A Tale of Two Cities – A Digital City Model and a Physical City in Real Life

This IOT project is undoubtedly inspired by SimCity, a city development and administration strategy computer game. By having a real city being digitized into a full scale computer model, it helps the city administrator (like mayor, head of various utilities and services) to be more effective in delivering their services, hence, improving the quality of life of the people.

All municipals or local governments have to deal with various kinds of services depending on jurisdiction according to their political and socioeconomic conditions or policies. Typically, there are private companies that are authorized or contracted to carry out some part of the services (e.g. utilities, transportation, cleaning etc.) on behalf of the municipals or local governments serving the city residents, property owners and its visitors. This solution is named “Smarty”, an abbreviated form of Smart-city”.

There are 4 building blocks to Smarty implementation:

1. System Architecture
2. Software Development
3. Infrastructure Deployment
4. User Adoption

System Architecture: Smarty sits on an open source Cloud Foundry cloud computing system with data persistency, analytics, security, and other essential microservices that are scalable. Various types of sensors are to be installed to the facilities (“things”) throughout the city with edge processing capability so that collected data are push to the cloud. Users consume the services of the system when they are connected to the central cloud-based server either via desktop or mobile devices.

A key subset to system architecture is on Master Data Management (MDM). All the infrastructures (e.g. roads, drainages, bridges, slopes, retaining walls), buildings (e.g. houses, gated communities, schools, offices, factories, shops and malls), public amenities (e.g. parks, bus stops, children playgrounds), utilities (e.g. street lighting, electric substation, telecommunication exchanges, transmission towers, exposed piping/valves) are to be uniquely coded according to a structured
semantic data layer (MDM). MDM lays the foundation for easy identification of the facilities right down to its parts.

**Software Development:** Taking advantage of the open framework of Cloud Foundry, microservices come in the form of applications that are platform agnostic. The use of common development technologies like HTML5, CSS, and JavaScript ensure applications can be viewed with modern desktop browsers or mobile apps on iOS or Android. A comprehensive software / product development strategy is needed with a clear vision that is focusing on user experience.

As some of the facilities are related to safety and security of the city residents or property owners, a robust **Cybersecurity** strategy is mandatory.

**Infrastructure Deployment:** Infrastructures, buildings (integrated CMMS, BAS etc.), public amenities, utilities, public digital devices (like CCTVs, weather stations, environment monitoring systems) are to be installed aligning to the software development strategy. Infrastructures are generally divided into public (such as weather stations), private (mandatory by local regulations) and voluntary (city residents or property owners) installations.

**User Adoption:** A user adoption strategy document is to be used to guide the public relation and communications team to engage various stakeholders (government officers, owners or leaders of services providers, city residents and property owners). Effective marketing campaigns like roadshows or user competition coupled with recognition to contributors (e.g. through gamification of the applications) have to be implemented at various stages of the roll-out, in sync with software version launches.
**Personas**

**Michael**  
*Mayor, City of Bright*  
“I like to make sure resident of the city is happy when we provide them exceptional amenities and services”

**Joe**  
*Owner, PowerBang Co.*  
“I want to be the best service provider to the city council that gives me reasonable business every year.”

**Susan**  
*Student, City of Bright*  
“My dream city is one that has fantastic public transport services and leisure amenities that are well maintained.”

**About**

**Michael**  
- 53, married, elected as mayor 2 years ago.  
- Educated in Ecology, Mike is passionate about creating a sustainable green city.  
- An IT savvy person who uses his tablet & mobile every day in almost all aspects of life.  
- Complaints from city residents or property owners keep him awake at night.

**Joe**  
- 45, married, 10 years hands-on running an electrical firm.  
- Assisted by 2 horticulturists and 15 workers providing electrical services to the city.  
- Joe recently learned to communicate with his team through mobile apps.  
- Having a fleet of machineries and 17 staffs, he has a vision to expand his business.

**Susan**  
- 20, single, a college student living with her parents.  
- She studies law and serve as volunteer in a local NGO.  
- Like most of the millennial, she has access to various types of information & likes to be treated as an adult.  
- Jogging on safe and well maintained sidewalks is her top priority.

**Responsibilities**

**Michael**  
- Mike is leading a team of city administrators in ensuring the smooth running and well beings of the city.  
- His task is to ensure all services provided are kept at its optimum level, if not surpassing expectations.  
- He chairs cross departments meeting every week to get updates from various head of departments.  
- Mike ensures all stakeholders (NGOs, resident etc.) are happy.

**Joe**  
- As the owner of an electrical company, Joe has to have good leadership skills to provide direction to his team.  
- He attends monthly meeting with the Head of Energy & Environment of the city.  
- Joe manages his finance with the help of his wife, a qualified account but work on as needed basis.  
- Joe has to handle all the business development activities such as bidding etc.

**Susan**  
- Susan often helps her parents to run errand when she is not attending lectures.  
- She serves as a commissioner in GreenXP, an NGO that advocates the need of preserving green and environmental protection.

**Main Goals**

**Michael**  
- A smooth running city operation with happy people around.  
- Create a smart city that attracts talent & businesses.

**Joe**  
- Maximizing operation efficiency & workers productivity.  
- Win more jobs in order to grow the business further.

**Susan**  
- A pleasant and healthy city to live in with all kinds of amenities & facilities.  
- Able to enjoy life in a hassle free city environment.

**Needs**

**Michael**  
- Mike always needs to know the conditions of all facilities, services such as transport, utilities etc. in real time.  
- He needs to have feedback & way to engage the resident.

**Joe**  
- Joe has to ensure his team response instantaneously to service request.  
- He needs a system that enables him to better allocate resources & gain productivity.

**Susan**  
- Susan needs to have a direct communication channel to all stakeholders, including the city council when things are not working as it should be.

**Pain Points**

**Michael**  
- The mayor often gets to know problems of the city operations through media & that can be too late to response to the needs.  
- Information comes in piece meal and in various formats and timing.

**Joe**  
- The city No. 1 electrician has to be in standby mode every time, waiting for report of malfunction of facilities.  
- Spring into actions without knowing what parts are needed on site & cause unnecessary delay.

**Susan**  
- Going to the media seems to be the fastest way to get attention of the city administration but that often considered an “over-kill”.  
- Petty complaints are often ignored due to complexity in making a report.
### User Experience Journey

#### User Experience Journey – A Daily in Life of a Mayor (Journey Duration: 16 hours)

<table>
<thead>
<tr>
<th>Actions</th>
<th>Mindset</th>
<th>Feeling</th>
<th>Touchpoints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start meeting</td>
<td>“Blackout last night? Where?”</td>
<td>☺</td>
<td>Meeting room</td>
</tr>
<tr>
<td>Hear report out</td>
<td>“Cars piled up due to fog?”</td>
<td>☯</td>
<td>Spreadsheet / slides</td>
</tr>
<tr>
<td>Pick up problems</td>
<td>“Hurricane is approaching.”</td>
<td>☯</td>
<td>Heads of various</td>
</tr>
<tr>
<td>Get suggestions</td>
<td>“Ensure drains are not clog.”</td>
<td>☯</td>
<td>departments</td>
</tr>
<tr>
<td>Decide actions</td>
<td>“Declare school off for tomorrow.”</td>
<td>☯</td>
<td>Officers in-charged</td>
</tr>
<tr>
<td>Approve budget</td>
<td>“Approve $20k to prune big trees.”</td>
<td>☯</td>
<td>News reports</td>
</tr>
<tr>
<td>Check status</td>
<td>“Rescue teams are in standby mode.”</td>
<td>☯</td>
<td>Social media</td>
</tr>
<tr>
<td>Advice resident</td>
<td>“Please stay indoor if possible.”</td>
<td>☯</td>
<td>Heads of departments</td>
</tr>
<tr>
<td>Get feedback</td>
<td>“Good. Everything is in order now.”</td>
<td>☯</td>
<td>Spreadsheet</td>
</tr>
<tr>
<td>Plan for future</td>
<td>“Real time data could be helpful.”</td>
<td>☯</td>
<td>dashboards</td>
</tr>
<tr>
<td>Engage resident</td>
<td>“We’re in standby. Call us if needed.”</td>
<td>☯</td>
<td>Social media</td>
</tr>
<tr>
<td>Socializing ideas</td>
<td>“Smart city will make a different.”</td>
<td>☯</td>
<td>Official events</td>
</tr>
</tbody>
</table>

- **Point of View**
  - Michael: As the city’s chief administrator, I need a way to get real-time information of the city operations, conditions of the facilities and services so that I can make informed and timely actions to respond. Better still, if I can make sure of the data collected from IoT connected assets, probes, measurement instruments etc. to make predictive or even descriptive decisions.
  - Joe: As the owner of the city’s street lights and closed circuit TV surveillance system contractor, I need a way to alert me whenever there is a malfunction of those facilities owned by the city council so that I can take immediate action to send my crew to the site and fix the problem without waiting for people to complaint. In that way, I can also ensure the safety of the people of the city.
  - Susan: As a student cum social worker, I need a way to effectively provide my feedback to the city administrator so that the amenities, facilities or services are always in its best operating conditions. In that way, I’m sure we will have a better quality of life, hence, attracting more like minded people to the city and turn the city to a sustainable one, if not a zero energy city.

- **Stakeholders**
  - Michael: Resident / property owners, Media, Business Owners / Contractors / suppliers
  - Joe: Customer (city council) / Head of Energy & Environment, Employees & shareholders of company, Resident / property owners
  - Susan: Resident / property owners, Media, Family members, NGO members

- **Competencies**

![Competencies Diagram]
User Experience Journey – Troubleshooting a Faulty Street Light (Journey Duration: 3 hours)

<table>
<thead>
<tr>
<th>Actions</th>
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<th>Feeling</th>
<th>Touchpoints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receive work order</td>
<td>“Mr. Beckmann is mad this time.”</td>
<td>☹</td>
<td>Mobile phone, Email</td>
</tr>
<tr>
<td>Understand content</td>
<td>“Faulty street light again.”</td>
<td>☹</td>
<td>Spreadsheet, Log book, Mobile phone</td>
</tr>
<tr>
<td>Categorize problem</td>
<td>“Don is available with 3 workers.”</td>
<td>☹</td>
<td>Warehouse, Mobile phone, Email</td>
</tr>
<tr>
<td>Decide what to be done</td>
<td>“It’s 3 hours since report. Action!”</td>
<td>☹</td>
<td></td>
</tr>
<tr>
<td>Check which team lead is on duty</td>
<td>“Take the truck with a boom lift.”</td>
<td>☹</td>
<td></td>
</tr>
<tr>
<td>Provide details &amp; instruct to act</td>
<td>“Bring along couple of light bulbs.”</td>
<td>☹</td>
<td></td>
</tr>
<tr>
<td>Facilitate tools &amp; equipment needed</td>
<td>“Joe, just replace a 200W bulbs &amp; it’s working.”</td>
<td>☹</td>
<td></td>
</tr>
<tr>
<td>Track progress &amp; troubleshoot, if needed</td>
<td>“Well done, Don!”</td>
<td>☹</td>
<td></td>
</tr>
<tr>
<td>Report back to customer work complete</td>
<td>“I will send you the invoice soon.”</td>
<td>☹</td>
<td></td>
</tr>
</tbody>
</table>

User Experience Journey – Launching a complaint about a pothole (Journey Duration: 20mins)

<table>
<thead>
<tr>
<th>Actions</th>
<th>Mindset</th>
<th>Feeling</th>
<th>Touchpoints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walk out of house</td>
<td>“This pothole may cause accident.”</td>
<td>☹</td>
<td>Sidewalk, Road</td>
</tr>
<tr>
<td>See a pothole near her house.</td>
<td>“A cyclist may fall if not careful. I must make a complaint.”</td>
<td>☹</td>
<td>Camera on phone, Mobile phone</td>
</tr>
<tr>
<td>Quickly assess the problem.</td>
<td>“I must capture the background.”</td>
<td>☹</td>
<td></td>
</tr>
<tr>
<td>Decide to make a complaint.</td>
<td>“About 200m from the church.”</td>
<td>☹</td>
<td></td>
</tr>
<tr>
<td>Take a photo of the pothole.</td>
<td>“Which 1800 number to call?”</td>
<td>☹</td>
<td>Mobile phone</td>
</tr>
<tr>
<td>Identify the exact location.</td>
<td>“Road &amp; Drainage Dept of Bright City.”</td>
<td>☹</td>
<td></td>
</tr>
<tr>
<td>Browse internet for phone number to launch a complaint.</td>
<td>“Yes, the pothole contains water &amp; pretty deep. I’ll send photo over.”</td>
<td>☹</td>
<td></td>
</tr>
<tr>
<td>Call up the number and gave details.</td>
<td>“20mins to make a simple complaint. How unproductive.”</td>
<td>☹</td>
<td></td>
</tr>
<tr>
<td>Email photo.</td>
<td>Receive confirmation of complaint made.</td>
<td>☹</td>
<td></td>
</tr>
</tbody>
</table>

Prototype

This Smart City application is a services/client built as the integral part of Smarty system. It connects its users directly to Smarty Cloud, the central system.

The app is rolled out in many versions by adding more and more services to enhance user experience along the way. User access is administered strictly by the city administration during registration. All users are able to view some of the common information (such as public events) but any further activation of functions would require a scanned copy of personal identification document (driving license, passport etc.) with verification through SMS or email confirmation.

Users are to choose from 2 of the 3 user group (i.e. city administrators, service providers, citizen or visitors). The access rights are granted based on these 3 personas to ease administration.

The concept of gamification is introduced right from the beginning to attract adoption level. It is for the city administration to decide how to rewards the points collected by its users (e.g. based on participation in providing feedback etc.).
Personal Settings and security verification are not shown here.
Note: I struggled in learning to use www.build.me to build the prototype in order to have the look and feel that I want but to no success. Please bear with me if the following link creates confusions rather than giving you a better understanding of the prototype. Otherwise, I am hoping the high fidelity prototype above would serve the purpose.

Prototype – Page Map
https://standard.build.me/home/projects/eab34f14bd44567d0cd468de/page-map

Published Page (maybe defective!)
https://standard.build.me/api/projects/eab34f14bd44567d0cd468de/prototype/snapshot/latest/index.html#/14775480785139733_S0

Opinions and feedbacks are most welcome through the link below:
https://standard.build.me/home/projects/eab34f14bd44567d0cd468de/research/participant/24b825a982e6667b0cd46ec6

~~~ The End ~~~