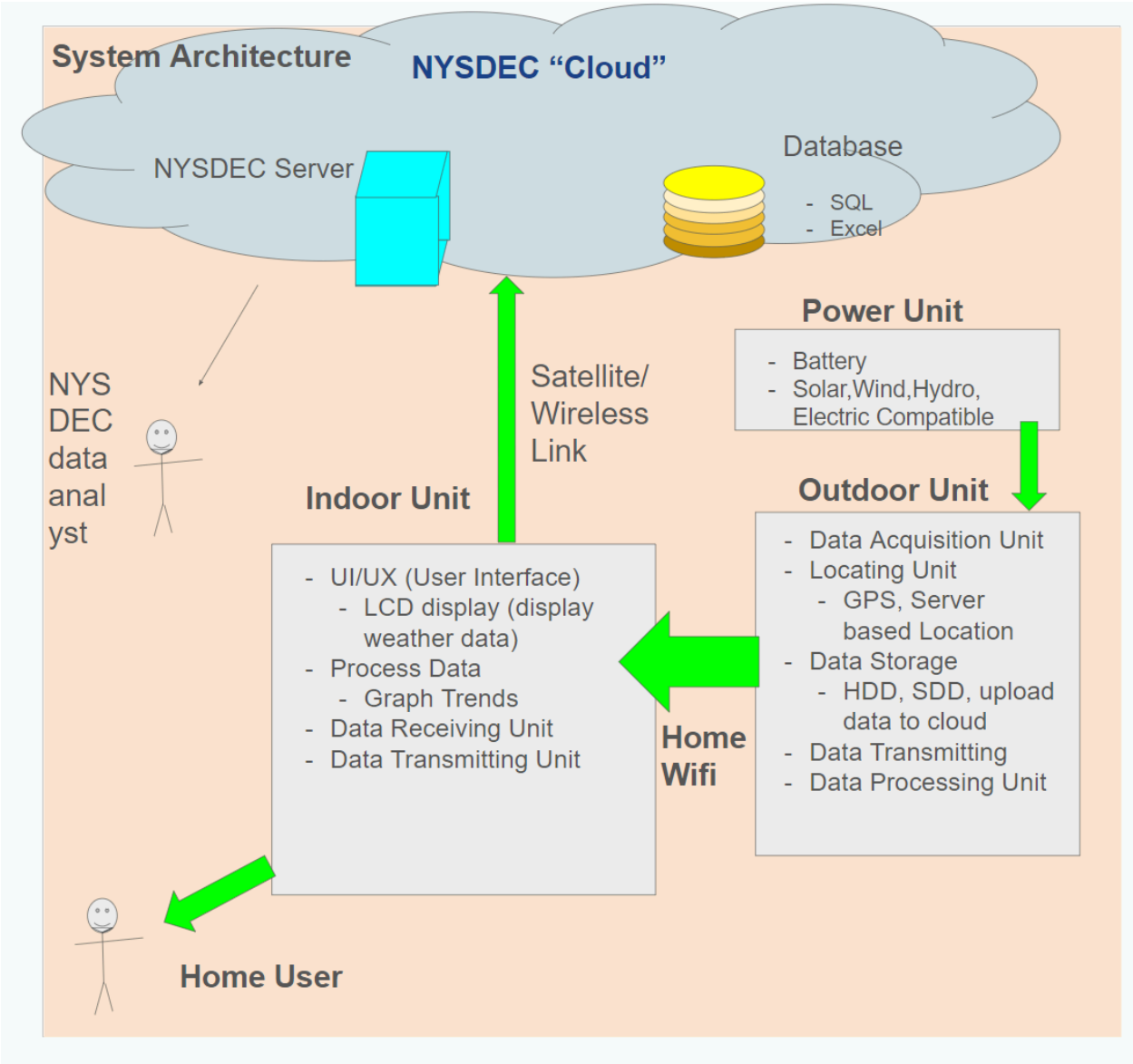
Part 1) Logical Design Diagram



Part 2) System Requirements

NOTE: Since The "System Requirements" Section notes that the 3 to 5 critically important system requirements which follow requirement guidelines discussed in class were completed in the previous Homework (Homework 4), many of the given Functional and Nonfunctional Requirements are derived from my previous Homework 4 submission

FUNCTIONAL REQUIREMENTS

1.) **Long Term Data Storage**

Definition

The developed system should be able to store data related to weather (which may including information on precipitation, wind speed/direction, soil content, and humidity) over a prolonged period of time before sending the accumulated data at regular but occasional intervals of time to a database on a server through NYSDEC in which NYSDEC data analysts can access and analyze the data.

Accomplishment of Requirement with System Architecture

Implementation of Data Storage as shown in the system architecture diagram given above can be done efficiently through usage of either a Hard Disk Drive, Solid State Drive, or uploading of information to a cloud backend server NYSDEC has access to. By fundamental principles of Computer Communication Networks, if it is assumed that the communication links between NYSDEC and the established system follows a client-server model where NYSDEC's cloud backend server is the "server" and the system is the "client", information can be stored for a long time if data is immediately sent from the system to the NYSDEC server. Hard Disk Drives and Solid State Drives are largely efficient because they are nonvolatile methods of data storage, meaning any data collected will not be lost even if the system loses connection to the end user's power supply.

2.) Data Transferability and Communication

Definition

The developed system must be able to send data that has been collected and stored over a given period of time to NYSDEC for analysis. The method and process of communicating data collected by the system at a home or business must then be readily and efficiently sent from the system to NYSDEC with an emphasis on sending data without any loss of the sent data and on easy accessibility of the data after being sent to NYSDEC by NYSDEC data analysts and researchers.

Accomplishment of Requirement with System Architecture

At a very high and general level, the system makes accommodations for the requirement of ensuring an efficient and accurate transfer of data from the system to NYSDEC's servers by considering usage of any method of wireless communication links or satellite communication links to transmit data to NYSDEC's servers. In the context of the system architecture diagram, wireless communication links will include sending data from the outdoor unit of the system to the indoor unit through the end user's WiFi system or close distance forms of data transmission like use of Bluetooth connections, while long distance communication of data can include efficient methods of transmitting data to NYSDEC like uploading data to a server NYSDEC can access or use of high frequency encoded signals (like radio signals) to send data over long distances to a local NYSDEC station for analysis. In edge cases where the end user may be in distant rural areas that are too far to connect to NYSDEC remotely , the system could transmit data through satellite communication links to NYSDEC for analysis.

3.) Accuracy of Data Collected

Definition

The developed system should be able to collect data on components of weather (including humidity, precipitation, and wind speed/direction) without any error or deviation of the data from data that is measured for similar aspects of weather by weather stations and research centers. Collection of accurate data can potentially help alleviate problems of further data analysis via usage of complex statistical/probabilistic analysis by NYSDEC data analysts to understand the data and will also benefit end users if used in parallel with a user interface by allowing users to access real time accurate weather reports through a common user interface. To ensure accuracy of the developed system, the system could be developed with built in methods of error analysis which can access data available for real time weather reports from other weather stations and research centers and compare how much its own collected data deviates from the data of other research centers and weather stations (with significant deviations requiring collection of new data).

Accomplishment of Requirement with System Architecture

In order to deal with the significant issue of possibly transmitting or collecting erroneous data on aspects of weather, the system architecture has been designed such that every unit that forms the system has a built in data processing unit before sending the data to NYSDEC for further analysis. Specifically, data collection will start at the outdoor unit of the system which will be responsible for acquiring data on aspects of weather, ,identifying where the system is located in New York State in order to give the system itself more context for analyzing the data by being able to compare its own data to local weather centers, and a data processing unit that will error check whether the data given is accurate (and otherwise collecting data again if the data is not accurate). If the data given is accurate, it is sent to the indoor unit of the system which does further processing of the data before displaying the data to the end user and sending the data collected by the outdoor unit to NYSDEC. In this way, by having error checking mechanisms at every part of the system, the system ensures that data collected is not only free of significant errors but is as refined and accurate as it could be.

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4.) Compatibility of System with Various Forms of Power Supply

Definition

Access to the power grid of New York State by end users is a common functionality among all end users (including businesses and homes), though the way the power is accessed may be varied and incarnate in forms like using solar power, hydro power, wind power, and electrical power given by conventional fossil fuels from power suppliers. Considering the variegatedness of how each home or business using the system obtains its power, the system should be able to integrate into any home and business and function similarly regardless of what kind of power each end user supplies their homes and/or businesses with.

Accomplishment of Requirement with System Architecture

To accommodate the diversity and variegatedness with which end users obtain power through the state power grid, the system may be designed such that it is powered by a high power, long lasting battery which is rechargeable. By use of batteries to power the system, the system will not directly be using the end user's existing power supply which minimizes the amount of power that the system uses from the end user's existing power supply before becoming too expensive,costly, or power hungry for the end user to be able to maintain it. Ensuring that this battery is rechargeable minimizes expenses and difficulty of maintaining the system again by allowing end users to control the system's power by regularly charging and changing the batteries of the system so that technicians from NYSDEC do not need to come regularly to check whether the system is powered on or not

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NONFUNCTIONAL REQUIREMENTS

1.) **User Friendliness**

Definition:
The system should be able to present accurate data on aspects of weather to end users in homes and businesses with a clean user interface which presents information in a manner that is easily accessible,readable and comprehensible. Ensuring accessibility of information to end users through a nice user interface will make the system more attractive to consumers and,thus, more marketable to all residents of New York State.

Accomplishment of Requirement with System Architecture
The system will be able to maintain a nice user interface by including an LCD display which (as indicated or inferred in the System Architecture Diagram) will display relevant aspects of weather data that might be of interest to the end user, such as the humidity or temperature outside. By working synchronosly with the data processing unit of both the indoor and outdoor parts of the system, the user interface for displaying data will ensure that the data is accessible and readible by selecting refined and processed data to display on an LCD screen and displaying that data thereafter.

Part 3) Design Alternatives

Alternatives for Designing Communication Links between the System and NYSDEC

- **Satellite Communication**
  <u>Design Tradeoffs</u>
  Benefits: Ensures that end users who are located in remote isolated areas with no direct access to centers where NYSDEC is located or where weather data is processed by NYSDEC can send their data to NYSDEC properly and accurately.

Consequences: Satellite communication heavily depends on transmission of signals to satellites which then send the data again to its destination. The time that is required between sending the signal to a satellite and the signal reaching its destination location is significant, and could cause delay in the amount of time it takes for the data to be transmitted and received.

- **Wireless Communication Links (including Internet networks)**
  Design Tradeoffs
  Benefits: Ensures that all end users who have some physical proximity to centers where NYSDEC processes weather data can have their own weather data sent to NYSDEC efficiently and reliably with no time delay. Generally, irrespective of the communication network used to transmit the data, the data sent by the system to NYSDEC will be accurate and sent as fast as possible with no difference in financial expenses needed to cover such data transmission on behalf of each end user.

  Consequences: Being able to design a system that incorporates every known possible form of wireless communication to its own methods of data transmission may require a significant amount of time. In addition to this, expenses needed to cover data transmission on behalf of the end user may vary greatly as different end users use different communication networks to access services such as the Internet and phone communication each of which have varying costs.

Alternatives for System's Identification of Its Current Location

- **Global Positioning Systems (GPS)**
  Design Tradeoffs
  Benefits: Global Positioning Systems are very complex systems which use various different layers of numerical analysis, algorithms, and mathematical procedures to define the exact location of a system as quickly as possible. This ensures that the system is able to locate itself relatively quickly and with more accuracy than other location services.

  Consequences: Global Positioning Systems are as efficient,quick, and accurate as they are expensive, especially when considering the fact that mobile global positioning systems available for consumer use even today costs well into the range of hundreds of dollars. Use of such sophisticated and expensive technology for a system that is intended for use by end users throughout the entirety of New York State,thus, is not scalable or economically feasible as mass production of such systems would cost NYSDEC a lot of money while distribution of such systems to end users could cost more assuming that the global positioning system could break or get damaged in the future.

- **Server Based Location Services**

  Design Tradeoffs

  Benefits: Many variants of computers and embedded systems are programmed to be able to identify their current location relative to a server or another peer end user with no significant time delay or expense. As a result, having been used by technology in the past, server based location services are reliable, time and cost efficient, and also are feasible when mass producing the system for distribution to end users throughout New York.

  Consequences: Though they may be rare, it is wise to consider edge cases when the servers of NYSDEC may be down temporarily or for a prolonged period of time. Such disturbances to the main server of NYSDEC could potentially halt every system's ability to locate itself entirely, and also simultaneously halt each system's ability to send and receive data if data communication is done through a server based model.