Smart Cities Design Readiness: Smart Health

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Overview

Overview - Mission

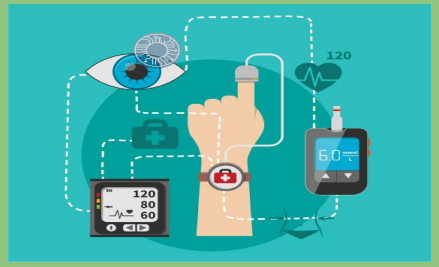
- Medical services provided by the city is more accurate and efficient
- Faster response times to those in need of medical attention.
- encourage users to follow healthier lifestyles through its live diet suggestions

Overview - Proposed Solution

Smart Health system that can:

- Accurately measure various health information about a person
- Allow the user to:
  - confirm what information gets stored
  - edit any information that is stored in the database
- Allow health care professionals and the user to access the information
- Find trends among all the stored health data to predict health issues across the city
- Make lifestyle recommendations for each individual based on their health data

Overview - Subsystems



Wearable Sensors

Smart Health App

Healthcare Officials Evaluation System

Data Servers

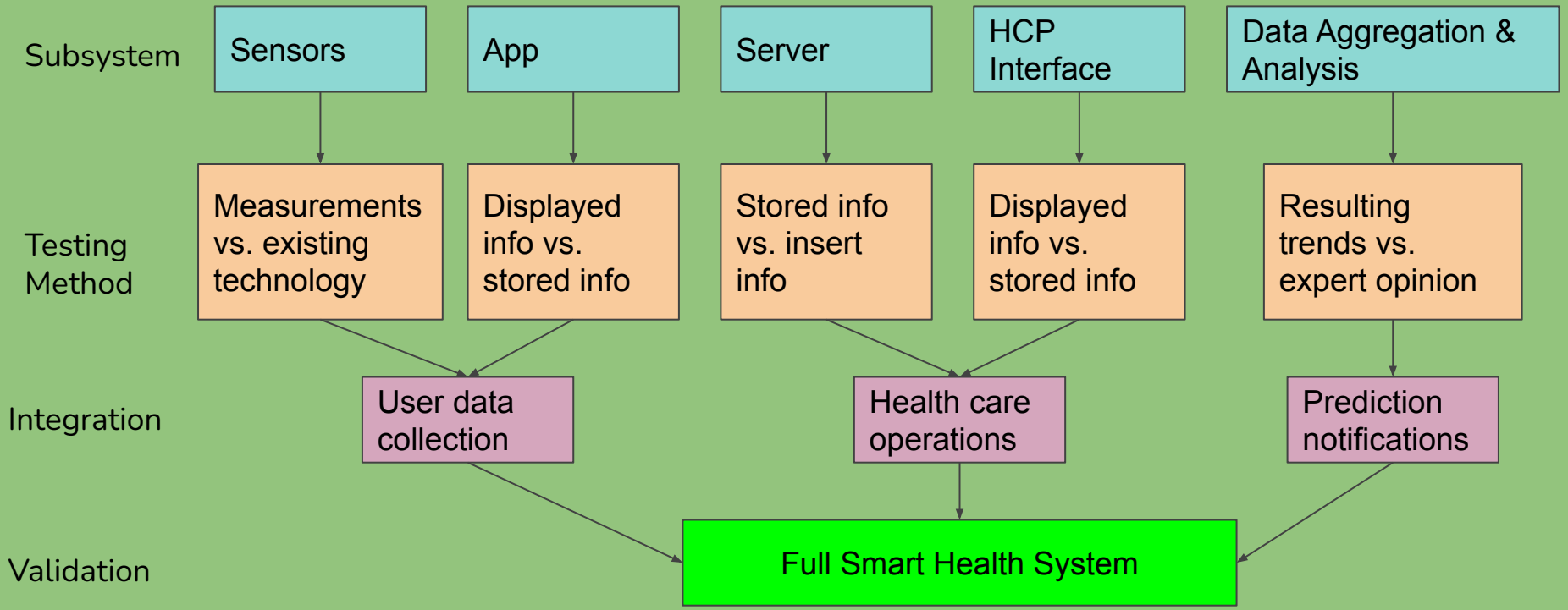
HCP Viewing Interface

Testing & Integration

Integration and Testing Strategy

Subsystem	Purpose	Top Level Functions
Wearable Sensors System	Data Collection	Measure patient health data points
Smart Health App System	Data Input, Modification	Display of data on UI
Healthcare Officials Evaluation System	Data Evaluation and Execution	Computing ML models for analysis
Data Servers	Securely Store Data	Take data from other subsystems
HCP Viewing Interface	Data Display	Take input from Data Server

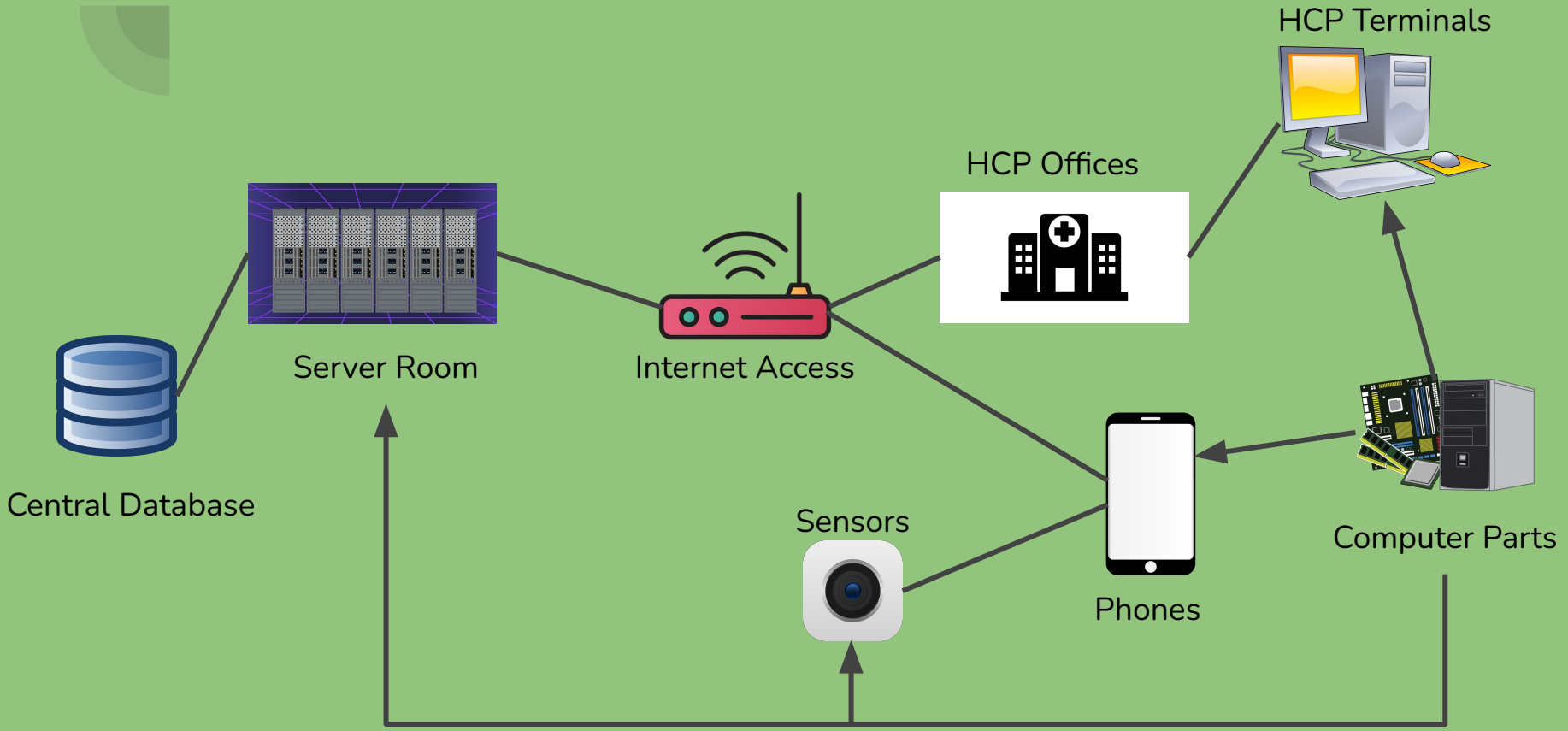
System Test Plan



Resources and Facilities

- Most sensors and data entry points are on users' cell phones, but some are also wearables or separate
- HCP offices will be able to access the database of patient information via terminals installed in those buildings/computers
- The city will have a central database that will collect patient information from the sensors and send the information either to those patients' phones via the app or to a terminal
- Reliable internet/server access
- Adequate supply of technology and parts to create the wearable sensors and interfaces

Resources & Facilities Diagram



Proof of Customer Acceptability - Working Criteria

Subsystem	Working Criteria
Wearable Sensors System	Collect accurate patients' health data and monitor to record any changes
Smart Health App System	Notify unmatched of input and data from wearable sensors. Let patients modify data
Healthcare Officials Evaluation System	Execute logistics of data trends and send back data analyzed to the data server
Data Server System	Securely store the data and maintain specs
HCP Viewing Interface System	Display the data and Let HCP to adds patients data

Reliability

Reliability Metrics

Both of Series System and Parallel System

Series: since the Data Server System is where 4 other subsystems reply on to receive data input for their own use and execute the analyzed or modified outcomes.

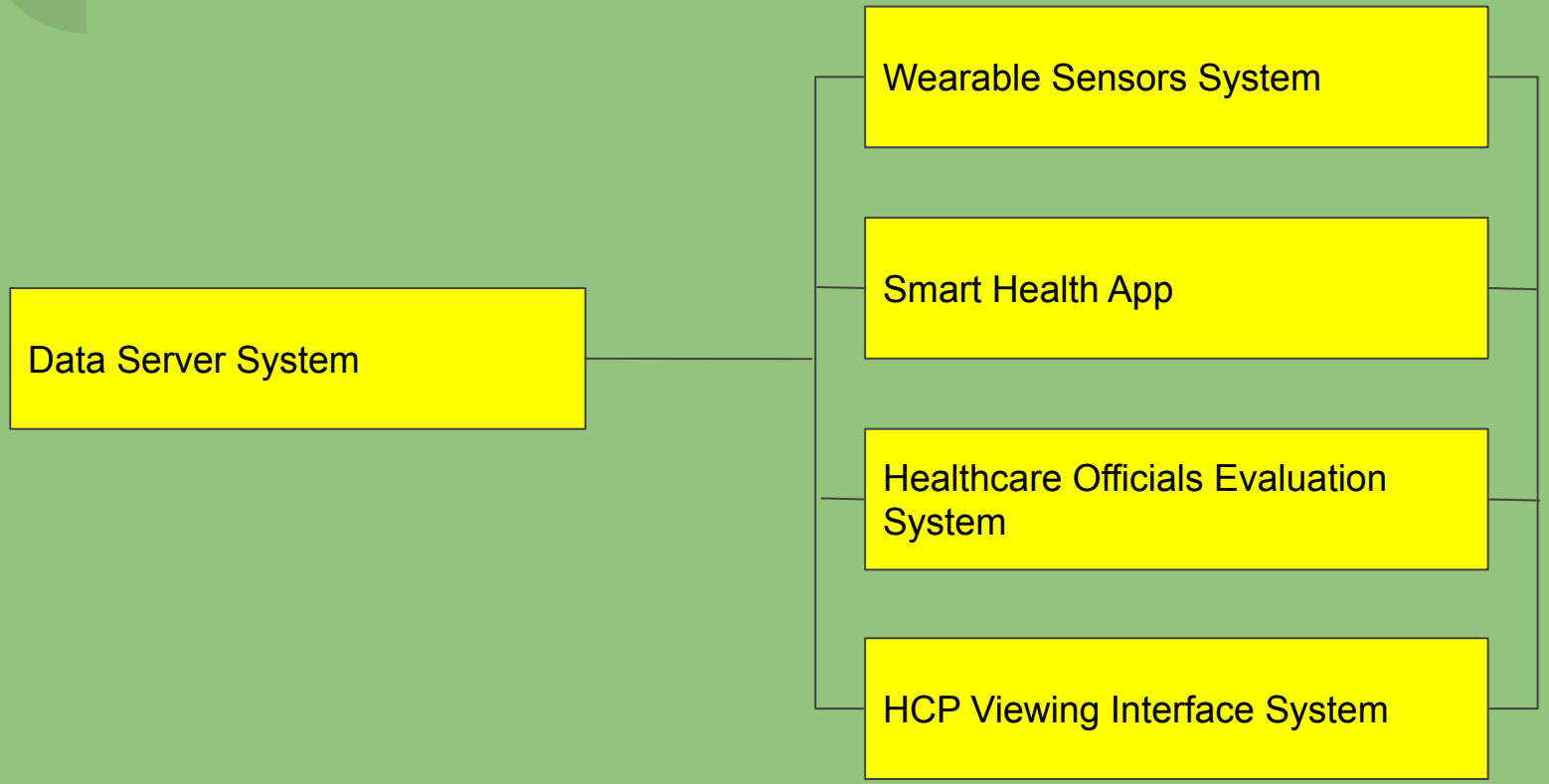
Parallel: 4 systems will make the parallel system

- ensure the system continues to serve community by providing accurate, time-saving, user-friendly services

The parallel system will continue to function as long as one of the systems is working properly. It's crucial for Healthcare System

We set the goal of our series to reach a reliability higher than 0.99 since the accuracy in Health System is critical.

Reliability Metrics



Reliability Metrics - Parallel & Series System

Since we have a Parallel & Series System

- R*{1-[(1-R)*(1-R)*(1-R)*(1-R)] = R*{1-[(1-R)^4]}

- R=0.99899

Problem Response Plan

1. **Problem Identification**
    a. We will examine what the issue is, and determine its severity according to the Pugh Matrix
    b. Issues will be tagged with what kind of issue it is (ex. Usability, Security, Data, etc.)
2. **Problem Containment**
    a. We will send an update that we are working on a specific issue, and create temporary fixes in the meantime so we can isolate the issue to prevent further issues from happening
3. **Problem Removal**
    a. We will fix any bugs/counter any issues in its contained environment
4. **Recovery**
    a. We bring back access to any of the systems/aspects of the systems that were taken down during containment, if determined safe and necessary
5. **Post-Incident Action Steps**
    a. We will re-examine the issue and use any learning points to modify any parts of the system/code/etc. to prevent it from happening again in the future

Modeling & Simulation

Goals of Mod & Sim

- A simulation of the system can be used to verify that the collection of information as well as the retrieval of information works well under stress
  - The city has 50,000 residents. It would theoretically need to be able to operate with low latency while all residents or at least most of the residents are using the system at once
- Launching the system without a simulation could potentially be dangerous
  - Without a proper stress-test, it would be possible that the system would fail in an emergency, potentially leading to serious injury or loss of life.
- It would be unrealistic for the team to be able to get all of the residents of the city to cooperate and use the system all at the same time
  - A simulation allows the team to handle a multitude of realistic scenarios without having to coordinate 50,000 people

Disruption Simulations

Disruption	Objective	Outputs
Patients can enter falsified or misleading information into the app	Determine how much falsified data can affect the overall metrics	Impact (skewing of data) of using false info for diagnosis
Data corruption due to power loss	Determine how long and our system can function and what happens to the data when power to the city grid is lost	Time that the system can withstand power loss Amount of data that would be lost
Unauthorized users accessing and manipulating health information	Determine how easily data can be manipulated how this will affect overall system functions	Impact of data manipulation Ability for data transmissions to withstand security threats

Confidence in Results

Disruption	Outputs	Rationale
Patients can enter falsified or misleading information into the app	Impact (skewing of data) of using false info for diagnosis	We want medical staff to be able to help patients to the best of their ability, and falsifying or mistakenly-entered health information carries a greater risk of misdiagnosis
Data corruption due to power loss	Time that the system can withstand power loss Amount of data that would be lost	In understanding what information was lost, it becomes possible to tell users that any data entered within a certain time frame did not get sent to the database and must be re-entered
Unauthorized users accessing and manipulating health information	Impact of data manipulation Ability for data transmissions to withstand security threats	We want to ensure that our users' sensitive information is kept a secret from hackers or other harmful individuals. By having an understanding of our own system's strength of security, we can properly inform our users how safe their information is with us, what might be leaked in case of an attack, and that we know what our current vulnerabilities are and that we are working on strengthening them

Robustness

Reliability	Add multiple checks to determine if information was stored/accessed successfully, incorporate system rollbacks in case of software failure
Maintainability	Update software as bugs are discovered or reported, add new features (such as additional collected health data as sensors get better)
Supportability	Train staff to answer questions and provide troubleshooting support on a hotline
Availability	Add a backup power supply to the database center to ensure that the system stays running even in cases of emergency
Testing	Develop test cases, systems tests, and integration tests to ensure that the system will continue to run as intended during and after development, integration, and deployment

Questions?