Open & School Category
Theme: My Smart City – Connecting Our Senses
Date: 16-Jun-2017

S/N	Challenge Statement
Challenge Sponsor: PSA Corporation Ltd	
CXA-01	**Challenge Title: Fleet Management**
	Description of the problem:
	There is a growing emphasis on energy savings and safety of vehicle operations in the port. With the advancement of wireless IoT technologies, it brings about new levels of capabilities to fleet management. Our fleet of equipment generate an enormous amount of information such as fuel consumption, miles logged, speed tracking, vehicle usage patterns and much more. Leveraging this vast pool of data via connected vehicles services would provide insights and enable greater visibility to achieve maximum operation control. Having a faster way to identify potential problems and mitigate risks that could jeopardize driver safety in the port can bring about significant benefits in terms of cost, staff and environmental well-being.
	Challenges:
	To propose and develop a solution that enables better management of the vehicles via connected devices.

	• To propose a solution using sensors and wireless IOT to gain greater visibility in fleet management. E.g. Vehicle status and preventive maintenance, speed tracking. • To develop a web-portal that helps to monitor and achieve the desired outcomes.
CXA-02	**Challenge Title: "Hot Desking" for a SMART office** **Description of the problem:** "Hot Desking" is an office concept being considered for adoption at our future office. In a "Hot Desking" environment, certain office resources are shared and will be utilized in a "first-come-first-serve" basis. This poses a challenge when employees will need to schedule meetings and discussions with our colleagues, as the availability of these supporting resources might not be available when needed. According to one workplace study, 70% of employees on similar arrangements waste 15 minutes per day trying to find a work area. Location-based technology (through connected lighting or sensors) helps to ensure that users can find free space easily and occupancy is updated on the booking system automatically to ensure accuracy. Users will also be able to enquire on availability of shared resources (e.g. printers, coffee machines, etc.), as well as their colleagues within the office. By placing information and control back into the hands of employees, this potentially disruptive "Hot Desking" arrangement can be highly successful and lead to a more collaborative workforce. **Challenges** To develop a mobile application to assist with booking of shared resources – desks, meeting rooms, phone booths & discussion areas. This will greatly improve staff productivity and ensure shared resources are utilized in a more efficient manner.
CXA-03	**Challenge Title: Securing IoT Devices with Blockchain** **Description of the problem:** With the proliferation of IoT devices & sensors in the port area, it is imperative to be able to trace the source IoT device and ensure secured communication between/among devices. Additionally, with increased deployment of automated equipment, information captured from sensors on our equipment are critical towards ensuring sustained high performance and resiliency. Hence, communication of IoT devices to the backend systems for analytics and recording purposes needs to be done in a secured manner. **Challenges**

	To develop a prototype of an ecosystem of IoT devices using Blockchain technology to perform secured communication in a distributed network to ensure authenticity and validity of message passing. Using Blockchain to validate a IoT device's identity in this network can ensure that no IoT device can be tampered with.
CXA-04	**Challenge Title: Smart Inventory & Asset Management** **Description of the problem:** As we progress towards year 2020, Singapore's labour shortage is probably the biggest challenge for growth and the restructuring of the economy towards coping with such pressures will take a considerable amount of time. We envisage a smarter inventory & asset management to better prepare for the resource crunch. Reducing or removing mundane tasks like tracking inventory movements, automatic refilling of low inventory stock and assets verification for compliance would help to enable better deployment of resources. Smart systems would also increase accuracy, reduce cost, improve process efficiency and eliminate non-compliances. With IOT Smart Inventory & Asset Management, it can enable automated asset monitoring, consolidated real time inventory listing and keeping a historical track of components stock levels. **Challenges:** • To propose a solution using sensors & wireless IoT to connect & collect information to better manage physical inventory & asset. • To develop a web-portal front end that supports the desired outcomes.
Challenge Sponsor: Cyber Security Agency of Singapore (CSA)	
CXA-05	**Challenge Title: Addressing the data integrity of IoT devices** **Description of the problem:** • Internet-of-Things (IoT) promises to revolutionize our homes and cities to become smarter, through machine-to-machine connectivity/communications that enable active monitoring and proactive control of our physical environments. • However, if the environmental monitoring data captured/processed/transmitted by an IoT device is compromised, this can mislead the controlling of the environment, which could lead to potentially damaging consequences. As such, it is

	important for manufacturers to build their IoT hardware and software with security-by-design (while aligned to industry security standards as a minimum baseline). • The context could be Smart Cities, comprising for example smart streetlighting, smart transport, security camera and environmental sensor. **Challenges** • Develop mechanisms/standards that can detect cyber attacks attempting to compromise the timely and accurate capturing/processing/transmission of data by a IoT device.
CXA-06	**Challenge Title: Addressing issue of compromised IoT devices** **Description of the problem:** • The largest ever (1.2 Tbps) DDoS attack on internet DNS provider (Dyn) in October 2016, crippled large swathes of users across Europe and North America from accessing the internet. The unprecedented scale of disruption is because this time the botnet commandeered Internet-of-Things (IoT) devices, which are generally more vulnerable than computers/smartphones and growing exponentially more numerous. • This is an important wake-up call across government and industry all over the world. The obvious systemic solution is for manufacturers to build their IoT hardware and software with security-by-design (while aligned to industry security standards as a minimum baseline). Nonetheless, we still need solutions to address the threat posed by the massive numbers of vulnerable IoT devices already deployed out there. • The context could be Smart Home, comprising for example home gateway, motion sensor, camera and smart TV. **Challenges:** • Develop mechanisms/standards that can detect anomalous behaviour of compromised home IoT devices. Note: Detect anomalous behaviour can encompass multi-faceted possibilities e.g. "the computer processes within the device" &/or "the network traffic in and out of the device" &/or "radio waves emanating from the device".
Challenge Sponsor: APM Property Management Pte Ltd (Suntec)	
CXA-07	**Challenge Title: Georectification on robotic cleaner** **Description of the problem:**

	Mall cleaners have extensive interior and exterior walkways with stone/tile flooring to clean. There is a need to deploy a fleet of robot cleaners to augment mall cleaners. A cleaner is required to guide the robot cleaning machine around the area to be cleaned as part of the mapping process. Following this mapping process, the robot cleaner is then deployed to clean the mapped area. Should there be any obstruction along the mapped route, the robot would stop its operations and wait for human intervention. **Challenges:** To propose and develop a solution that addressed one or more of the following challenges: - To automate the mapping of areas that robot cleaners are supposed to clean. The current mapping process is too manual, time consuming and not a very smart way to execute. - To incorporate an intelligent logic such that the robot cleaner can circumvent any obstruction along the mapped route. - To automate the recharging of robot cleaners: detect low battery and navigate to charging bay. Currently, there is a need to manually deploy a cleaner to bring the machine to the charging bay. - To propose a solution where robot cleaners (perhaps in a fleet of 2 or 3 machines) working as a team with the cleaner so that the cleaner could cover the areas that the machine cannot be deployed to clean. - To propose a solution using sensors and wireless IoT to gain greater visibility in fleet management of the robot cleaners. There should be analytics that would - validate the areas cleaned - generate data on the areas cleaned - analyse the deployment of the cleaning team and scheduling etc

Others

CXA-08	**Challenge Title:** Understanding crowd engagement of ad-hoc events in common spaces (e.g. airport, malls, exhibitions) **Description of the problem:** There is a multitude of installations/events for visitors of common spaces, including art installations, pop-up activity booths etc. Today, data such as footfall, utilization rates and satisfaction levels for such installations are collected by surveyors as it is not cost effective to implement a permanent fixture on these temporary installations. Furthermore, feedback gathered is limited to the duration that surveyors have been engaged. The results may also lack insight on the form of interaction and behaviour taken place between the visitor and the installation/event. In consideration of the current digital landscape, visitors may also turn to social media to share on their experience, which contains raw insights that may not be captured during surveys.

Common space operators would like to collect continuous data on parameters such as footfall, dwell time, crowd movement, behaviour and satisfaction levels at these installations to obtain insights on visitor engagement with such installations. If possible, these data on physical interactions and presence can be cross-referenced with social media feedback/comments on the installation for a more in-depth analysis. The analysis and insights would be used to understand how well-received installations are to enable operators to make informed decisions to better cater to visitors' preferences and enhance their experience.

Challenges
Design a solution to gather data (such as footfall and utilization rate) to determine visitor engagement with these temporary installations.

- The solution should be able to be used on any installations/events and is portable to different installations of different scale and nature. As a guide, the scale of the installations/events are as follows:
  1. Small installations: A static or interactive installation such as art piece, landscape or sculpture, requiring minimal or no movement from visitor to view it completely.
  2. Medium installations: A static or interactive installation of a considerable footprint, requiring visitor to move around and to interact with the exhibit.
  3. Large installations: A single or collection of installations across a wide space with varying nature of interaction (i.e. static, interactive) with no gated / controlled access, allowing singular or multiple points of entry/exit.

- The parameters collected may vary for each installation. For instance, a possible parameter for an art installation could be the dwell time of a visitor; however, this parameter might not be as applicable for activity booths that have fixed program duration. The solution should factor in the ability to customize data parameters to collect for each installation. Examples of parameters are as follows:
  1. Unique footfall
  2. Dwell time
  3. Heat maps / Zonal heat maps
  4. Unique visitor path
  5. Unique views
  6. Satisfaction
  7. Demographics
  8. Interaction

	9. Custom input by visitor: For feedback, visitor comments or suggestions 10. Social media feedback / comments • The solution should include both the hardware and software used to collect and analyze data.
CXA-09	**Challenge Title: Gathering Insights from Feedback Channels** **Description of the problem:** A typical enterprise's Contact Centre and Customer Insights team handle large volumes of visitor feedback each day. It is an operational challenge to sieve through and respond to voluminous feedback in a timely and efficient manner. To add to the challenge, image-driven feedback via social media is growing and there is a need to move in tandem to this change in order to stay on the pulse of the customer. To streamline the process, an enterprise would like to implement a system to aid their officers in categorizing and prioritizing written feedback so as to enhance responses to our users. **Challenges:** Design a solution to categorize and prioritize written feedbacks from emails, social media etc. to ensure quicker and better responses to delight feedback contributors. • Natural language processing could be utilized to segment and prioritize feedback (e.g. complaints, compliments), allowing an enterprise to better manage our responses that are urgent whilst optimizing manpower. • Solution could consider image analytics to obtain a higher accuracy of segmentation, expand an enterprise's feedback capture pool and widen understanding of customers. • If possible, design proposed responses to help feedback contributors respond quicker and confidently as well as to delight visitors.