# Funnyland Project Proposal:

Using machine learning models, 1) optimize and automate transfers of inventory resources between stores to maximize revenue and inventory turnover and 2) generate a buy order.

# Agenda:

## Introduction

## Define project scope, objectives, and requirements.

## Identify stakeholders and their roles.

## Develop a project timeline with milestones.

## Breakdown of prototype’s key features and implementation

## Data Extraction and Analysis Process

## Risk assessment and mitigation strategy.

## Quality assurance and testing.

## Detailed documentation

## Monitor project progress and performance.

## Prepare for project closure and evaluation.

## Introduction:

In today's rapidly evolving business landscape, there is a need for efficient and data-driven inventory management solutions. However, there exists a lack of implementation of data evaluation and machine learning analysis in our organization. Therefore, this project aims to leverage machine learning technologies to optimize inventory management and accurately forecast sales trends, leading to better resource allocation, and streamlined stock replenishment processes.

## Project Scope, Objectives, and Requirements:

The scope of this project includes:

* Implementing machine learning algorithms for sales forecasting and inventory allocation.
* Developing an automated algorithm for generating buy orders based on sales predictions and stock levels.
* Integrating the solution with our existing inventory management system - allow for real-time updates.
* Providing an intuitive interface for users to access historical sales data and insights.

The main objectives of this project are:

1. Enhance sales forecasting capabilities to make informed inventory planning decisions.
2. Improve inventory allocation accuracy and reduce stockouts and overstock situations.
3. Implement an automated buy order generation system to ensure timely stock replenishment.

## Stakeholder Identification and Roles:

The key stakeholders involved in the project are:

* Mr Duy (Mentor): Responsible for overseeing the project's budget and resource allocation.
* Ms Huong: End-users who will interact with the system for sales analysis and inventory allocation. (Beta Testing)

## Project Timeline with Milestones:

* Week 1 - 2: Gather project requirements, finalize objectives, and define scope. Prototype and complete the proof of concept.
* Week 3 - 5: Develop sales forecasting algorithms and integrate them with historical sales data.
* Week 6: Implement inventory allocation algorithms based on sales forecasts and current stock levels.
* Week 7: Design and develop the automated buy order generation system.
* Week 8: Conduct data extraction from SERP and set up data storage on MongoDB.
* Week 9: Integrate the solution with the existing inventory management system and conduct initial testing.

## Breakdown of prototype’s key features and implementation:

Sales Forecasting:

* Use a time series model to predict using historical data (Py pandas)
* Identify different features that affect sales such as days of the week, promotions, or holidays.
* Create lag features to capture dependencies.
* Consider different models and produce an output
* Using TensorFlow for deep learning models

Inventory Allocation: Time to stockout appropriately between 2 prototype stores (taking account each store’s stock level and demand forecast)

* Using the forecasted information from feature 2, combined with current stock levels at different stores and reorder points (how often/when should the stock be replenished), implement inventory allocation algorithms.
* Use optimization libraries such as SciPy to implement the algorithm
* Provide a greedy approach to maximise profit (heuristic approach)
* Attempt to provide a real-time update to every stock reallocation and after each bills.

Automated Buy Order Generation:

* Calculate the reorder point (the safety stock level for each item). This depends on a variety of features including but not limited to:
  + The item replaceability
  + The item’s seasonal appearance
  + Lead time
  + Average daily sales
  + Safety stock
  + Price
  + Current stock levels
  + Produce a buy order to account for future sales

## Data Extraction and Analysis Process:

This involves extracting from SERP (Funnyland’s current database) and manipulating using Excel script (VBA).

Using Python Pandas to extract and clean the resulting .csv file and upload it onto MongoDB, where the data will be available for display and analysis.

1. Risk Assessment and Mitigation Strategies:

Potential risks include:

* Data quality issues affecting forecasting accuracy. Inaccurate algorithms.
* Delays in data extraction or integration with the existing system. Leading to inefficient data collections
* Technical challenges in developing complex algorithms. Over-running the schedule.

Mitigation strategies include:

* Conducting thorough data validation and cleansing.
* Establishing clear communication channels with stakeholders to address delays proactively.
* Implementing regular testing and quality assurance measures.

## Quality Assurance and Testing:

Testing will be conducted at each development stage to validate the accuracy of sales forecasts, inventory allocation results, and the buy order generation system. Quality assurance measures will be implemented to ensure the system meets predefined performance criteria.

## Detailed Documentation:

Detailed documentation of all project-related activities, decisions, and progress will be maintained throughout the project lifecycle. This will be recorded on google docs for easy access by the mentor and supervisor. Comments would also be included in the code to assist in understanding and debugging.

1. Monitoring Project Progress and Performance:

Regular project reviews and status updates will be conducted to monitor project progress, assess performance against milestones, and ensure adherence to the project timeline. This is completed once a week at the end of the week, to attend to any issues or modify the schedule/timeline appropriately. This will be done through reviewing update on Google Docs and also the codebase through GitHub.

## Project Closure and Evaluation:

Upon project completion, a comprehensive evaluation will be conducted to assess the project's success in achieving its objectives and meeting stakeholder expectations. Lessons learned will be documented for future reference.

Timeline: 8 weeks

1. **Week 1 - 2: Establish and implement sales forecasting.**
   1. Select appropriate ML models based on data characteristics and forecast requirements.
   2. Train and fine-tune the selected models using historical sales data to generate accurate sales forecasts.
   3. Evaluate the forecasting performance and refine the models if necessary.
2. **Week 3 - 5: Inventory allocation.**
   1. Integrate the sales forecasting results with the current stock levels and reorder points to implement inventory allocation algorithms.
   2. Optimize the allocation algorithms to ensure efficient utilization of resources while avoiding overstock or stockout situations. (take stock levels from different stores and coordinate)
3. **Week 6 - 7: Attempt to generate buy order.**
   1. Set up automated triggers to monitor inventory levels and trigger buy order generation when the stock reaches the reorder point. (must consider ways to transfer data from SERP to the database on a daily basis? Or real-time update)
   2. Implement algorithms to determine the quantity to order based on factors like lead time, historical sales data, and safety stock considerations.
4. Week 8**: Complete data extraction and analysis.**
   1. Finalise scripts and process to extract data effectively and efficiently.
   2. Familarise management of database and MongoDB
5. Re-evaluate
   1. Review the overall performance and effectiveness of the inventory management system, including sales forecasting accuracy, inventory allocation efficiency, and buy order generation process.
   2. Gather feedback from end-users and stakeholders to identify areas of improvement and insights for future enhancements.