



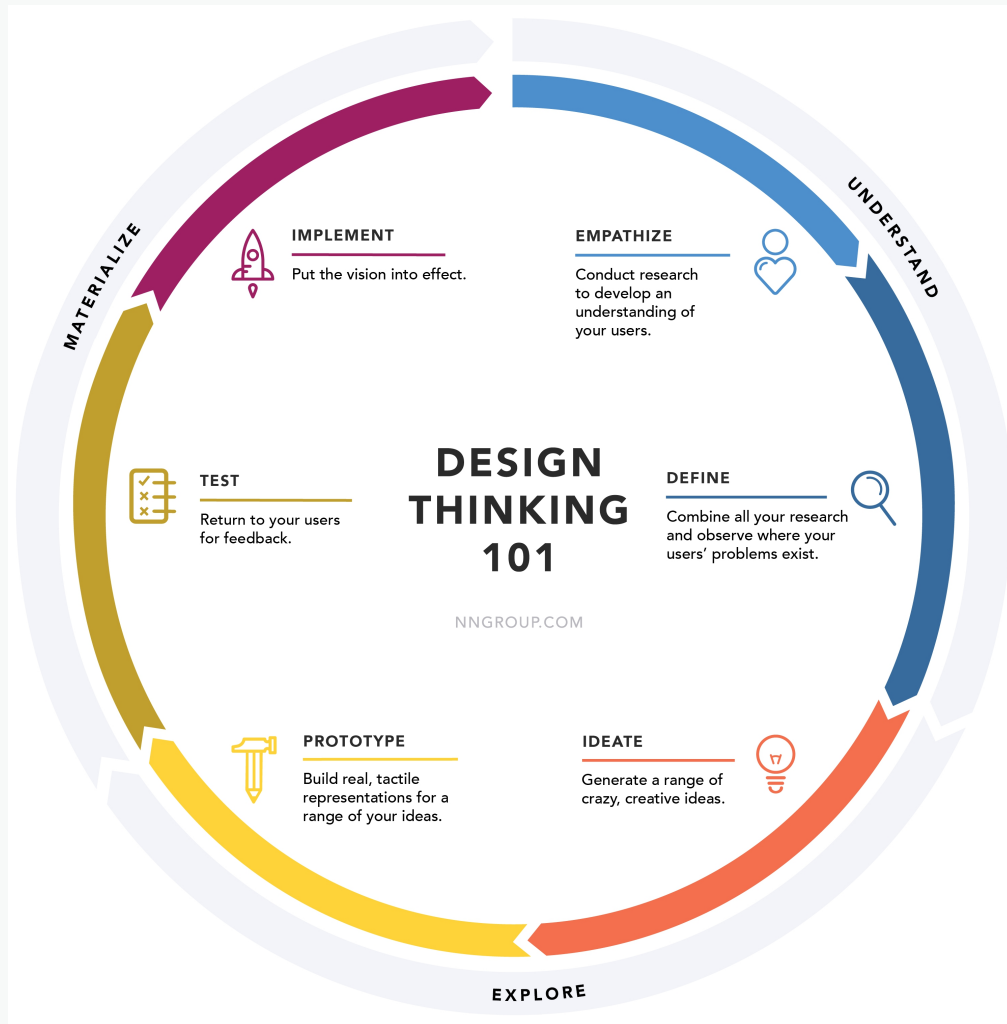
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Education : Universiti Teknologi Petronas [December 2020]
Major in Information Systems

Job : Android Mobile Developer

Program Applied : Digital Development

Problem Solving Approach



1. Emphasize

Do research based on case study such as understanding the term of foot traffic and how retail business works.

2. Define

Understand deeply the scope of case study and whom will involve.

3. Ideate

Thinking all possible solutions for the define problem statement.

4. Prototype

Create a prototype based on finalize idea.

Case Study:

With Internet of Things (IoT) on the rise, one of Maxis’s big retail clients is seeking to innovate in this space.

They want to understand foot traffic of shoppers in their stores across the nation.

Problem Statement:

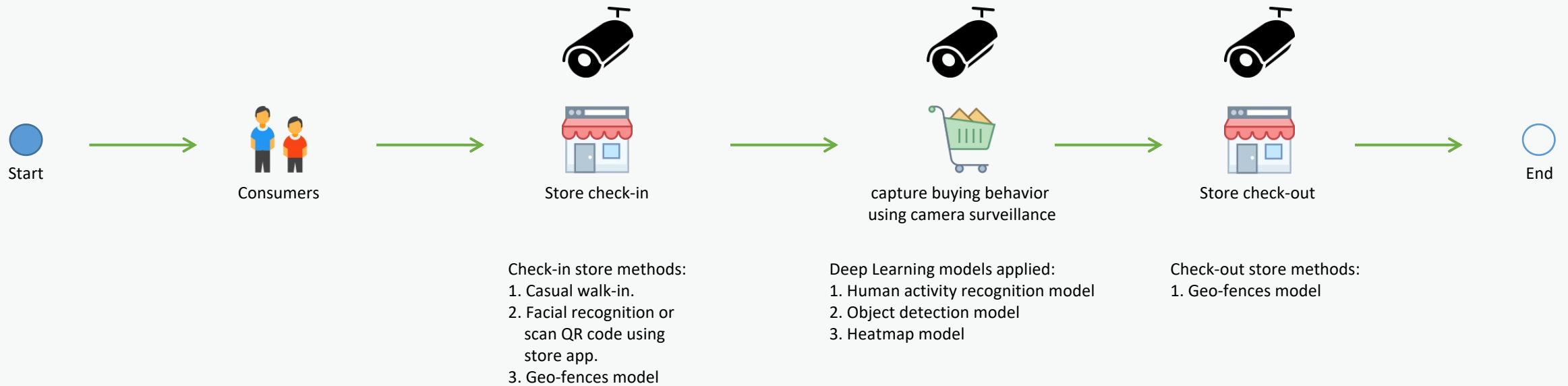
Understanding foot traffic is really vital for any business especially the retail sector as they do hold a various number of products in the inventory. Hire a counter person at the entry point is one of the traditional ways to understand foot traffic. Having monthly statistics of consumers won’t be enough to completely understand and analyze how the business approaches and sales revenues doing.

With IoT technology implementation such as object detection and heatmap, these technology able to do beyond than counting consumers such identify consumer behavior, able to analyze best and poor product segment and able to properly manage staffing schedule.

Client’s Persona:

- Name: ABC Hypermarket
- Outlet: More than 150 outlets across nationwide.
- Product: Household, grocery, wet and dry goods.
- Request: To further understand and analyze consumers’ foot traffic by venturing into IoT technology sector.

Solution: Foot Traffic Analysis using Computer Vision with supports Deep Learning AI Model

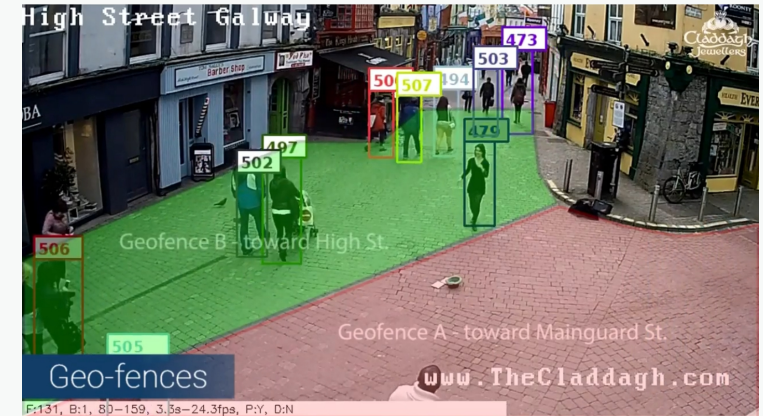


Pros and Cons for Store Check-in Methods

	Casual Check-In	Facial Recognition / QR Code (Custom Store App)
Pros	<p>Clients:</p> <ul style="list-style-type: none"> - able to analyze general consumers' buying behavior such type of goods bought and average time spent in the store. 	<p>Clients:</p> <ul style="list-style-type: none"> - able to retrieve and analyze specific consumer's buying behavior such as type of goods bought and time spent in the store based on unique ID. - able to create personalized promotions for the consumers through app notification. - able to improve consumers's trust and loyalty. <p>Consumers:</p> <ul style="list-style-type: none"> - each registered consumer will have their own unique ID. - able to keep track of goods bought, total cost amount and time spent in the store through the app. - an alternative for paperless receipt. - fast check out without need to queue for cashier if integrated online payment available.
Cons	<p>Clients:</p> <ul style="list-style-type: none"> - Human error in manually processing huge amount of data may lead to inaccurate data process and report. <p>Consumers:</p> <ul style="list-style-type: none"> - Unable to keep track of goods bought and the total amount spent in the store if they lost the receipt paper. 	<p>Clients:</p> <ul style="list-style-type: none"> - Need to clearly state how the data gathered being utilized without affecting consumers' privacy issues. <p>Consumers:</p> <ul style="list-style-type: none"> - Data privacy issues.

Capture Consumers Buying Behaviour Explanation

Deep Learning Model	Explanation
1. Geo-fences model	<ul style="list-style-type: none"> - Provide analysis of consumers' presence in the designated area. - Assist clients in determine the current and total number of consumers in the store. - Assuming the green area as inside store area and red area as outside store area, while the line between these areas as checking point to determine the consumers' position. - As consumers cross into green area, each consumer will be assign an id by object detection model which simultaneously works with the human activity recognition model to keep track of their buying behavior and movement in the store. - Data collected: Consumers' position based on X and Y position in camera frame.
2. Human activity recognition model	<ul style="list-style-type: none"> - Provide analysis of consumers' body movement in the store such as pickup or return goods on the racks, and a number of interactions between staffs and consumers. - Assist clients in understanding consumers requests and able to provide a better training for staffs in interacting with consumers. - Data collected: Consumers' body movement such walking, pick up goods and interact with staffs.



Geo-fences model



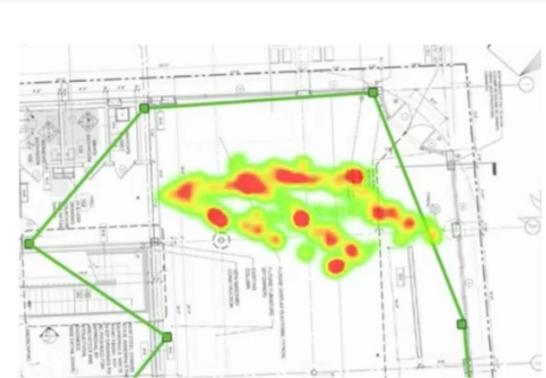
Human activity recognition model

Capture Consumers Buying Behaviour Explanation

Deep Learning Model	Explanation
3. Object detection model	<ul style="list-style-type: none"> - Provide analysis of the type of goods pick up and purchased by consumers. - Assist clients in identifying the best and poor products segment in the store. - Data collected: Images of items pick up or interact with by consumers.
4. Heatmap model	<ul style="list-style-type: none"> - Provide analysis of hotspot area visited by consumers in the store. - Assist clients in determining the best possible products segment arrangement around the store to improve the consumers' engagement at least visited products segment. - Data collected: Consumers' geo-location movement from entry point until exit point of the store.

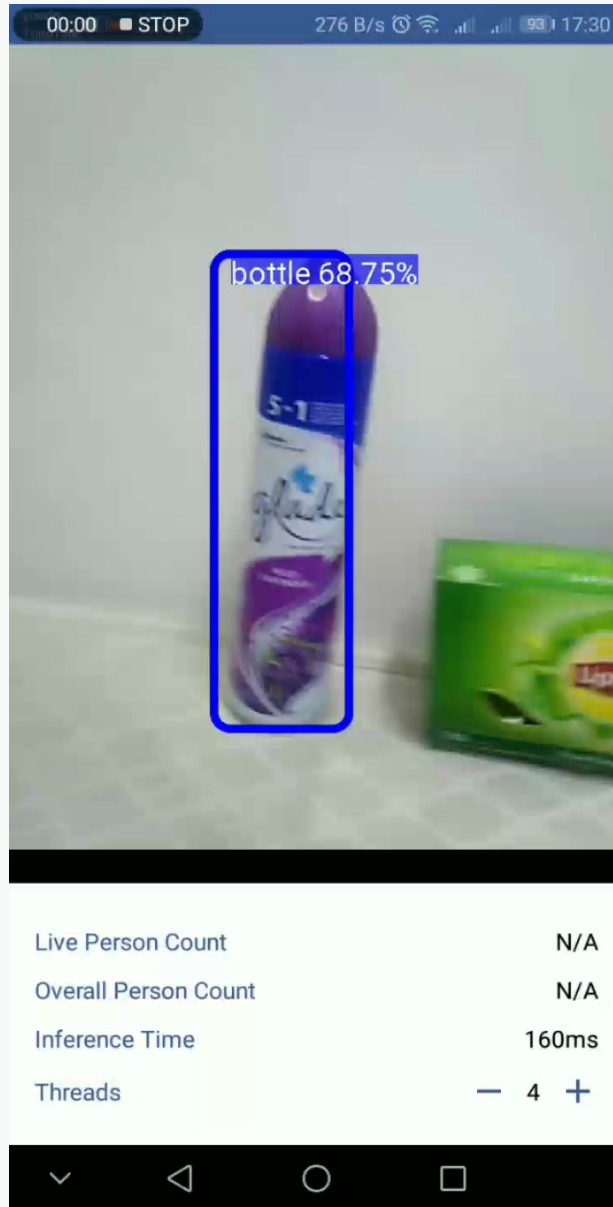


Object detection model



Heatmap model

Android App Demonstration using Object Detection Model



Tools used:

1. App Development - Android Studio (Java).
2. Object Detection Model - Tensorflow Lite for mobile app compatibility.
 - i) Inference time : time taken to process image input and display result based in model.
 - ii) Thread : to increase image time processing (limited to mobile processor capacity).