

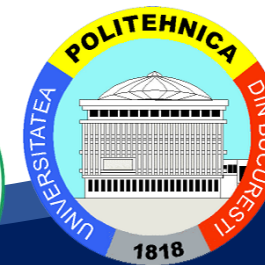


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Advanced Optimization: Techniques and Industrial Applications

Module 3: Optimization and Its Applications in Industry 4 Era



Curriculum Development
of Master's Degree Program in

Industrial Engineering for Thailand Sustainable Smart Industry

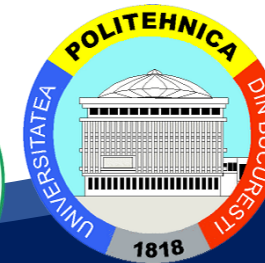


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Session 3.2:

Optimization (Opt) concept and Its Applications in Industry 4.0 Era



Curriculum Development
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Industrial Engineering for Thailand Sustainable Smart Industry



3.2 Optimization (Opt) concept and Its Applications in Industry 4.0 Era

- **Digital** describes electronic technology that generates, stores, and processes data.
- **Digital technology** means that devices more compact, faster, lighter, and more versatile. Huge amounts of information can be stored locally or remotely and moved around virtually instantaneously.
- **Optimization** as the process of using digital technology to improve existing operating processes and/or business models and digital transformation as the process of exploiting the latest digital technologies
- **Digital optimization** is the process of using digital technology to improve existing operating processes and business models.



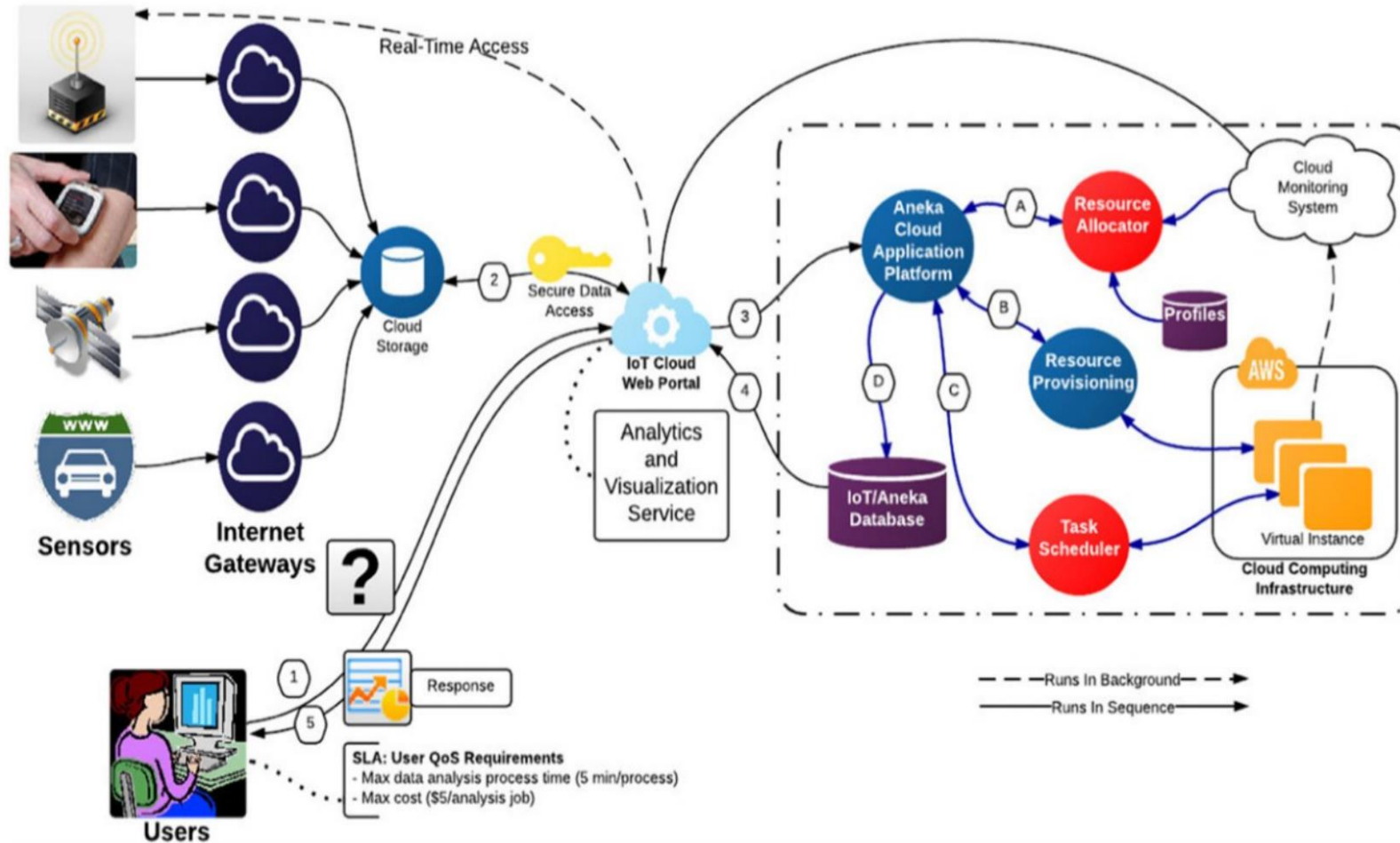


3.2.1 Optimization concept in Industry 4.0 era

- Traditional prescriptive analytics and decision-making methodologies are inadequate to fully capitalize on the unprecedented opportunities due to the **explosion in big data** and the **need to make decisions in real-time**.
- A real-time data collection leads to the issue of handling and analyzing dynamic big data
- A real-time data (i.e., from sensors, GPS, camera, or connected devices) may keep arriving and changing, and so any optimization must be efficient and dynamic.
- Developing an optimization model with a large amount of real-time data is one challenge.
- I4.0 facilitates the vision and execution of intelligent automation and **enables faster, more flexible, and more efficient processes to reduce costs, produce higher- quality goods, and enhance customer service.**



3.2.1 Optimization concept in Industry 4.0 era



Source:
https://pdfs.semanticscholar.org/72c4/d8b64a9959ea45677ca1955d3491ef0f1c62.pdf?_ga=2.76056273.536293324.1570544037-789585656.1570544037





3.2.2 Optimization applications in Industry 4.0

Example 1: Application of Industry 4.0 technologies in waste collection solutions and the optimization



Figure xx. The Waste Collection Cloud and its connections with the cyber-physical waste collection system including customers, garbage trucks, waste management sites and customer support (Bányai et al., 2019)



3.2.2 Optimization applications in Industry 4.0

- **Example 2: Semiconductor fab operations**
- Real-time dispatchers (RTD) determine the dispatching, routing, and sequencing rules for each wafer, vehicle, and machine to maximize the productivity/yield.

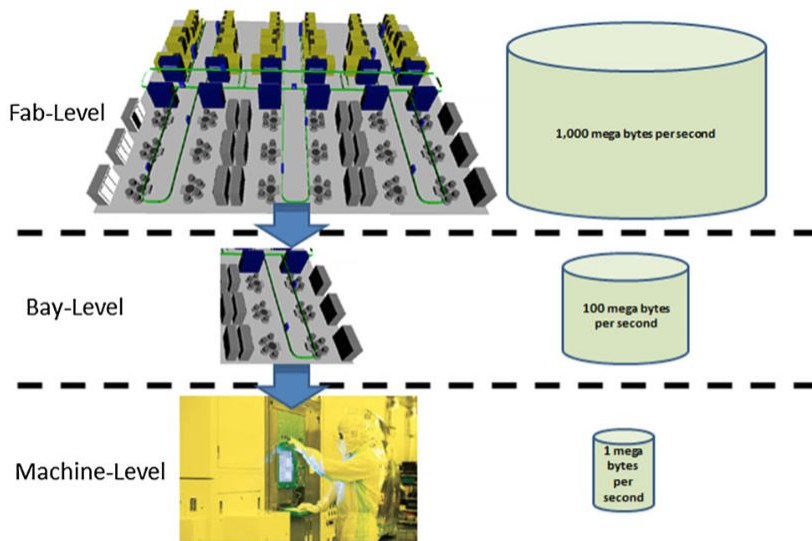


Figure 1 Big dynamic data challenge in semiconductor manufacturing. (Source: Xu et al., 2016)

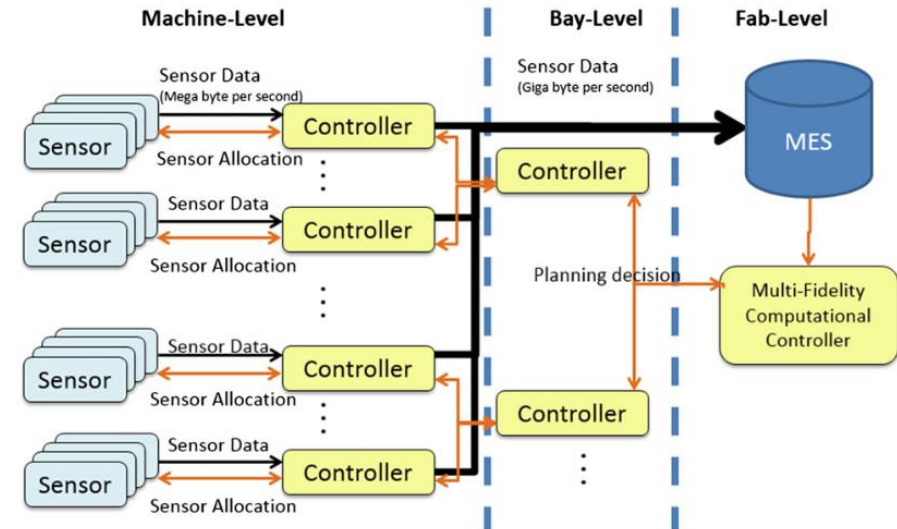


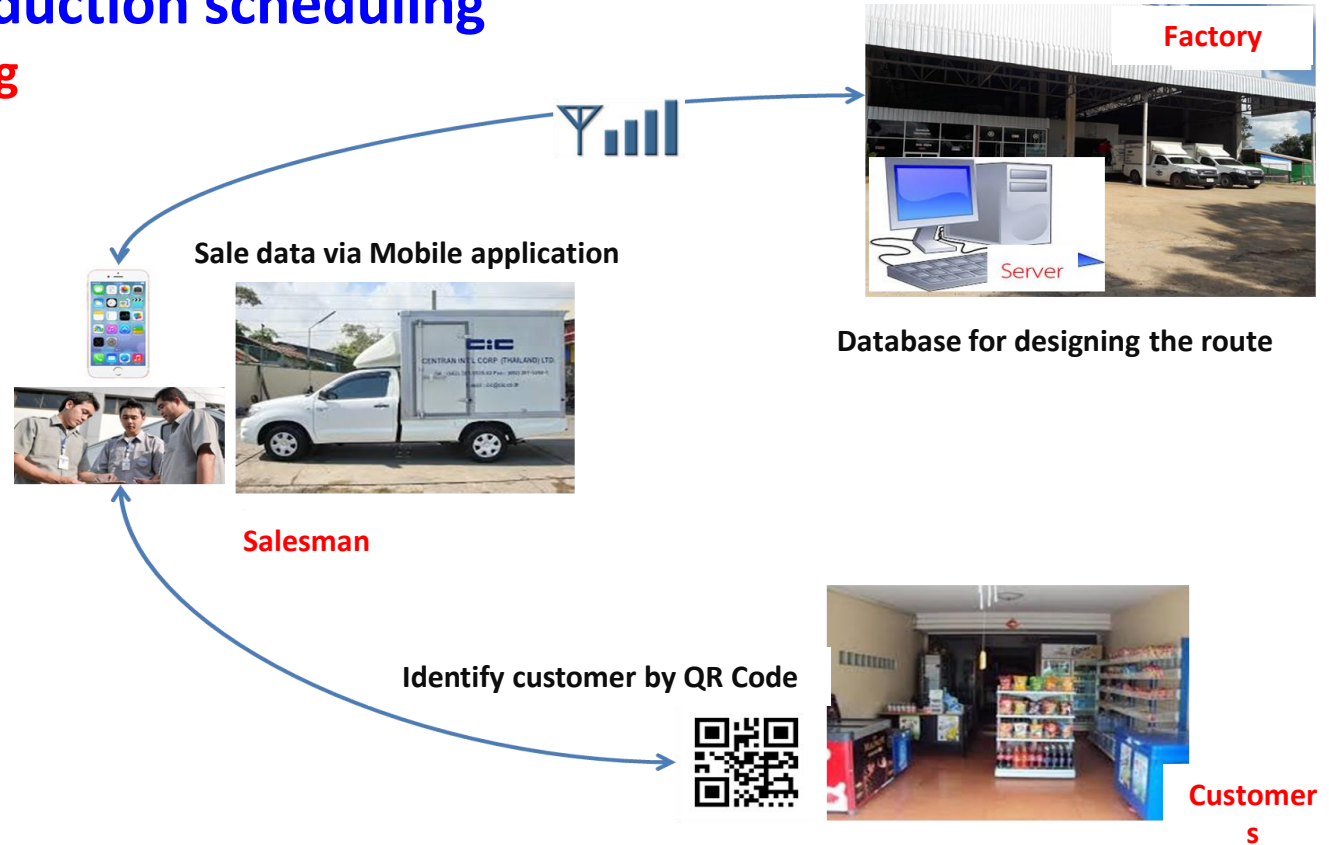
Figure 2 Hierarchical computational paradigm. (Source: Xu et al., 2016)

3.2.2 Optimization applications in Industry 4.0

Example 3: Ice transportation and production scheduling

Challenges of the traditional ice manufacturing industry:

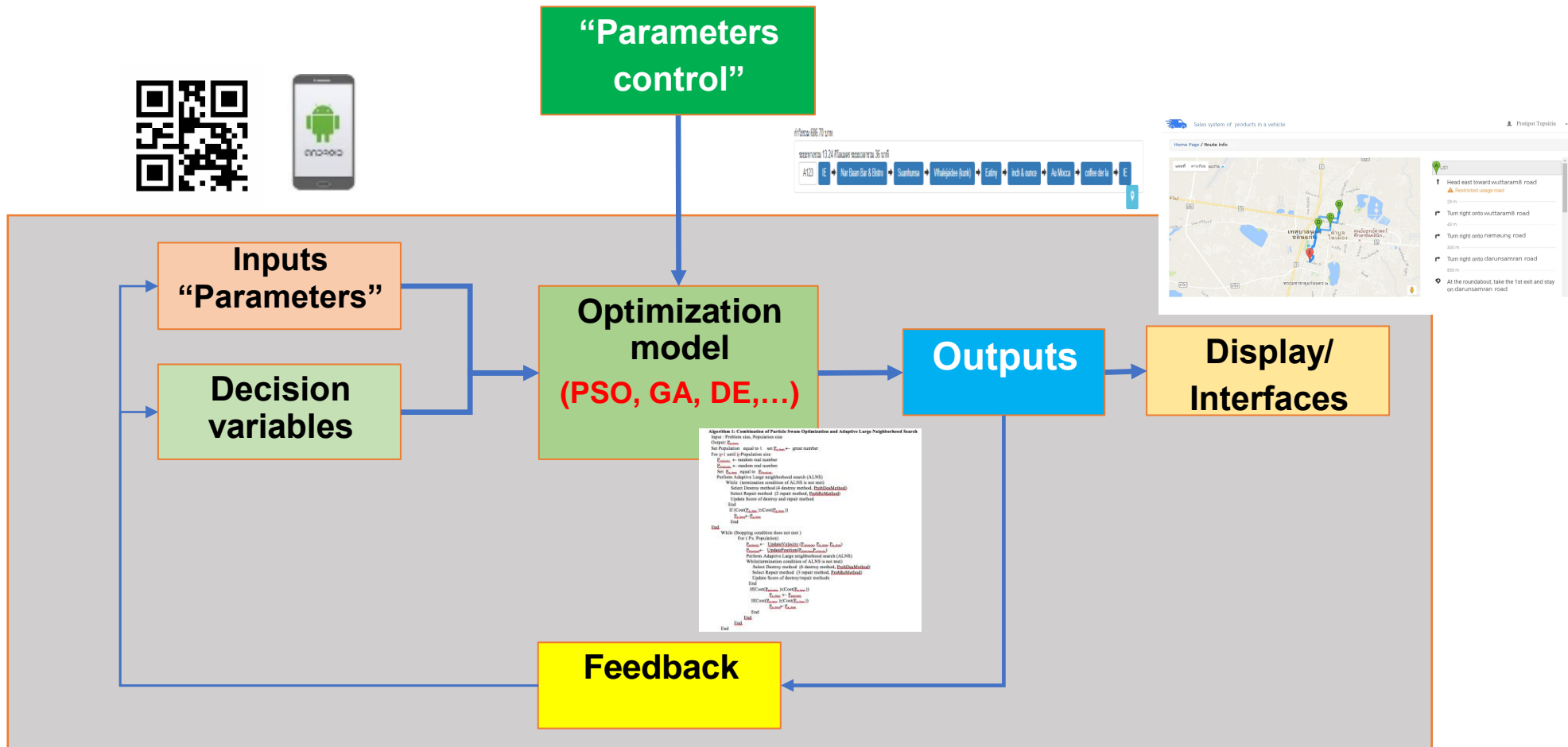
Objectives:



Proposed Transportation software architecture and mobile application



Systemic flow diagram





Database system and mobile application in ice transportation “Input parameters”

Customer data

Code, name, route, contact info

Product Sale System

Report

Daily Sale Report Sale Daily Report by product type Demand Report

Route

Update Distance & Time Route Determination

Setup

Name's Title	Province Data	Amphure	District Data
Types of Vehicles	Product Unit	Product Type	Product Data
Route No.	Span of age	Vehicles	Ice Container
Types of Customers	Competitors	Share Market	Objective Data
Customers	Distribution/Factory	Distance/Time	Salesman Data

Product Sale System

Home / Customer

Customer


#	Customer Code	Customer	Route No.	Mobile Number
1	C2003015	Tawandang Khon Kaen	สาย 2	081 260 0760
2	C2003016	Tong Plapao	สาย 2	085 014 4140
3	C2003017	Green Hotel Khon Kaen	สาย 2	043 247 222
4	C2003018	KB coffee	สาย 2	087 796 5656

Make QR Code for customer

Product Sale System

Home / Customer / Edit Customer Data

QR Code Customer Data Contact Person Ice Bucket Data Average Sale Volume Others



Save

Database system and mobile application in ice transportation

“Parameter controls of the Optimization model”

Home / Route Determination Running for the optimum route

Route No. สาย 3	Date to send product 13/05/2020	Start time to send product 06:00	Max travel time for each route (min) 240	Differential price 3.00
No. of particles 20	Iteration 100	Max of consecutive iterations not producing an improving solution 5	No. of DC 1	

No. of particles No. of iterations

Calculate **Route computing**

Click "Export" to export data to calculate by other softwares' algorithms and click "Import" to import the results to this program

Export Choose file No file chosen

- Select the route
- Input parameters





Database system and mobile application in ice transportation

Solutions for route optimization and distribution location using actual distance Interfacing with Google map

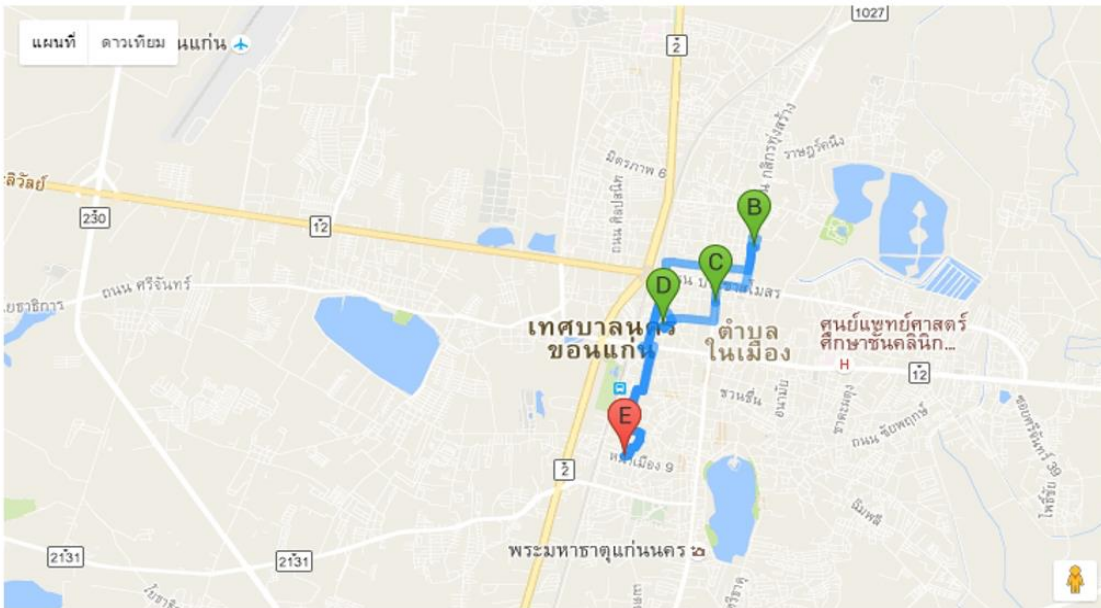
Display/Interface of the outputs



Sales system of products in a vehicle

Pratipat Tepsirin

Home Page / Route info



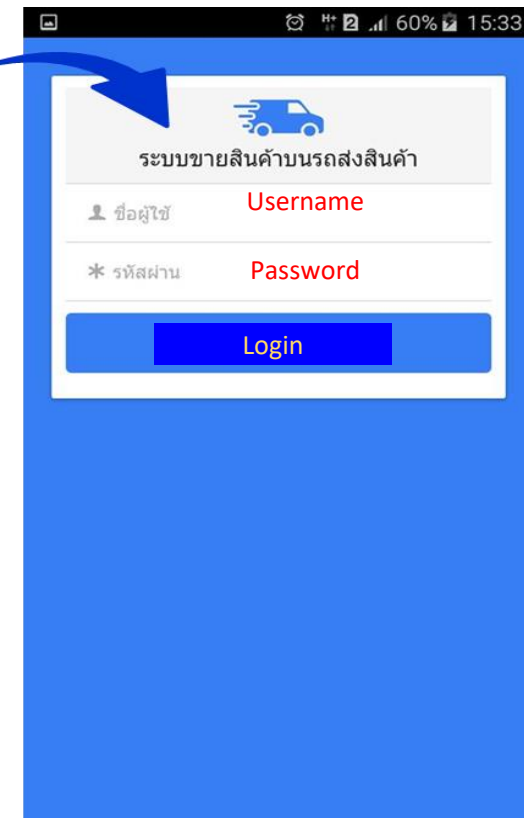
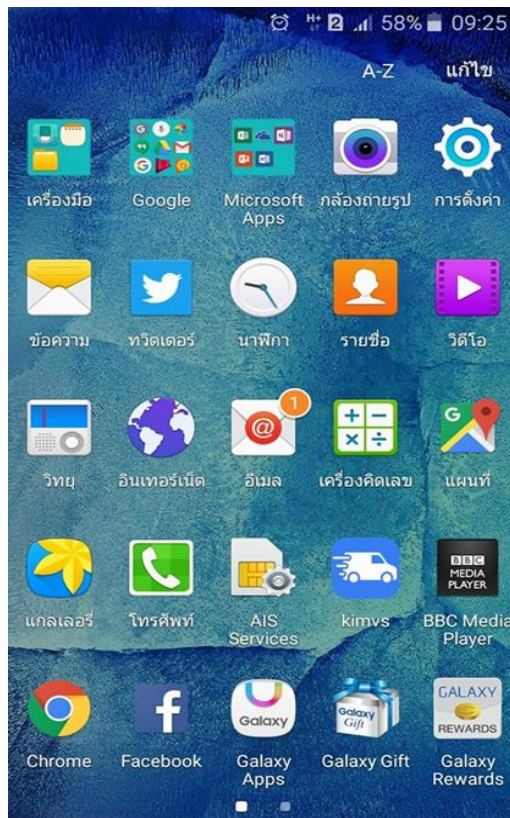
- A LS1
- ↑ Head east toward wuttaram8 road
⚠ Restricted usage road
29 m
- ➡ Turn right onto wuttaram8 road
43 m
- ➡ Turn right onto namaung road
300 m
- ➡ Turn right onto darunsamran road
850 m
- 📍 At the roundabout, take the 1st exit and stay on darunsamran road

Route info



Mobile Application

Login to the system





Database system and mobile application in ice transportation

Mobile Application

Sales

