NSE 2017 - Big Data Challenge
Students and Mentors Training Workshop

Time	Activity
2.00pm	Introduction - Background of NSE
2.05pm	NSE 2017 - Timelines
2.10pm	NSE 2017 – Overview
2.30pm	Demonstrations
2.40pm	Introduction to MODSTORE
2.50pm	Hands-on session
4.00pm	End of workshop

National Research Foundation
Prime Minister's Office
Singapore

Institute of High Performance Computing
A*STAR

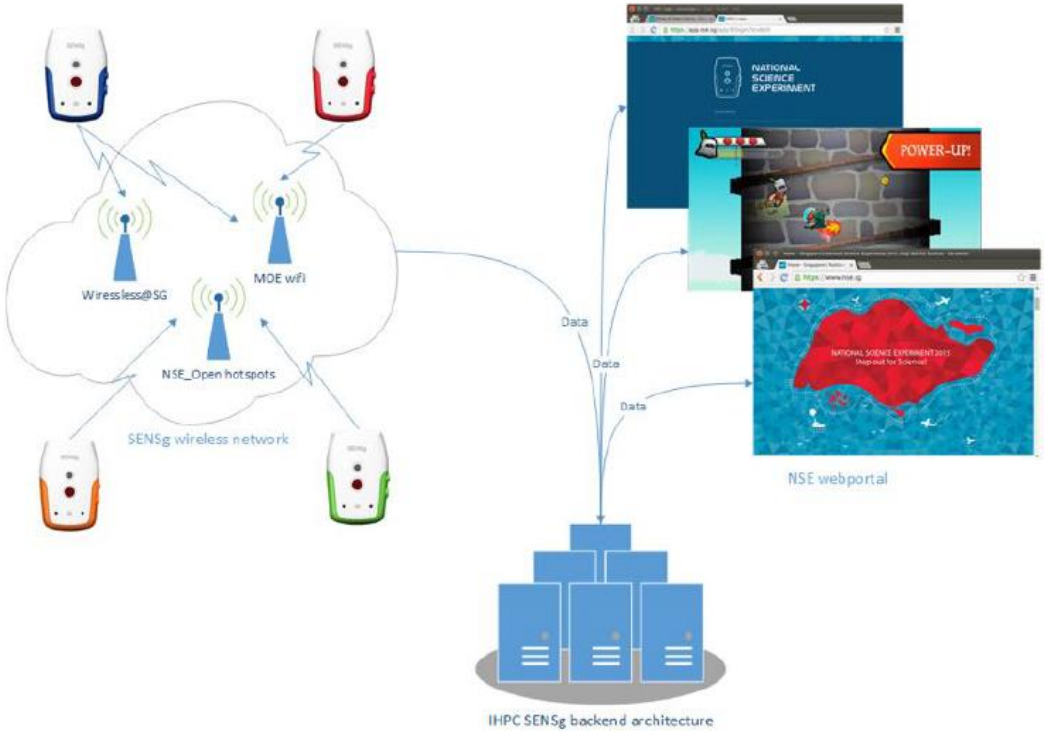
Singapore University of Technology and Design

Science Centre Singapore

NSCC Singapore

Background of NSE

- A **nation-wide project** launched by President Tony Tan in Jan 2015
- First National-scale deployment of **IoT devices** designed for ease of use
- Involved **176 schools** and more than **90,000 students** in 2 years
- ~60 teams from 23 schools participated in the **inaugural NSE Big Data Challenge in 2016**



NSE 2017 - Sustainable Urban Living

This year, **you** design your own experiments

Each team will be provided with **120 SENSg devices**

Study the impact on the world and how to live sustainability

NSE 2017 - Sustainable Urban Living

- **Mentor connect**
  - Secondary school students → STEM ALP Educators or the teacher in-charge.
  - JC / Poly / ITE → Industry Mentors (SAP, Fujitsu, ST Engineering, etc.)

NSE 2017 - Mentor's role

- Guiding the teams in the formulation of the hypothesis, the execution/methodology, and data analysis.

- Sharing with the team the sensors, data and data science platform which are available for use.

Learning Goals – Research

- Problem identification
- Sources of information
- Problem analysis

WHY: To learn from the experience of others before you

Learning Goals – Hypothesis

- Innovation/novelty
- Impact
- Technical accuracy

WHY: To learn how to set your goals and plan your experiment

Learning Goals – Experiment

- Plan/design
- Execution/methodology
- Error analysis

WHY: To ensure that your hypothesis is rigorously tested against empirical evidence

Learning Goals – Presentation

- Creativity
- Quality of text/visuals
- Effectiveness

WHY: To learn how to communicate your findings clearly so others can learn from your experience

SENSg Device


Gyroscope

Magnetometer


Accelerometer


Barometer


Humidity


Temperature

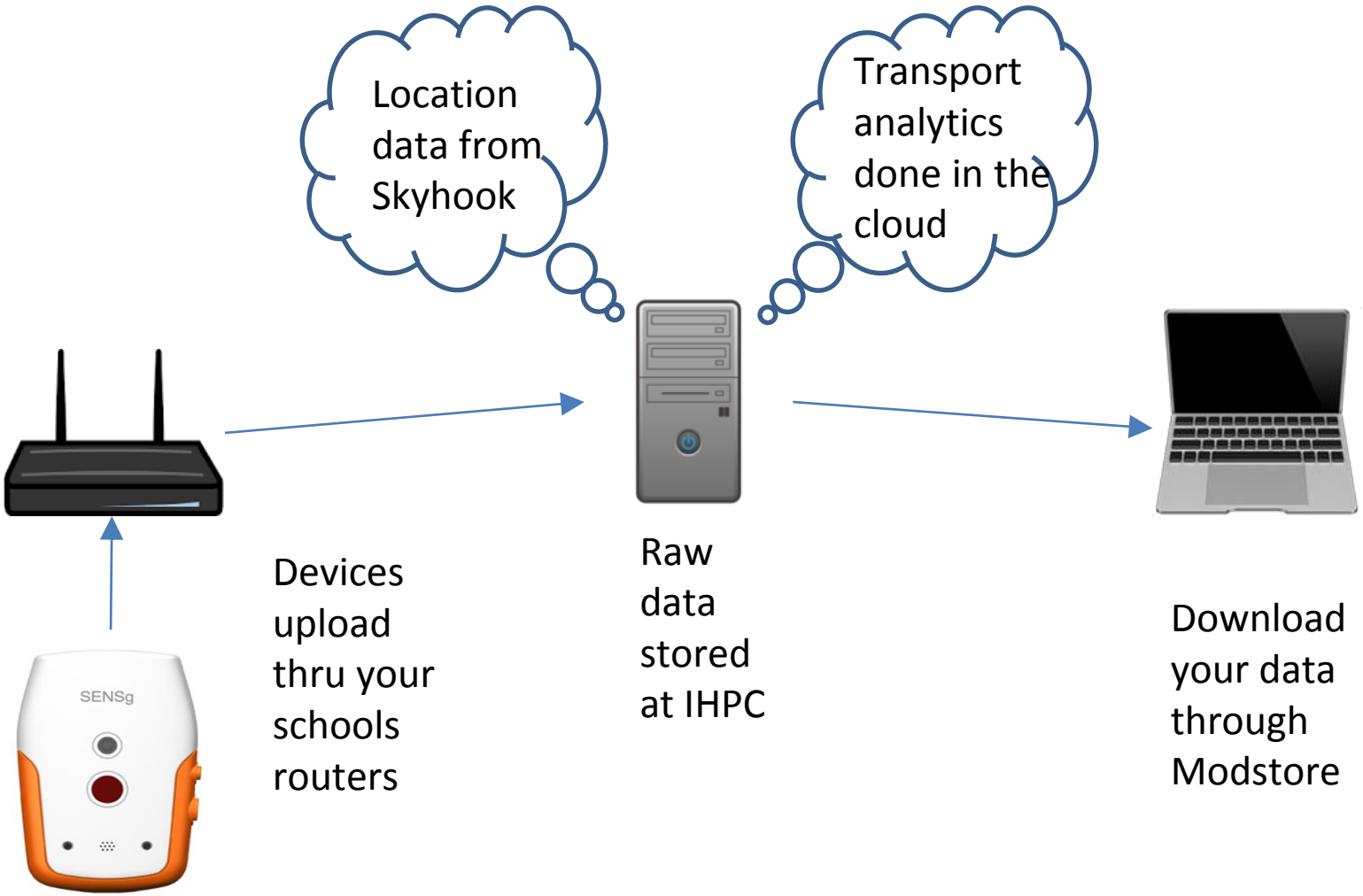
Light

Noise Level

Data Accuracy

Sensor	Range	Accuracy	Units	Poll Freq (Hz)
Accelerometer	±2g~±16g	-	m/s^2	100 (for 1 sec)
Gyroscope	±250 to ±2000	-	deg/sec	100 (for 1 sec)
Magnetometer	±4800uT	-	uT	100 (for 1 sec)
Light Intensity	0.165 to 100k	-	lux	0.1
Sound pressure	30 to 130	SNR: 63	dB	0.1
Relative Humidity	0-100	+/- 3	%	0.1
Amb.Temperature	-10 to +85	+/- 0.3 @ 25°C	°C	0.1
Pressure	300 to 1100 hPa	+/- 0.12 hPa	hPa	0.1
IR Temp	-40 to 125	+/- 3	°C	0.1
Buzzer	-	-	-	-
RGB LED	-	-	-	-
Wi-Fi Radio	-	-	-	-

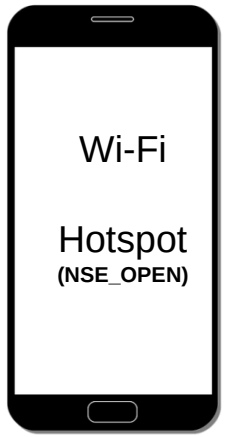
Data Flow Diagram – Mode A



Note: Sample rate = 15-20s , sleeps after 2min of inactivity

Data Flow Diagram – Mode B

Device acts as Webserver



Create a hotspot on your mobile phone

Use smartphone app (Fing) to find IP address of the SENSg device

Use the web browser on your mobile or laptop to view and save data as a CSV file.

*Ensure you connect the laptop to the hotspot

Note: you can also use readily available apps to log additional sensor & location data directly, e.g. Androsensor

Note: Sample rate = ~1Hz , doesn't sleep , No button press

Process flow

- Consider using Mode A first – all data can be downloaded from Modstore directly
- Consider Mode B if you need to deploy at static locations unmonitored or have high sampling rate
- Additionally, you can also use other smartphone apps or sensors (e.g. RasPi/Arduino) to help you collect other types of data that you might need
- Also, you can use external datasets if you find helpful

Processed data available

Variable	Explanation
aircon_co2	CO2 emissions from aircon
aircon_energy	Energy consumption of aircon
poi_lat	Point of interest (POI) latitude
poi_lon	Point of interest (POI) longitude
stairs _climbed	Number of stairs climbed
travel_co2	CO2 emissions from the transport mode
outdoor_time	Time spent outdoor
am_travel_mode	Transport mode in the morning
pm_travel_mode	Transport mode in the afternoon

Example use cases

- Transport modes analytics
- Air-con usage & carbon footprint
- Walking-paths analytics
- Button press events

Limitations

- No video/audio recordings
- Data sampling rate
- Locations accuracy 100m on average
  (no built-in GPS)
- Not water-proof
- Battery life lasts 3 days max for Mode A,
  4 hours max for Mode B
- Poor light (and other) data if not worn properly

NSE 2017 Timeline

Dates	Calendar of Activities
22 May - 29 May	Workshop for Student Teams
27th Jun - 28th Jul	Experiment starts - Collection of data
4th Aug	Submission of reports deadline
28th Aug	Announcement of finalists
(TBC)	Grand Finale

Judging Rubrics

No.	Criteria	Percentage
1	Research • Problem identification – Definition of the problem and hypothesis • Sources of information – Types and number of quality sources cited to strengthen the claim • Problem Analysis – Depth to which the problem was analysed by the team	25%
2	Solution • Innovation – Whether the findings provide value-added novelty • Impact – Whether the findings have the potential to impact and improve public policy in Singapore • Technical Accuracy – Solution exhibits accurate analytics and technical depth	25%
3	Experiment • Experiment Plan – Clear, well-structured plan • Execution – Methodology • Error Analysis – Limitations and possible sources of errors identified and quantified	25%
4	Reporting / Supporting Materials • Quality of Text – Level of detail and depth of description • Quality of Visualisations – Visualisation schemes used to represent context, analysis and findings • Presentation Effectiveness – Message delivery and organisation of the report	25%
	Total	**100%**

Assessment

- Report Submission – Students to upload reports in Modstore
  - 6 pages report, font size 12 including annexes.

  **Kindly note that all additional documents (maps, slides, videos, etc) need to be included as links in the report document.

Theme | Sample Experiments

Physical Comfort

- How comfortable is your classroom? (Why? How can it be improved?)
  - Experiment : Students grouped in classrooms to analyze temperature/light/sound pressure sensor data values & correlating with the number/type of button presses to assess comfort level in classrooms or even determining specific time when students feel comfortable/uncomfortable most

- Do open public spaces make a good first impression? Are there enough places to sit? (Are seats conveniently located?)

Mobility

- Do joggers have a favourite jogging track? And why?
  - Experiment : Analyze GPS data(smartphone) generated by 100 joggers to infer the properties of the tracks including trajectory. Light sensor can be used to detect sheltered regions as lower light intensities.

- Are paths disabled-friendly?
  - Experiment : Analysis of device locations based on able-bodied & wheelchair bound participants travelling patterns. Connecting, forming travelling paths and calculating total distances. Longer distances travelled indicates not disabled-friendly paths.

Neighbourhood

- How can we foster social interaction and create a sense of community and neighbourliness in our neighbourhood?
    - •Experiment : Analyse the environment(Temperature/Humidity /light) in various community centres for specific activities like reading rooms, music or spiritual events.Data generated shall be used to provide valuable feedback on how we can improve the services resulting in vibrant social fabric.

- Are our Neighbourhood Age-friendly?
    - •Experiment : The infrastructure in the neighbourhood should ensure equal benefit to wheelchairs, bicycles and baby strollers.Let us create a adequate support infrastructure to our senior citizens and encourage them to come out of the house and actively socialise amongst the community

Health, Well-being

- Do students feel more content indoors or outdoors?
  - Experiment : Collecting and analyzing temperature and humidity data from sensor device involving a group of participants. A drop in temperature and humidity concludes that one is located indoor, otherwise outdoor.

- When being active or passive?
  - Experiment : Correlating sensor's accelerometer readings with students activity level. High accelerometer readings can be associated with students activeness and more physical movement of a student.

SENSg DEMO