The Use of Smart Forest System during Post-COVID-19 in Forest Management and Conservation

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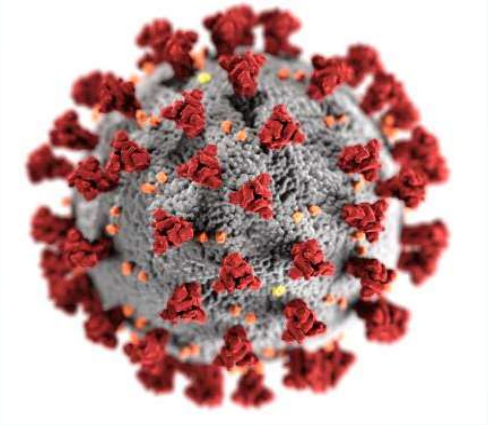
INTRODUCTION



- COVID-19 in Malaysia
  - First wave- mid March 2020
  - Second Wave- mid May 2020
  - Third wave – September 2020 until now
- Government enforced Movement Control Order (MCO)
- Consequences:
  - Economic activities affected
  - Forestry operations stop
  - Enforcement activities also affected
- Online and remote monitoring methods become more important --- SMART FOREST

WHAT IS SMART FOREST?

- The smart forest system that has been used in some developed countries utilize integrated digital technologies that contributes towards the enhancement of forest management and conservation by providing forest resources information more accurately and timely.

- Activities in the forestry sector have been exposed to Internet of Things (IoT) technology such as the use of GPS (universal positioning system), drones and GIS (geographic information system). However, these digital equipment are commonly been used separately where the results obtained may not be comprehensive.

- Smart Forest system is expected to be able to integrate the existing digital technology that been used. This system can be easily accessed and used by forest managers in the decision making processes.

- The pandemic COVID-19 phenomena has shown that the smart forest system is more critical and timely due to limitation of movement and physical interaction.

- The use of the system should be intensified even in the post COVID -19 as new norm and adaptation on the forest management and conservation in this country. Researchers also would benefited a lot by using the smart forest system in their research activities.

Examples of Smart Forest

Smart Forest, USA

News and Events

How Forests Can Improve Health And Slow Climate Change

July 20, 2020 Lindsey Rustad discussed *How Forests Can Improve Health And Slow Climate Change* on New

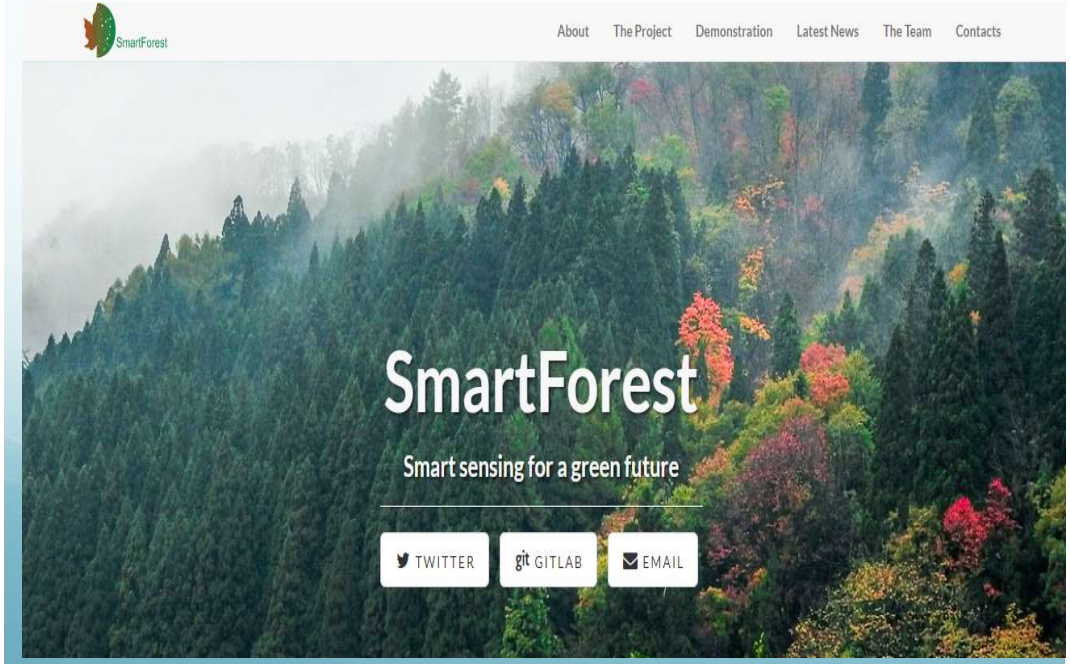
Smart Forests are a network of long-term ecological and silvicultural research sites that are distributed across the United States and are instrumented with a suite of environmental sensors. These sites harness near real-time data to fuel innovation and support science, education and natural resource management in the 21st Century.

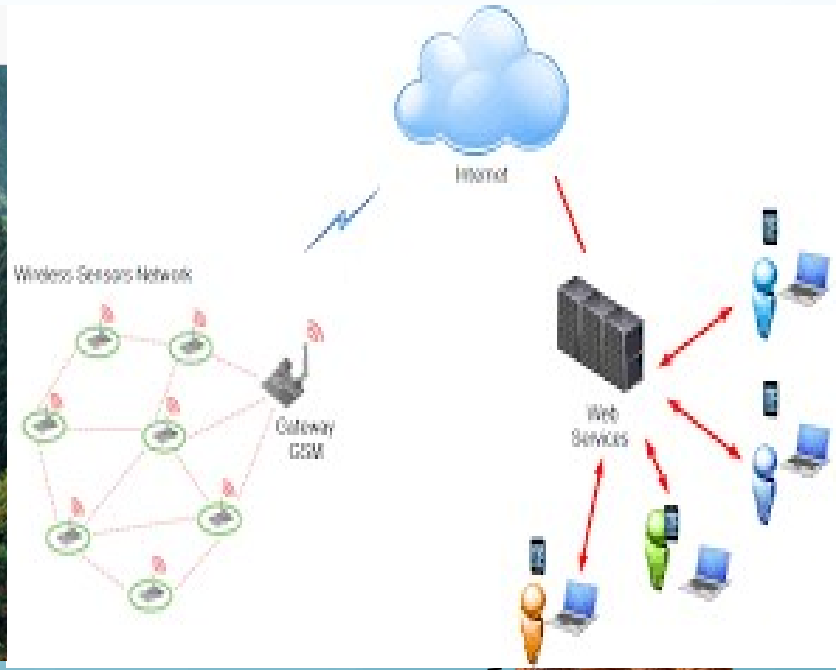
Netherland

The Smart Forest aims to develop applications for owners of forest parks, for real-time monitoring of their property.

Through a network of low-cost sensors we intend to anticipate the environmental conditions conducive to the occurrence of fires and to detect them at the beginning.

..... Smart Forest Project, Portugal (2017)

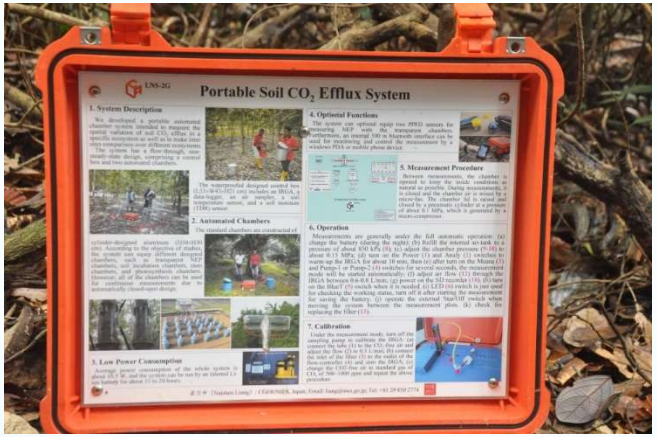




EXISTING 'DIGITAL' FOREST RESEARCH IN MALAYSIA

Controls of Soil CO_2 Efflux of a Lowland Tropical Rainforest Ecosystem in Peninsular Malaysia

Project members: Naishen Liang (NIES), Xin Zhao (NIES), Munemasa Teramoto (NIES), Yao Tze Leong (FRIM), Samsudin Musa (FRIM)
Project duration: 2017 - now



The 'Portable Soil CO_2 Efflux System' developed by Dr Naishen Liang that measures soil CO_2 respiration.

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Gas Exchanges of Southeast Asian Tropical Rainforest

Project members: Yoshiko Kosugi (Kyoto Univ.), Satoru Takanashi (FFPRI), Shoji Noguchi (FFPRI), Takuya Saito (NIES), Tatsurou Nakaji (Hokkasido Univ.), Hiroki Iwata (Shinshu Univ.), Tamon Yamashita (Shimane Univ.), Shinya Funakawa (Kyoto Univ.), Masayuki Itoh (Kyoto Univ.), Mai Kamakura (PD. Kyoto Univ.), Ayaka Sakabe (PD. Kyoto Univ.), Wakana Azuma (PD. Kyoto Univ.), Makoto Shibata (PD. Kyoto Univ.), Shinichi Watanabe (D1 student, Kyoto Univ.), Abdul Rahim Nik (FRIM),Siti Aisah Shamsudin (FRIM), Marryanna Lion (FRIM), Samsudin Musa (FRIM), Ahmad Makmom Abdullah (UPM)

Project duration: 2017 - now

The equipment used to capture various of data is installed on aluminium tower in Pasoh, Malaysia

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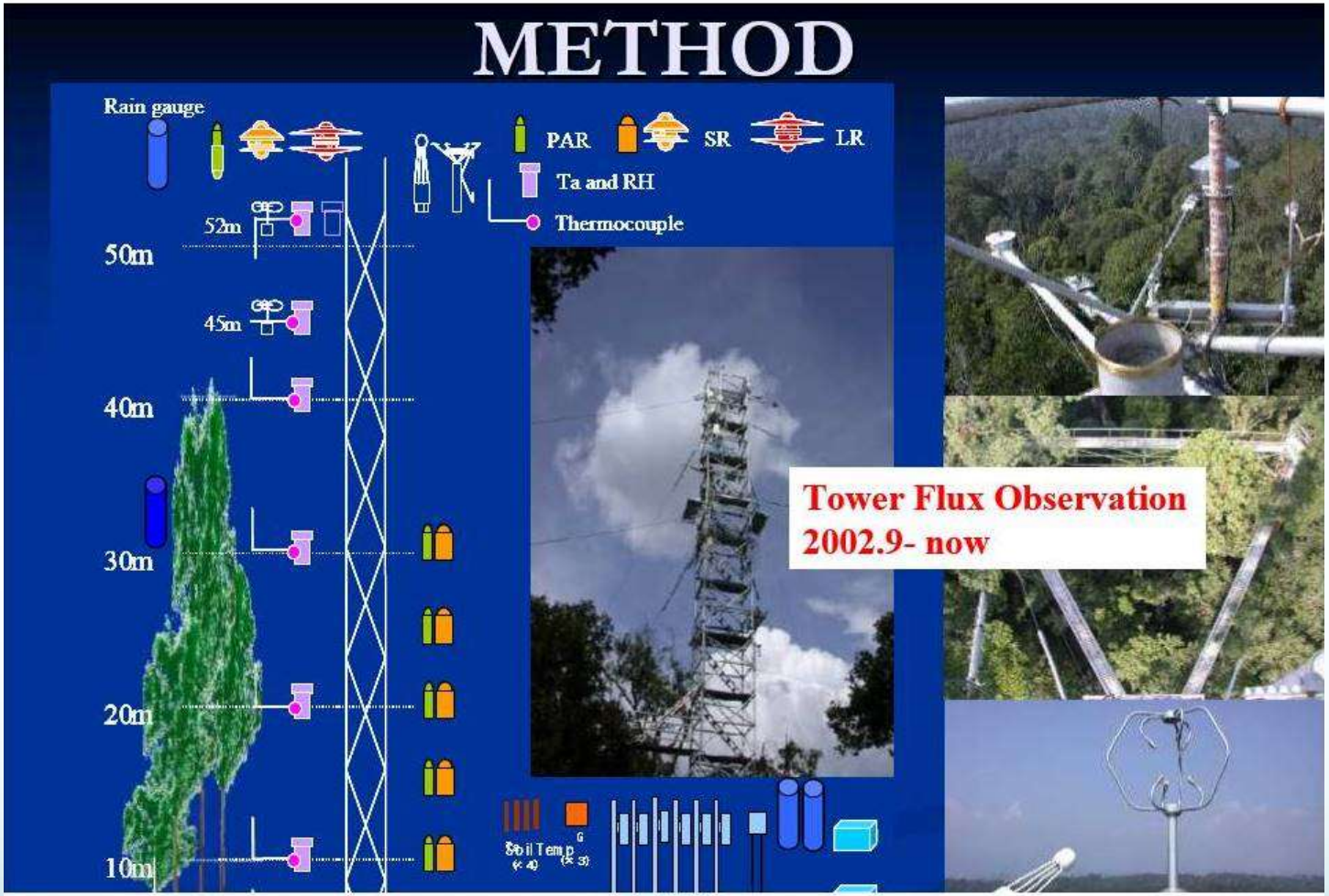
METHOD

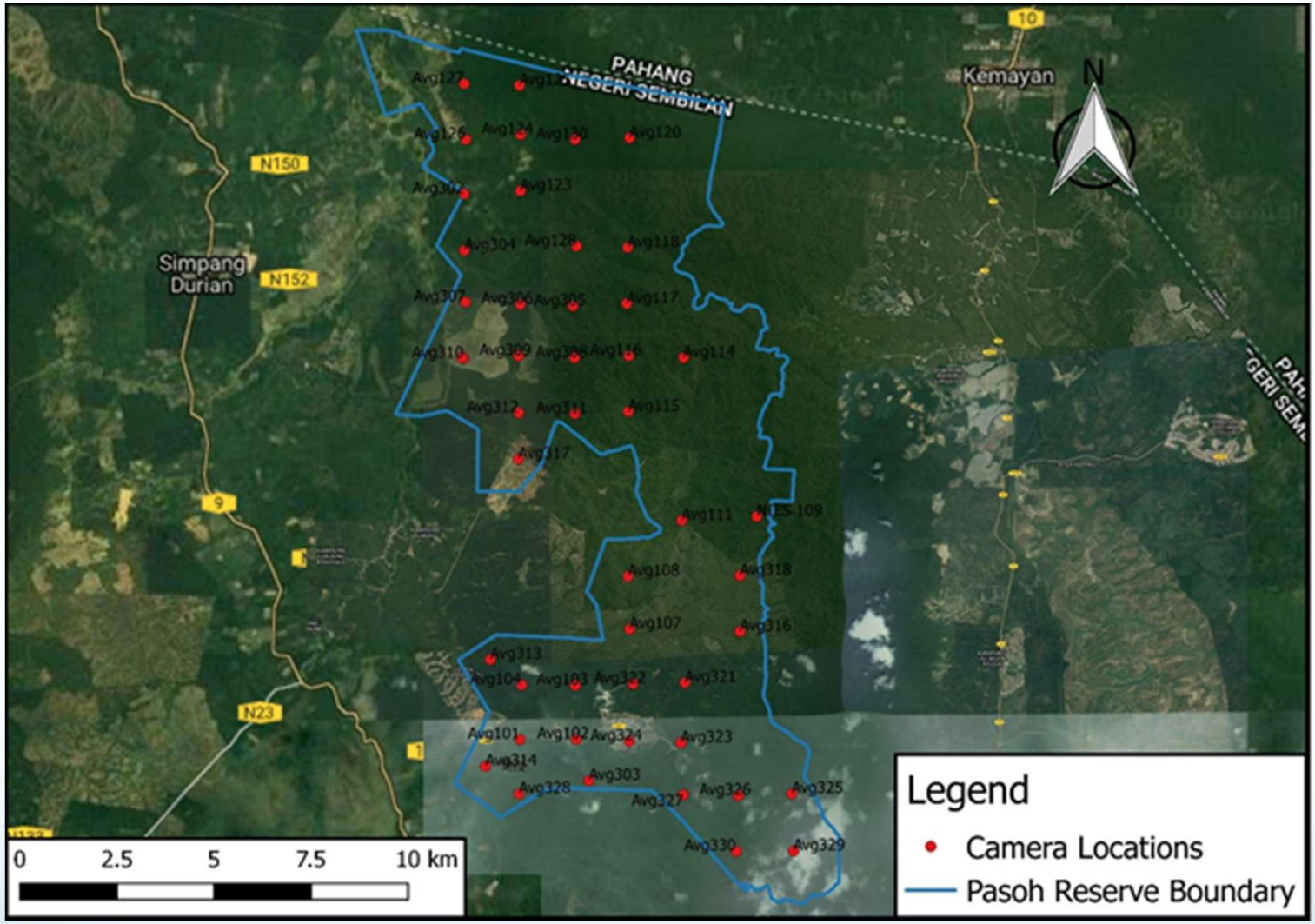


Seasonal/interannual variations in evapotranspiration and CO_2 exchange at Pasoh, with the change in environmental conditions?

Population Viability of Vulnerable Wildlife in a Sustainably Managed Fragmented Production Forest

Project members: **Manabu Onuma** (NIES), Jonathan Moore (Univ. Nottingham Malaysia Campus), Yao Tze Leong (FRIM)
Project duration: May, 2016 - now

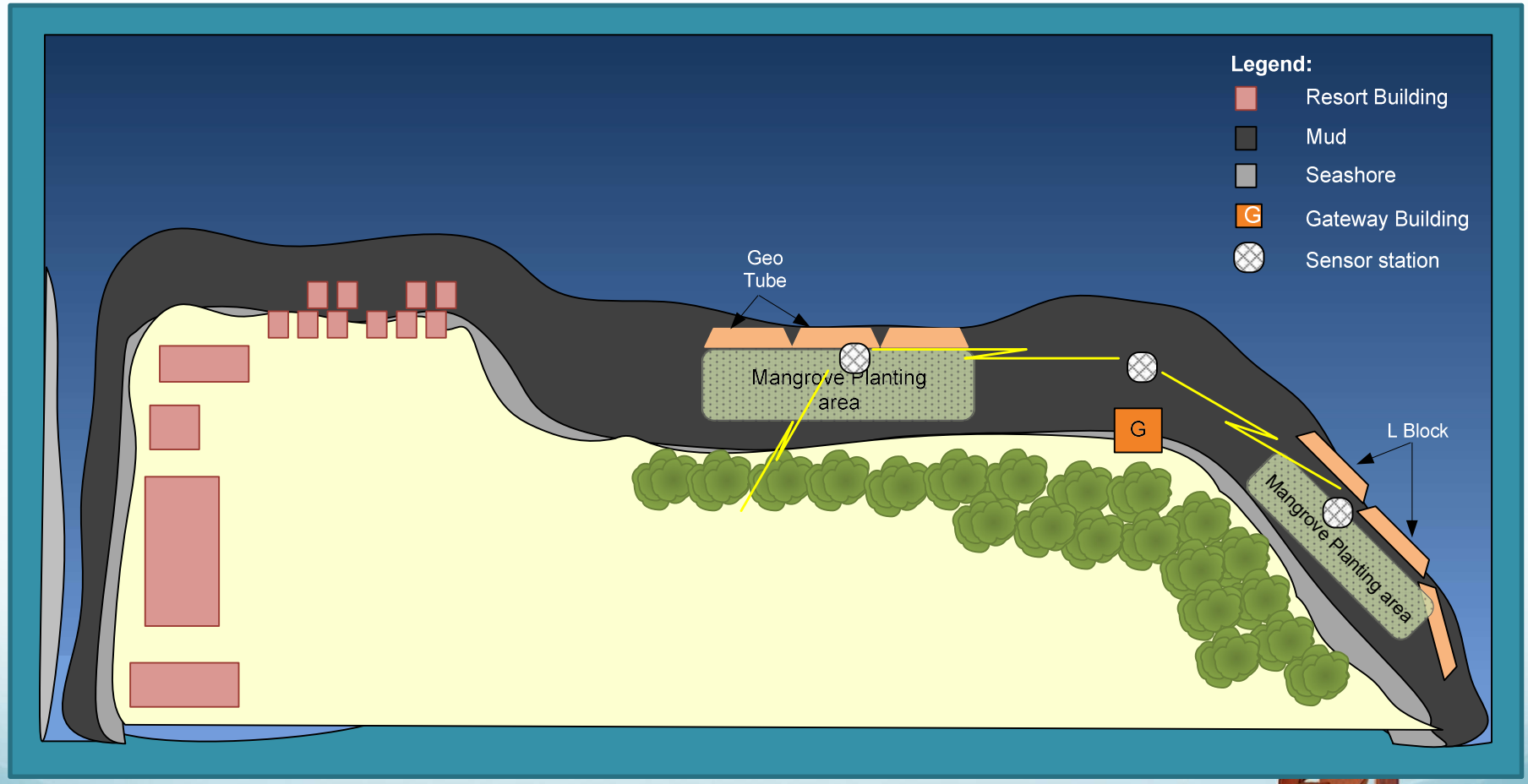
Camera trap is installed on a tree at knee level to capture image of animal that passing by.



50 cameras are installed all over Pasoh FR with 2 km interval

Some of the images captured by camera trap

Integrated Environmental Monitoring System (IEMS) at Sg Hj Dorani (mangroves)



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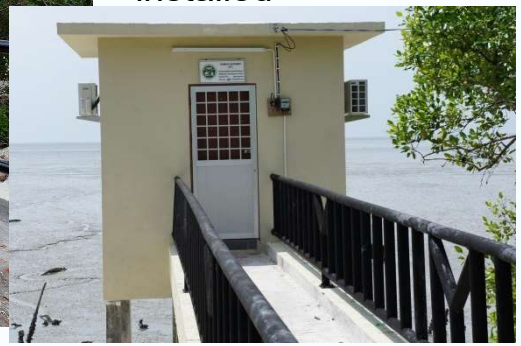
IEMS: Capturing Environmental Data At Mangrove Research Site In Sg Hj Dorani

SENSOR STATION
- Ready for use

GATEWAY HOUSE
- Structure completed
- Electricity and aircond installed



DATA GENERATED
- Graphical & digital
- Tested at UTM

Installation of IEMS 15-22/3/2015

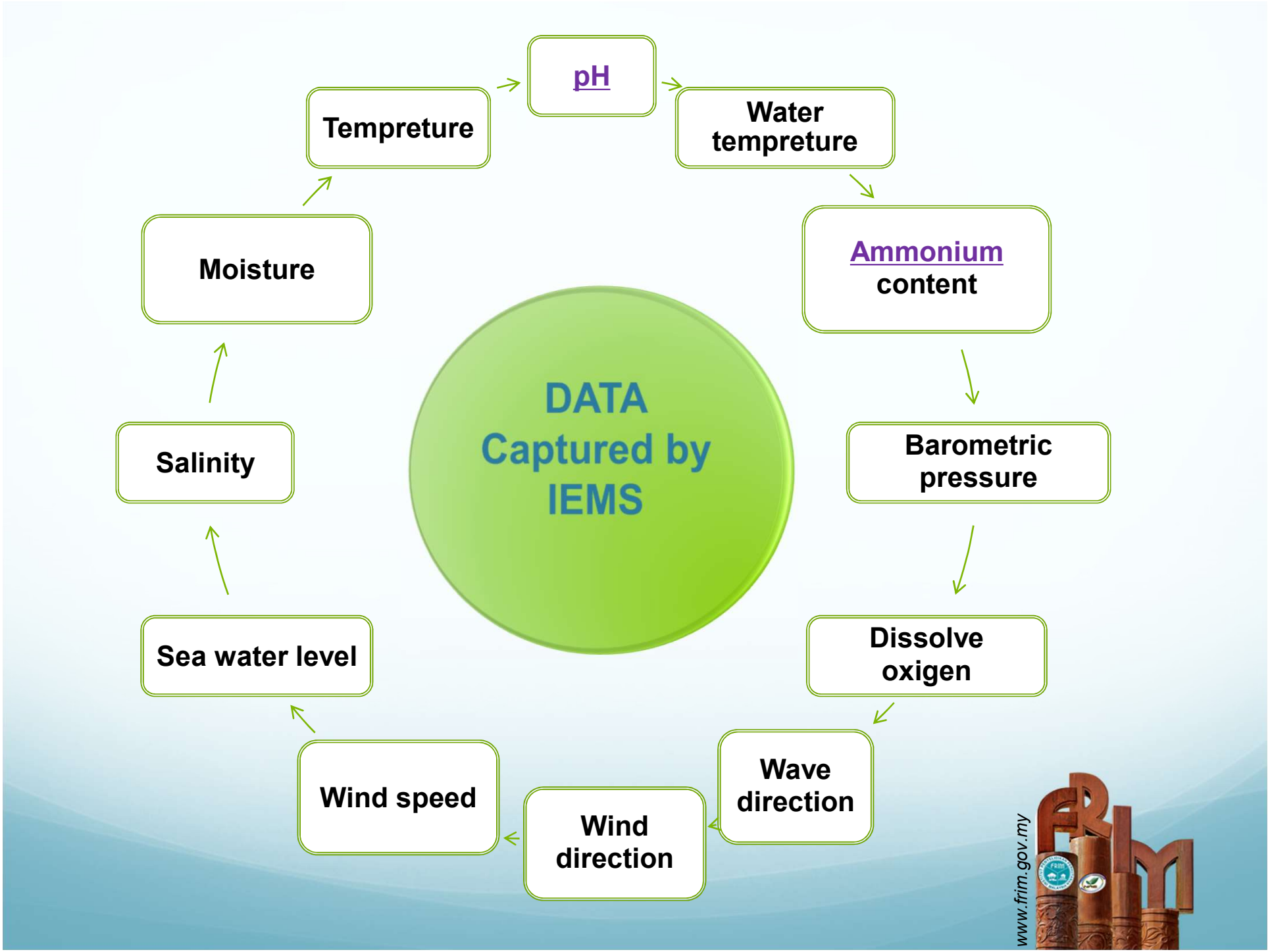
Movement during installation

Installation of solar panel and control tracks

Tower No. 3 : Installation of solar panel

Checking od captured data at Gateway

Gateway house control


pH
Water tempreture
Ammonium content
Barometric pressure
Dissolve oxigen
Wave direction
Wind direction
Wind speed
Sea water level
Salinity
Moisture
Tempreture
DATA Captured by IEMS
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Free Air CO_2 Enrichment (FACE)

	FACE, FRIM
Vegetation type	Production Forest
Climate Zone	Tropical (Southeast Asia)
FACE structure	12 m diameter, 6 tower ring, 12 m height
CO2 treatment levels	Ambient+0,Ambient+ppm
Treatment start date	August 2017

#being conducted in
Tekam Forest Reserve, Jengka, Pahang

FACE


14.12.2017 14:46


Carbon Dioxide
459ppm
18:25:37 100%
05.02.2018 18:25


CONTROL PANEL

MBOR Awards

"First ' Free Air CO_2 Enrichment (FACE)' System Developed in a Tropical Production Forest"

MALAYSIA BOOK OF RECORDS SDN. BHD. (Co No. 594642-T)
3A-02C, Menara BRDB, 285 Jalan Maarof, Bukit Bandaraya, 59000, Kuala Lumpur, Malaysia.

THE MALAYSIA BOOK of RECORDS

Tan Sri Datuk Danny Oei
Founder

Strive for Excellence

YBhg. Dato' Dr. Abd. Latif Mohmod
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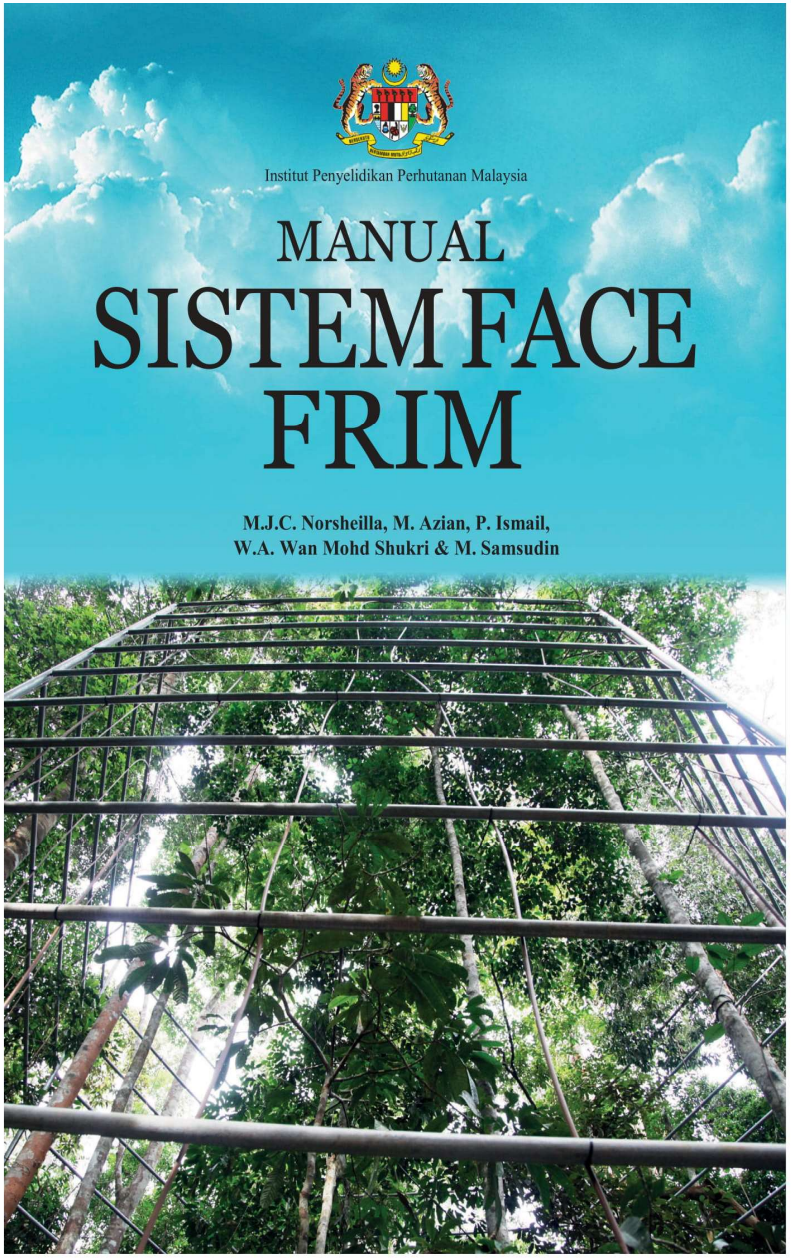
Our Ref: FRIM/NS/5251/18
March 15, 2018

Dear YBhg. Dato',

Re: Certified Entry Into the Malaysia Book of Records :-
"FIRST 'FREE AIR CO^2 ENRICHMENT (FACE)' SYSTEM DEVELOPED IN A TROPICAL PRODUCTION FOREST"
(Starting date: August 3, 2017 ; Venue: Compartment 84, Tekam Forest Reserve, Jerantut, Pahang)

Congratulations for being certified as a national record holder! On behalf of The Malaysia Book of Records, I would like to welcome INSTITUT PENYELIDIKAN PERHUTANAN MALAYSIA (FRIM) to our family of high achievers.

Published manual



CURRENT SMART FOREST PROJECT BY FRIM

Brief Information

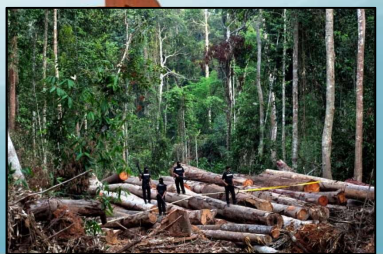
- FRIM has received allocation for the proposed SMART FOREST project, funded by Government of Malaysia under 12th Malaysian Plan (2021-2025).
- Develop and testing the Smart Forest in FRIM campus and Terengganu (a forest concessionaire).
- Services on the system by MIMOS and related universities/ IT companies.
- FRIM is working with Forestry Departments and KPKKT, Terengganu (a forest concessionaire) on the testing.

Problems & Issues

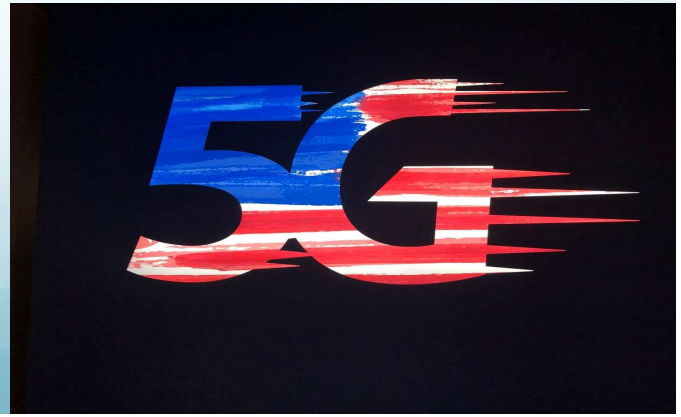
- Forest data and information not integrated and not in the form of digital
  - Data not in digital form
  - No *one stop center* for data and information
  - Difficulties in data & info retrieval

- Difficulty in Forest Resource Planning
  - Forest management plan
  - Decision making process

- Continuous and real time monitoring difficulty
  - Encroachment & illegal activities
  - Forest stand health
  - Clean water supply
  - Forest fire
  - Carbon stock & Climate change
  - Carrying capacity



Current Malaysian Government Policy and Program



Example of existing Smart Forest concept of forest monitoring by MIMOS (Malaysian Institute of Microelectronic Systems)

Technology Summary

IoT-Based Smart Forest Monitoring and Surveillance System Monitoring and surveillance system for remote monitoring application

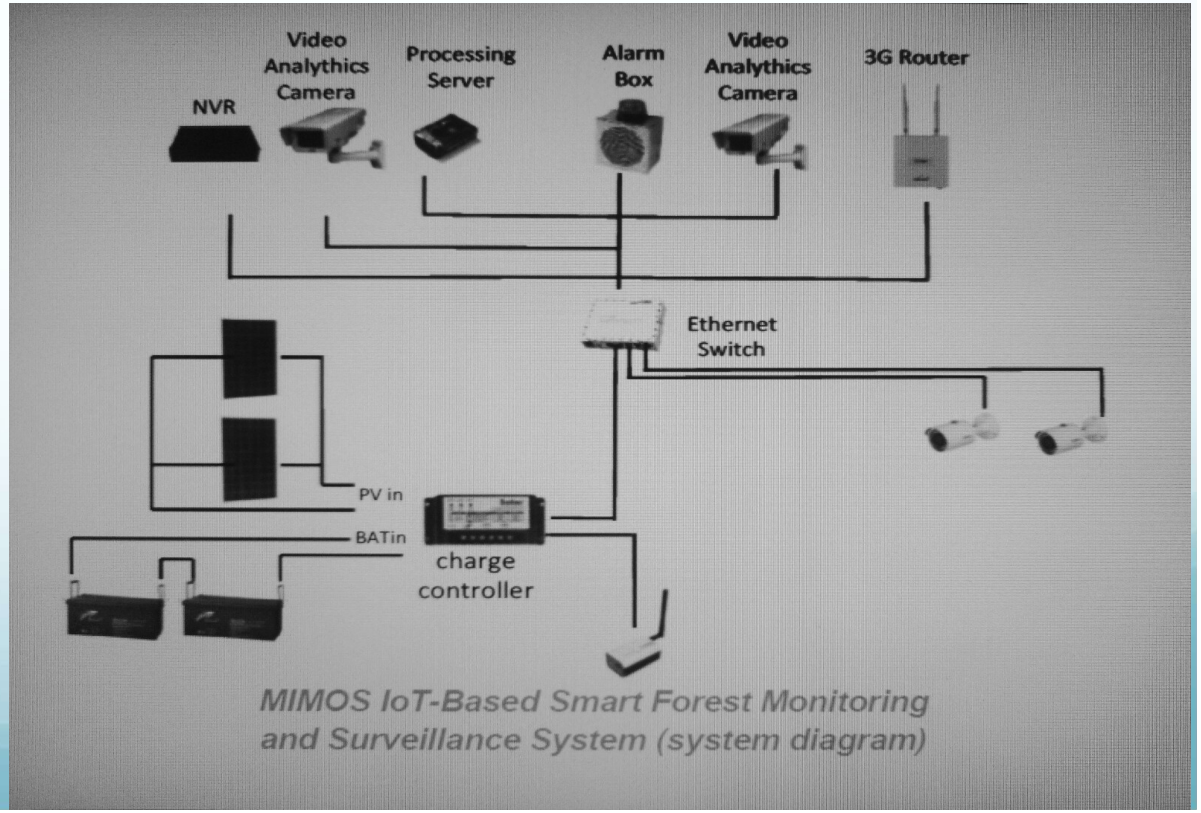
Industries: Forestry, Government

Features:

- Camera surveillance
- Trespassing detection
- Alert system
- Report generation
- User notification

Technology Benefits

- Reduction in human intervention
- Connectivity in unconnected areas
- Enhanced security
- Flora and fauna protection



CONCEPT SMART FOREST

Satelite Image

Forest

- IoT Perimeter Control
- IoT Temperature
- IoT Weather
- IoT GPS
- IoT Dendrometer
- IoT Waterlevel
- IoT Motion Camera

Forest Mangement Information System (FMIS)
Forestry Data, Vector Data Raster Data, administrative boundaries, slope, drainage, forest type,
density, soil, site quality and non-spatial data

Web Application

Application Server

Satellite Communication

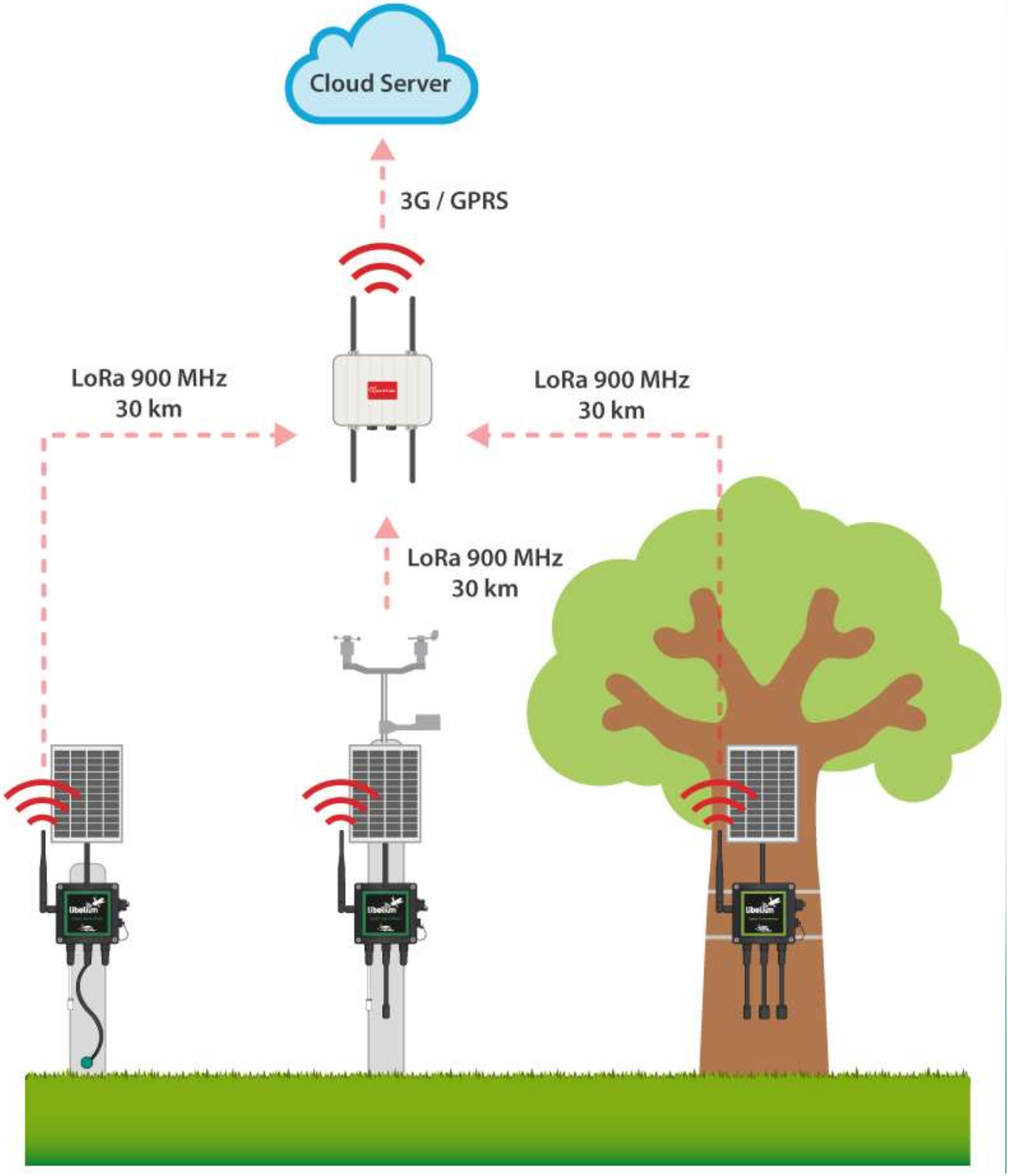
IoT Gateway

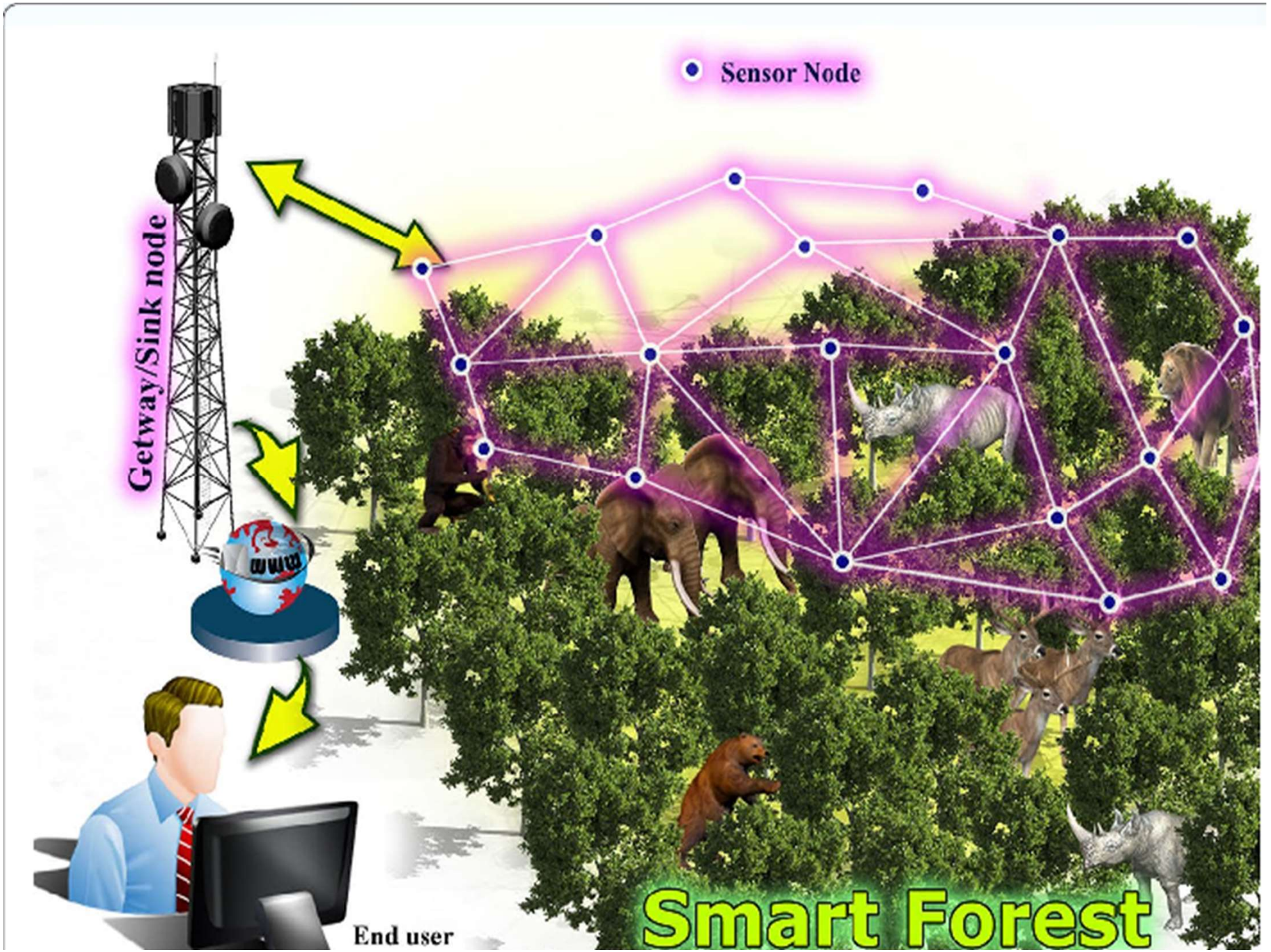
IoT Gateway Tower

GPRS

Communication Server

Main challenge: poor signal in forest areas.




Sensor Node
Getway/Sink node
End user
Smart Forest

SENSORS/EQUIPMENT TO BE USED

- Drones and satellites images for monitoring of forest operation.
- Surveillance sensors/cameras for boundary control.
- Sensors for water level/hydrological parameters.
- Sensors/camera trap for wildlife.
- Dendrometers for forest growth.
- Surveillance cameras in forest recreation areas.

CONCLUSION

- ✓ Smart Forest system is believed to the future way managing forest resources.
- ✓ Limited movements and cost-effective (longer term).
- ✓ This R&D is to prove that latest technologies are useful and in line with the needs in forestry sector for research and forest management/conservation.
- ✓ Needs to increase expertise among the foresters~ improve knowledge on the use of the technologies (~training enhancement in forestry schools).

Acknowledgements:

- **Dr Khali Aziz Hamzah (Director General FRIM)**
- **Dr Ismail Harun (ex-Fellow FRIM/ President, Institute of Forester-IRIM)**
- **Mr. Mohd Rizuwan Mamat (Project Leader Smart Forest, FRIM)**
- **Mr. Azharizan Mohd Norizan (Secretariat/member Smart Forest Project, FRIM)**
- **Dr Samsudin Musa (ex-Fellow FRIM/ Project Manager ICCFS, UNDP).**
- **Dr Azian Mohti (Senior Research Officer FRIM)**