

# Project Proposal

*ANLY482 Analytics Practicum*



# SMU

SINGAPORE MANAGEMENT  
UNIVERSITY

## **Analytics Cafe**

Chen Shiqi

Tan Wei Lin Joanna

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## 1 Introduction

Sponsor Company	HoiPOS
Point of Contact	Calixto Tay
Team Members	Chen Shiqi Tan Wei Lin Joanna

## 2 Overview

HoiPOS<sup>1</sup> provides innovative point-of-sales (POS) systems to the Food and Beverages sector. The company offers efficient and innovative tablet POS systems for their clients while giving themselves a competitive advantage by providing useful analytics solutions to aid business owners in making business decisions. It is important for restaurants to know how to exceed customer satisfaction in order to stimulate current growth in sales through repeat customers and to attract new customers.<sup>2</sup>

The data collected from HoiPOS systems is enormously extensive; it stores and records more information compared to traditional systems that usually only take into account the sales amount and profits. As HoiPOS systems are integrated into tablets, the data collected covers more than just sales figures. It includes information such as time taken to serve a certain dish, which combination of dishes are often ordered together and more.

## 3 Motivation

1. Traditional POS systems are used mainly for completing orders and payments from a terminal. Data collected from these systems are hence limited to sales figures. A successful F&B business should not only analyse sales figures but also other aspects of the business such as efficiency of the current operations, inventory stocking, marketing campaigns and etc.
2. As HoiPOS systems are programmed to offer a broad array of features such as sending/receiving orders to/from the kitchen, modifying orders, completing orders, and completing different modes of payments for an order. The data that

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<sup>1</sup> See more about HoiPOS <http://www.hoipos.com>

<sup>2</sup> Mining Restaurant Data: Knowing Your Customer - <http://www.hospitalityupgrade.com/magazine/magazine-Detail-ID-522-Mining-Restaurant-Data:-Know-your-customer..asp>

is collected from these functions are more comprehensive compared to data from traditional POS systems. By analyzing and making sense out of these data, it could help businesses identify trend and find out information that is unknown to them and thus helping them improve, profit and efficiency. While the current analysis is helpful as it compares historic data and real-time data to compare trends and identify pitfalls and successes in the business, the visualizations used can be improved to offer a more comprehensive understanding of the data.

3. Most of HoiPOS competitors do not offer visualizations of data that is actually useful to businesses. Merely identifying that a business has performed better last week than this week does not provide useful information to the owners. Knowing the cause of last week's better performance will be more useful as they can replicate the cause to achieve success again. An example would be identifying which particular item's popularity is contributing to the better sales performance in the business allows the owner to inform the kitchen to prepare a certain dish at a faster rate will translate to higher table turnover rate.
4. Furthermore, most of HoiPOS competitors do not offer comprehensive visualizations of the data analysis which often confuses the client and hence not maximizing the potential of the information extracted from the data.

## 4 Objective

The objective of this project is to provide an interactive dashboard of different visualizations of data collected from HoiPOS systems. The project aims to improve HoiPOS' data visualizations as well as add more visualizations of data analysis to value-add their POS system to clients. This project also aims to be able to apply descriptive analytics and effective visualizations to gain insights not only on the sales performance but also operations and marketing campaigns.

The final product will consists of an interactive visualization dashboard which will be designed to provide visualizations that can be easily understood by the layman as well. Intuitive functions such as cross filtering, will be implemented to allow business owners to conduct exploratory data analysis without needing technical knowledge. To ensure that the dashboard is easy to use, the team will also conduct several user testing with stakeholders.

The main objective of the project would be to develop the following functions/visualizations:

#### A. Filter data by date/time

- This allows to choose certain periods of the year to analyse as different seasons of the year could have a higher anticipated sales performance e.g restaurants near F1 location during F1 event
- Being able to view analysis of data at a more micro level also allows the business owner to understand which time periods are peak periods and hence make better human resource deployment decisions quickly
- Anomalies in the data can also be noticed quickly and will be able to have a reference point of why the anomaly happened using the date and time. E.g Spike in orders during F1 event

#### B. Dashboard for visualizations

- Sales Performance over time:
  - i. Includes overview of sales, average amount earned a day, number of orders, target analysis and more
  - ii. Compare historic data and real-time data to notice gaps and/or trends
- Association Analysis of items
  - i. To allow users to identify popular combination of items. This information is useful when crafting marketing campaigns e.g combo meals of the popular combinations of items
- Visualization of Popular Items
  - i. To allow users to identify most popular items and/or identify items that are least popular. This information informs users about items that are not being ordered frequently could be removed from the menu to reduce wastage and costs
  - ii. Exploring further for Popular Items - Visualization of Popular Items Modifier
    1. To allow users to identify the most popular item modifier i.e hot/cold options for a cup of tea. This information may prompt users to modify the menu to accommodate for the popular preferences.
  - iii. Users will be able to cross-filter the data using time as a variable to see the popular items at different time periods
- Visualization of Productivity Analysis
  - i. Users will be able to analyse time taken to prepare different food items and how it varies across the day. This insight will be able to aid business owners in making operational decisions with regards

to human resource and productivity in the kitchen.

- Cross-filtering
  - i. Allow users to quickly have a glance of different set variables across a few different visualizations.

## 5 Data

The data are provided by the sponsor in CSV format. The data consist of information of the order such as the staff in charge, order time, purchased item, promotion, discount, mode of payment. The required data will be extracted out and further processing will be done.

Note: Due to NDA, the company whose data were collected will not be disclosed and we will be using PLU code to represent the product.

## 6 Scope and Methodology

### 6.1 Data Exploration

Study the ER diagram to understand what data and how it stored in the database. Understanding how the data are linked and identify what data will be required to create the visualization and perform analysis. After identifying the variable needed, we will request the sponsor to extracted the data from the database.

### 6.2 Data Preparation

Ensure that the data are of valid structure and correct format. Join the necessary file together to allow for creating of visualization.

### 6.3 Visualization of Sales across Time

Graph will be created for the user to view the sales across time. The graph will also allow the user to be able to quickly view the trend. They would be able to see when are the peak period where there are more sales and better allocate manpower to meet the demand. They can also and make comparison for the sale across different time period to know if they are performing better or worst.

Graph consideration: Calendar view/Horizon Graph

## **7.4 Visualization of gross sales, revenue, number of orders**

This graph will allow the user to see the value of the gross sales amount, revenue and number of order for different time period. The user should be able to see how well they are performing with a gauge or a marker to indicate the target.

Graph consideration: Bullet Graph

## **6.4 Association Analysis of Items**

The graph will show the breakdown of food by categories such as main course, dessert and drinks. The purpose of this graph is to see what items the customer normally purchase together in order to come up with promotional bundle or discount to increase the customer return rate.

Graph consideration: Parallel Sets/Sankey Diagram

## **6.5 Visualization of Popular Items and modifier using cross-filter**

This graph is to show sales of the different product to see which are the most popular item and modifier. Cross filter function can let the user identify which are the most popular item across different time. They can also see the increase or decrease in sale for the product compared to the previous week or month. The user can see which product is least popular and constantly rank at the lower tier and consider removing the item from the menu to prevent extra cost incurred from making the product and minimize food wastage.

Graph consideration: Treemap/Sunburst Diagram and bar chart with cross filter

## **6.6 Visualization of Productivity Analysis**

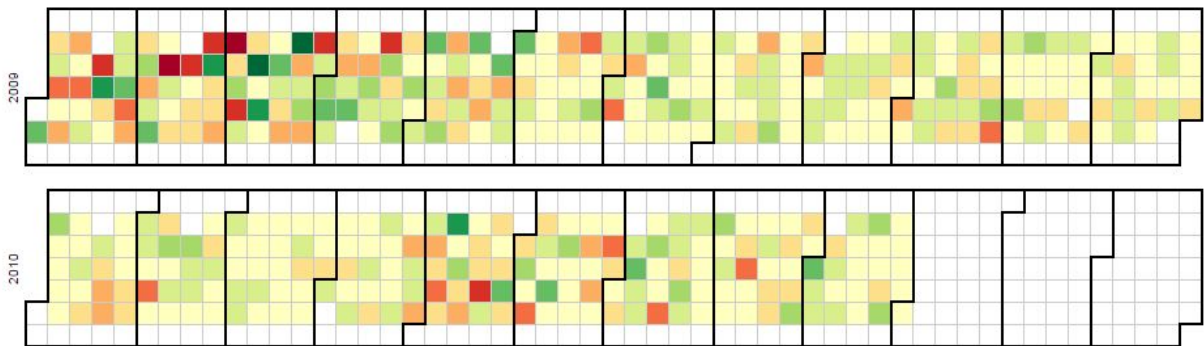
This graph shows the time taken to prepare a particular dish over the course of the day. As there might be a few of the same dishes being prepared at the same time, an aggregation will be implemented to the variable. This graph will be able to inform users how long it takes to prepare a dish during different periods e.g peak hours vs non-peak hours. Understanding this data will allow business owners to identify when there is a spike in the time taken to prepare the dish at a certain time period, and hence might consider improving productivity through increasing human resource or increase kitchen equipment.

Graph in consideration: Bar charts and area chart with cross filter

## 7 Visualizations

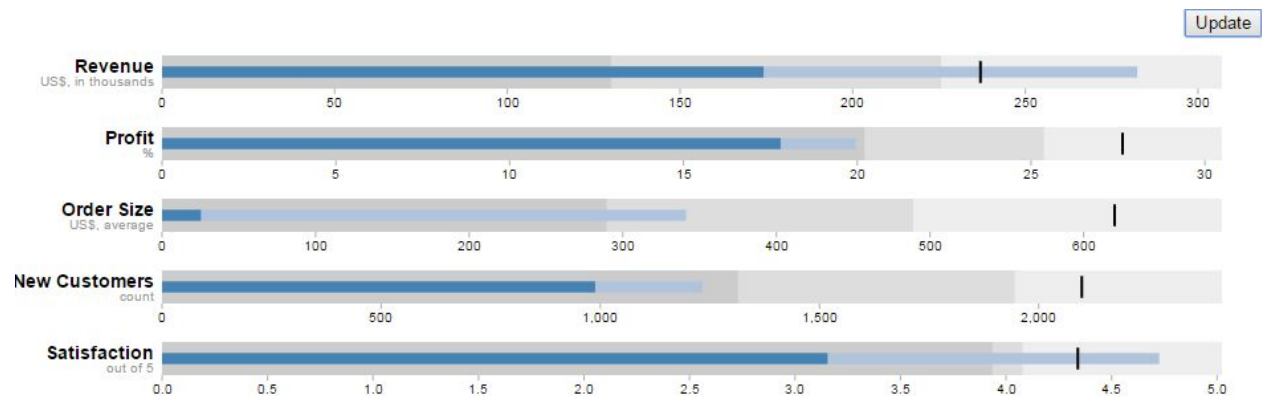
The following graph are taken into consideration for the dashboard.

### 7.1 Calendar View



The calendar view<sup>3</sup> chart allows user to easily know when there is a high profit and when the profit is average via the color attribute. User could also make comparison for sales across different weeks and months easily and more accurately by looking at weekend or weekday respectively instead of having to check what day it is. From this chart, we would be able to see make comparison and identify trend for sales across weekday/weekend, different week, month and year.

### 7.2 Bullet Graphs<sup>4</sup>



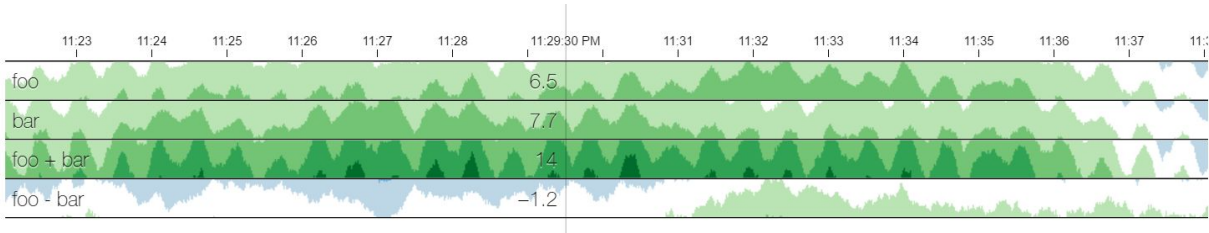
<sup>3</sup> See more about Calendar view chart here: <https://bl.ocks.org/mbostock/4063318>

<sup>4</sup> See more about Bullet graphs at <https://bl.ocks.org/mbostock/4061961>



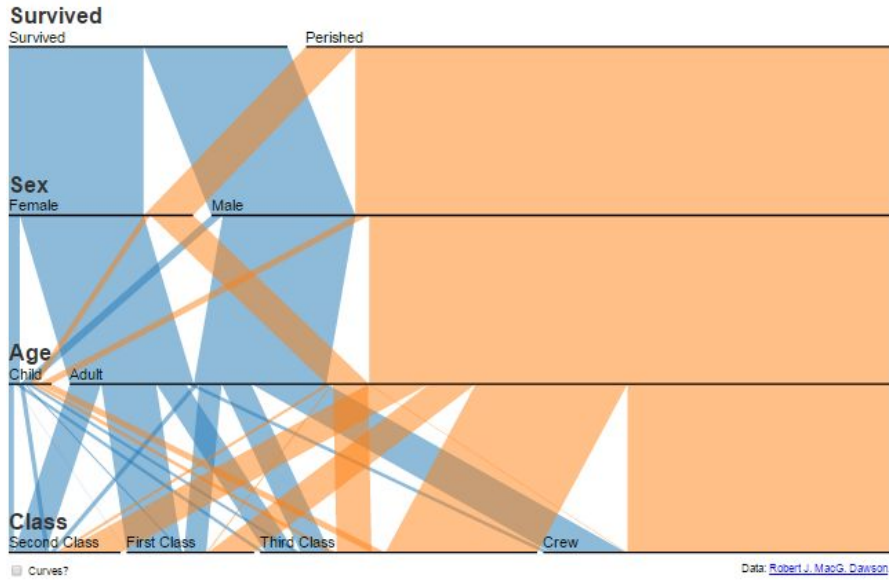
This graph allow user to see mutiple thing on one chart. The user can see the value such as revenue of the current selected time period and compare it against a set of range to see which range category it currently fall user and the marker could show the target achieve for the previous time period and allow user to see how much different is the value.

### 7.3 Horizon Chart for Number of Orders



This graph allows user to compare the number of orders taken at different times of the day.<sup>5</sup>

### 7.4 Parallel Sets

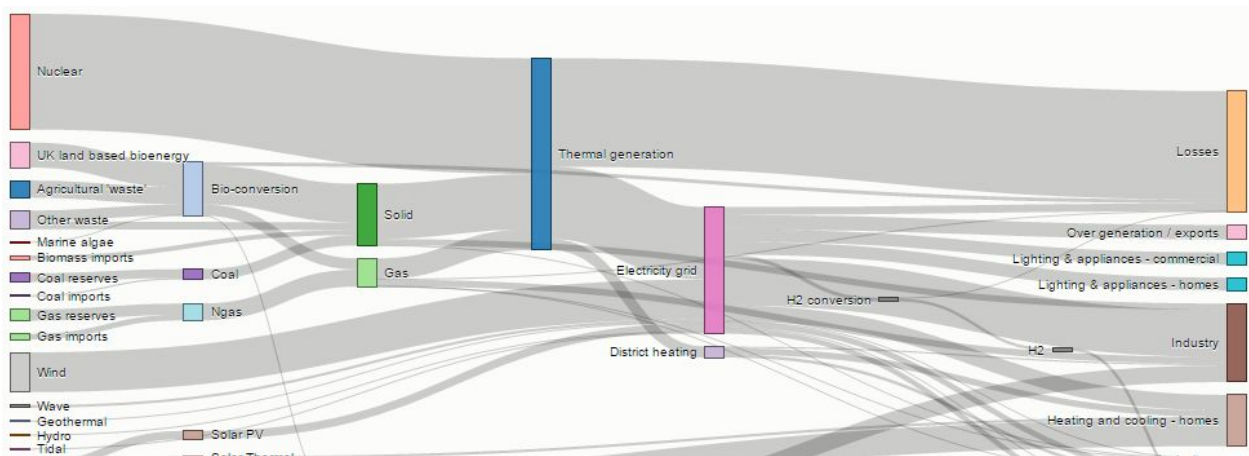


This graph allow the user to see the multiple dimension. It allow the user to see the dimension and its subcategories.<sup>6</sup>

<sup>5</sup> See more about Horizon Charts at <https://square.github.io/cubism/>

<sup>6</sup> See more about parallel set at <https://www.jasondavies.com/parallel-sets/>

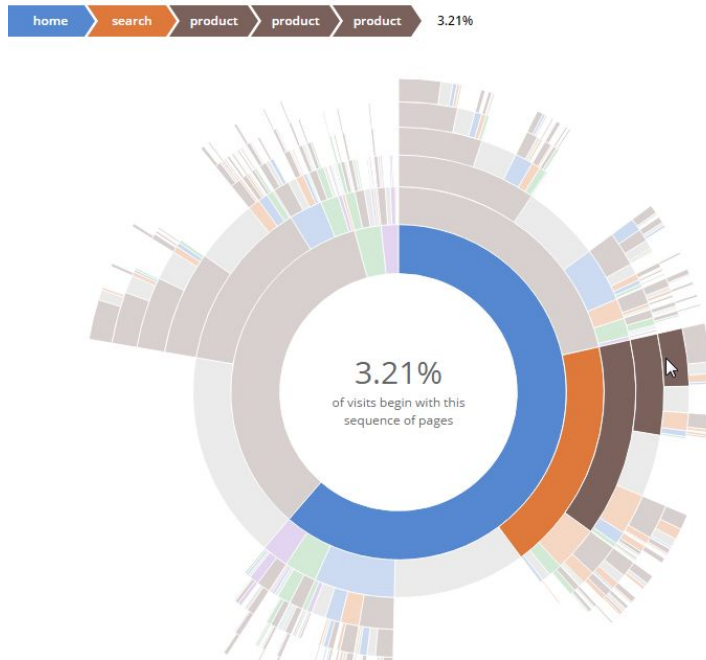
## 7.5 Sankey Diagram



This graph allow the user to see the flow and the thickness of the line could represent the popularity. <sup>7</sup>

<sup>7</sup> See more about sankey diagram at <https://bost.ocks.org/mike/sankey/>

## 7.6 Sequence Sunburst Diagram



The diagram can show the data in sequence so it will be useful for identify the most popular item and the modifiers. <sup>8</sup>

## 9 Technology

- D3.js

D3.js is a JavaScript library for manipulating documents based on data.

- Dc.js

dc.js is a javascript charting library with native crossfilter support and allowing highly efficient exploration on large multi-dimensional dataset (inspired by crossfilter's demo).

- JMP Pro

JMP Pro is a statistical analysis software from SAS that provides all superior capabilities for interactive data visualizations, exploration, analysis and communication.

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<sup>8</sup> See more about sequence sunburst diagram at <http://bl.ocks.org/kerryrodden/7090426>

- nvD3.js

An extension library consisting of re-usable charts and chart components for d3.js without taking away the power that d3.js gives you.

- Tableau

Tableau Software helps people see and understand data. Tableau helps anyone quickly analyze, visualize and share information.

- React.js

A javascript library for building user interfaces that is frequently used in conjunction with d3.js.

## 8 Timeline and Schedule (Gantt Chart)

TASK	Member-in-charge	WK 1	WK 2	WK 3	WK 4	WK 5	WK 6	WK 7	WK 8	WK 9	WK 10	WK 11	WK 12	WK 13	WK 14	WK 15	Status	
<b>REQUIREMENT GATHERING</b>																		
Gather requirements from client	Joanna																	Planned
Tools exploration	Shiqi																	Actual
Draft Proposal	Joanna																	
Submit Final Proposal	Shiqi																	
Update wiki	Joanna																	
<b>Milestone 1: Submission of Proposal</b>																		
<b>DATA CLEANING &amp; EXPLORATION</b>																		
Obtain datasets	Shiqi																	
Data exploration	Joanna																	
Scope refining after data exploration	Shiqi																	
<b>VISUAL ANALYTICS</b>																		
Research and brainstorm for most suitable visualizations for data and context	Joanna																	
Design mock-up of prototype	Shiqi																	
Present mock-up to sponsor	Joanna																	
Modify mock-up	Shiqi																	
Update wiki with finalized mock-up	Joanna																	
<b>PROTOTYPE</b>																		
Begin Coding	Shiqi																	
Review and Revise Prototype with Sponsor and Supervisor	Joanna																	
<b>IMPLEMENTATION: ITERATION 1</b>																		
Visualizations for sales performance (over time)	Shiqi																	
Visualizations for popular items and modifier	Joanna																	
<b>MIDTERM</b>																		
Update and refine wiki for Midterm	Shiqi																	
Midterm report write-up	Joanna																	
Midterm presentation slides preparation	Shiqi																	
<b>Milestone 2: Midterm Presentation</b>																		
<b>IMPLEMENTATION: ITERATION 2</b>																		
Visualizations for association analysis of items ordered	Joanna																	
Visualizations for productivity analysis	Shiqi																	
Improve application based on midterm feedback	Joanna																	
User Testing with Stakeholders	Shiqi																	
Modify and improve based on feedback	Joanna																	
<b>FINAL</b>																		
Final Report Write-up	Shiqi																	
Update and refine Wiki	Joanna																	
Prepare presentation slides for final presentation	Shiqi																	
Final Presentation	All																	
Final Submission	All																	
<b>Milestone 3: Final Presentation</b>																		

## 9 Limitations

S/N	Limitations
1	This project does not read from real-time data as it reads from a static csv file. During pass-over of the project and integration, the way to read the data might have to change.

## 10 Risk Management

Risk Type and Description	Implications	Likelihood	Impact	Mitigation
Sponsor might be busy with higher priority business schedules and may not have time to meet the team	Unable to move development forward as user testing will not be possible to be arranged at scheduled date	Medium	High	Upload codes and documentation on Github and allow Sponsor to run codes on local computer and provide feedback through online communication
Sponsor might add or propose changes in prototype frequently	Initial planned schedule might be delayed. Project requirements might not be met due to time constraint.	Low	High	Team to meet sponsor regularly to keep both parties up to date with the latest information.

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