

# Smart Cities Design Review: 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

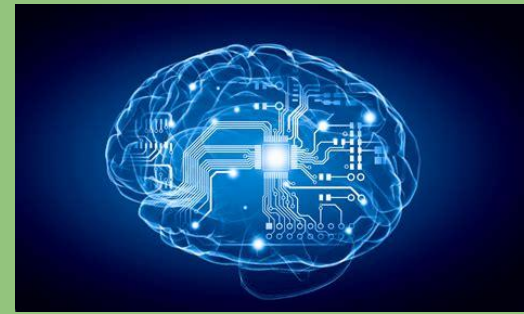


Smart Health system that can:

- Accurately measure various health information about a person
- Store the information in a database
- Allow the user to confirm what information gets stored
- Allow the user to 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



# Proof of Concept



We know that:

- Doctors and nurses make guesses on a patient's condition based on their symptoms
- It can be difficult for information to travel between hospitals and doctors' offices that are out-of-network
- More information gathered accurately can greatly reduce the risk of a misdiagnosis
- Patients may lie about their symptoms, or may not notice when symptoms began

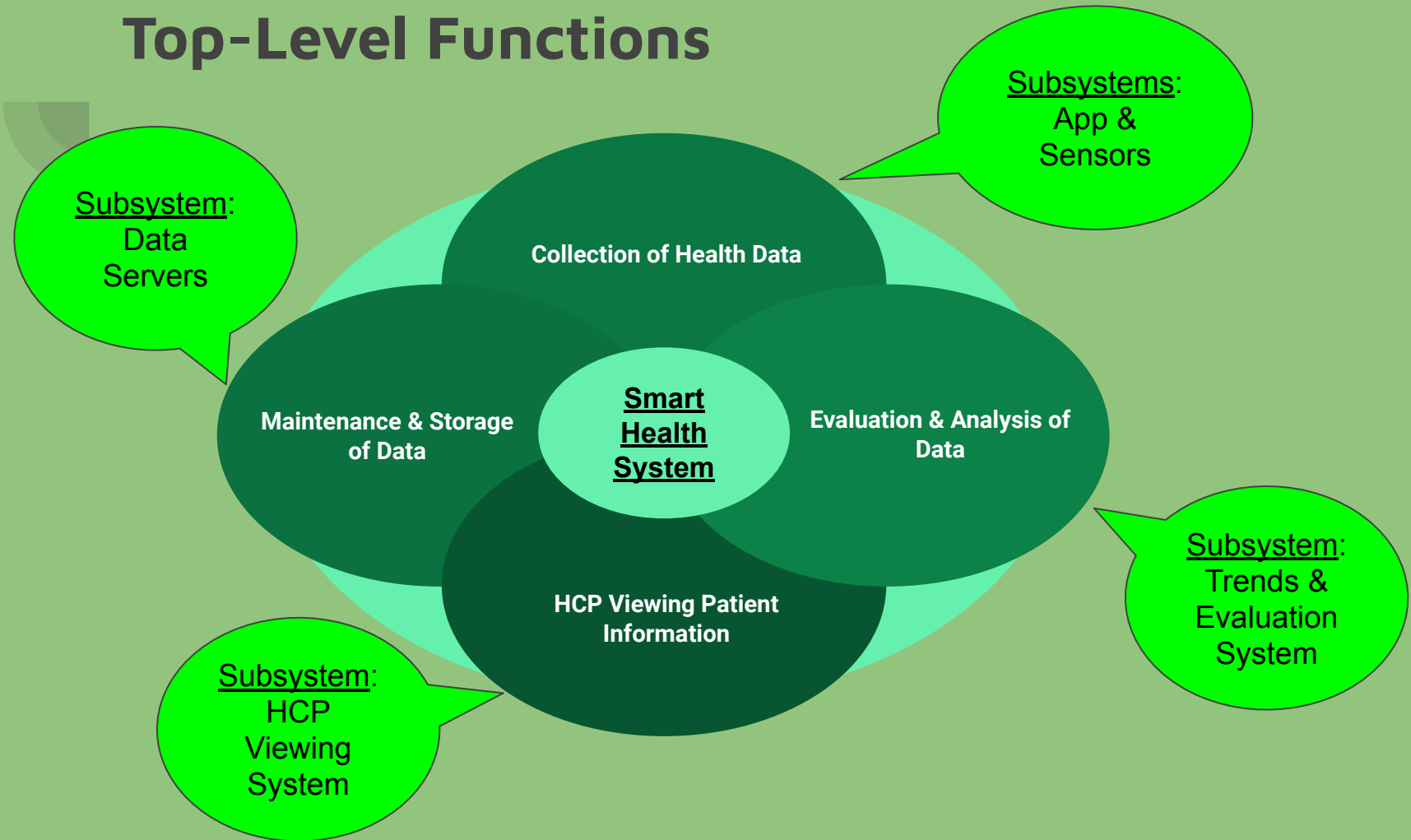
Based on these observations, a system that can accurately measure patient health information constantly and make the information easily accessible would likely help doctors and nurses make better, more informed decisions on a patient's health.



# Functions



# Top-Level Functions






## Functional Interactions - Internal

Internal Function	Inputs	Outputs
Collection of User Health Data	Wearables and entered app data	Packaging of data to be sent to storage
Maintenance & Storage of Data	Data packages	Unpacking and structuring data depending on data type
Evaluation & Analysis of Data	All unvalidated user data in storage	Trends & analysis models, evaluated health data
HCP Viewing of Patient Data	Individual user data	A visual of the patient's health history




# Functional Interactions - External

Internal Function	External City System(s)	Inputs	Outputs
Collection of User Health Data	Info & Comms	Raw user health data	N/A
Maintenance & Storage of Data	Info & Comms	Stored user health data	N/A
Aggregation & Analysis of Data	Info & Comms	City Health data	N/A
	Infrastructure	Health information about users in certain buildings	Information on if a building is safe/unsafe to inhabit
	Agriculture	Information on if certain foods are causing symptoms	Guidance for necessary food recalls
HCP Viewing of Patient Data	Info & Comms	Patient-specific data	N/A

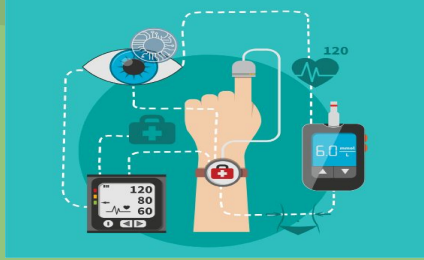


# **Subsystems & Requirements**



**Communication:** proactive notification and better collaboration among departments and patients

# Major Subsystems & Requirements Mapped



Wearable Sensors  
(Accuracy)



Smart Health App:  
(Efficiency)



Healthcare Officials  
Evaluation System  
(Accuracy, Communication)



Data Servers:  
(Safety)



HCP Viewing Interface:  
(Efficiency, Communication)

# Key Requirements & Tradeoffs (1/4)

## Wearable Sensors Requirements

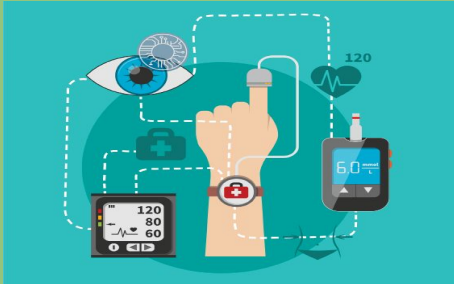
- Collect accurate health data from patients
- Monitor patients to record any changes
- Accommodate patients' daily activities

## Smart Health App Requirements

- Let patients enter, remove, and edit any information
- Notify if data input by patients don't match data from wearable sensors
- Provide an UI with a high usability
- Control the data collection through sensors

## Tradeoffs for Wearable & App Combination:

Simplicity has given up to increase functionality by providing more accessible User Interface on Smart Health App, instead of managing all the controls through the wearables



# Key Requirements & Tradeoffs (2/4)

## Healthcare Officials Evaluation System Requirements



- Execute logistics of data trends by computing machine learning models
- Send back the data analyzed to the data server

### **Trade-offs:**

- Simplicity in system has given up to enhance the validity of the analyzed data
- Short modelling time has given to maintain the maximized accuracy in city trends.

# Key Requirements & Tradeoffs (3/4)

## Data Servers Requirements



- Securely store the data sent from other subsystems
- Maintain a minimum of 512 GB disk space available
- Maintain a minimum of 1 Gpbs Ethernet connections
- Maintain static ports and a static IP address
- Execute requested data to other subsystems.

## Trade-offs:

- Low Database Maintenance cost has given up to guarantee security
- Low Database Maintenance cost has given up to increase query performance of data transfers

# Key Requirements & Tradeoffs (4/4)



## HCP Viewing Interface Requirements

- Take inputs from data servers and display properly
- Let HCP to add patients data and provide recommendations

## Trade-offs:

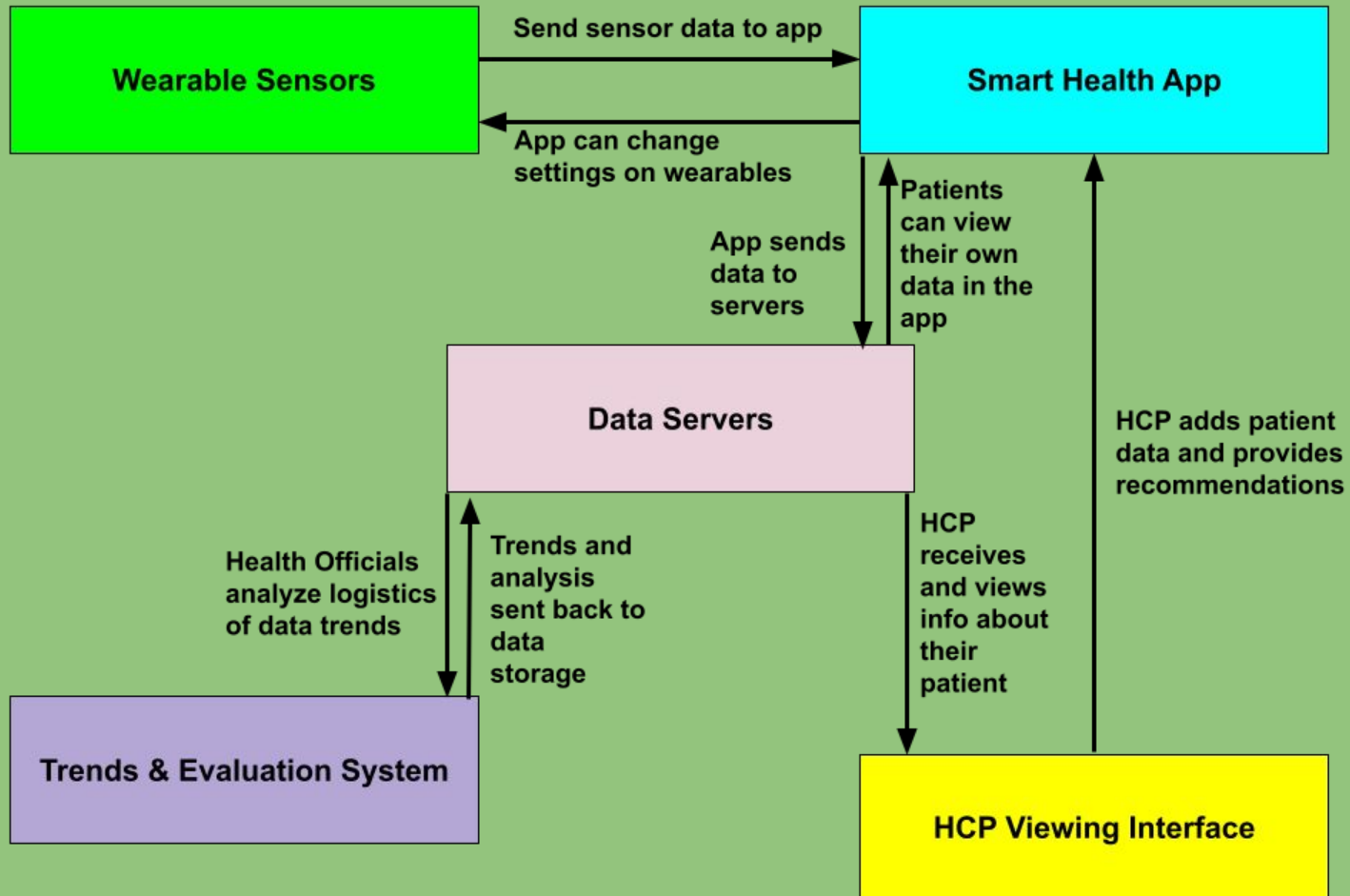
- Patients in person interaction has taken off to lessen time constraints and location constraints that patients experience





# Subsystem Interactions





Internal Subsystem	External System	External Interface Inputs	External Interface Outputs
Wearable Sensors	N/A	N/A	N/A
Smart Health App	Info & Comms System	Patient data to be sent to the data servers	N/A
HCP Viewing Interface	Insurance Companies	Individual patient health data	Insurance rates based on patient health
	Pharmaceutical Companies	Health information regarding a company's specific treatment	Information on how successful their treatment is
Data Servers	Info & Comms System	Authentication to access the stored data	N/A
Evaluation System	Pharmaceutical Companies	City health data trends	Information on what treatments are in demand at the moment

# Alternatives

# Alternative Solutions

- **Sensors around city**

- Pros

- Continuous tracking for the most part
    - Ability to track where illnesses may start from

- Cons

- Expensive and more difficult to maintain
    - Concern about privacy

- **Smart watch only (no phone)**

- Pros

- Continuous tracking
    - Less devices if person wants to use sensors
    - Kept on more than a phone/being under a city sensor

- Cons

- Accessibility (more difficult to navigate)
    - More common to have smart phone over smart watch






# Comparison Visualization

	Weight	City of Sensors	Smart Watch Only	Mobile App
Criteria				
Privacy	3	-3	3	3
Security	4	4	4	4
Accessibility	2	0	-2	2
Accuracy	3	3	3	0
Communication	2	0	2	2
Safety	3	-3	3	3
Training	2	2	-2	-2
Efficiency	1	1	-1	-1
Usability	1	0	-1	1
Total		4	9	12



# Possible Risks & Mitigation Strategies





Potential Risk	Severity & Likelihood	Mitigation
1. Patients can enter falsified or misleading information into the app	<b>High Impact</b> <b>Medium Possibility</b>	Accuracy Measure that patient's HCP can use to evaluate if true or false
2. Data corruption due to power loss	<b>Medium Impact</b> <b>Medium Possibility</b>	Robust power management and protection involving the use of external storage drives as backup devices and use of backup generators
3. Unauthorized users accessing health information	<b>High Impact</b> <b>Medium Possibility</b>	Patients are able to tune themselves what information gets collected and what does not. Only HCP and HCO that have some relation to the patient are granted access to their information



# Risk Matrix



Possibility

Possibility	High					
				1		
	Medium			2	3	
	Low					
		Low		Medium		High

Impact

**Questions?**

