it will be done on an isolated circuit to prevent any damage.

Test	Download (Mbps)	Upload (Mbps)
Base Ethernet	734.03	852.85
Base Wi-fi	171.62	104.38
Comtrend Wi-Fi (5 GHz First Floor)	99.36	73.12
Comtrend Wi-Fi (2.4 GHz First Floor)	107.65	93.07
Comtrend Wi-Fi (5 GHz Basement)	110.20	78.99
Comtrend Wi-Fi (2.4 GHz Basement)	75.83	72.00
Comtrend Wired (First Floor)	236.32	322.13
Comtrend Wired (Basement)	116.98	75.77
Maxlinear Wired (First Floor)	300.47	416.56
Maxlinear Wired (Basement)	104.81	82.11

Similar Devices Tested

- With Comtrend having the best download and upload speed during testing (over Wi-Fi), this will be our baseline for creating our prototype. At the very minimum, our device should have greater speeds than this one.

Conclusion

- Conducted a comprehensive research of competitor products to understand the operation mechanism.
- Researched and updated electronic base knowledge to assembly discrete part into a printed circuit board.
- Designed a high level diagram of the slave unit, featuring all of the design requirements specified by the client.
- Researched parts that could be used in the design for the assembly of the slave unit next fall.

Future work

- Working on order electrical parts.
- Learn and get use to with G.hn technology, KSZ9897 chipset
- Create a prototype, test the design in various conditions, troubleshoot and refine errors.
- Create a user guide booklet for the client.
- Research Wi-fi mesh technology so that the two devices can create a better overall connection to Wi-Fi around the building they are installed.

References

- Maxlinear G.hn Chips
  https://www.maxlinear.com/
- Microchip Ethernet Switch IC
  https://www.microchip.com/
- Xingtera G.hn Chips
  https://xingtera.com/wired/portfolio/ghn-chipsets/