12/11/2023

CAPSTONE PROJECT

Bank of Montreal (BMO)

Final Report

Group Members:

Alvin Johnson

Jobin Bennet

Mitulkumar Ahir

Suraj Yadav Alluri

Mani Meghana Ammu

TEAM MEMBERS & RESPONSIBILITIES: 3
EXECUTIVE SUMMARY: 3
PROJECT SELECTED: 4
COMPETITIVE ANALYSIS: 4
SWOT 4
PROBLEM TO BE SOLVED - DESCRIPTION. 6
BUSINESS REQUIREMENTS 7
1 HIGH-LEVEL BUSINESS REQUIREMENTS 7
FUNCTIONAL REQUIREMENTS 7
PERFORMANCE REQUIREMENTS 8
OVERVIEW OF AVAILABILITY REQUIREMENTS 8
OVERVIEW OF TECHNICAL REQUIREMENTS 9
LEGAL REQUIREMENTS 9
OPTIONAL REQUIREMENTS 9
FUNCTIONAL REQUIREMENTS 10
NON-FUNCTIONAL REQUIREMENTS 11
AS-IS PROCESS FLOW 14
TEST STRATEGY 19
SCOPE 20
TEST APPROACH 21
TEST ENVIRONMENT 23
TESTING TOOLS 24
RELEASE CONTROL 24
RISK ANALYSIS 24
REVIEW AND APPROVALS 25
POTENTIAL SOLUTIONS 25
INTERNAL DEVELOPMENT: 25
HYBRID DEVELOPMENT 26
STATUS QUO 27
IMPLEMENTATION STRATEGY 27
1. DEPLOYMENT APPROACH 27
2. TRAINING 27
3. ROLL OUT PLAN: 27
3.1 First phase: 27
3.2 Second Phase 28
3.3 Third Phase 28
4. FALLBACK OPTION 28
5. ITIL PROCEDURE 28

6. DEPLOYMENT METHOD 28
6.2 Push Method 28
7. TIMING AND COST 28
ROI CALCULATION 28
Assumptions: 29
Costs: 29
Benefits: 29
ROI Calculation: 29
DATABASE DESIGN 30
TO-BE PROCESS FLOW 31
TRANSITION REQUIREMENTS 32
REFERENCES 34

Team Members & Responsibilities:

Name	***Role***	***Position***	***Responsibilities***
Meghana	Project Manager	Project Manager	Overall project success, Status Report, Risk Log, Business requirements,
Alvin	Business Analyst	Assistant Project Manager	Ensuring quality, Project Charter, and Test strategies.
Mitul	Business Analyst	Business Analyst	Transition requirements, Implementation strategy, Design options
Suraj	Business Analyst	Business Analyst	Business Stakeholder Engagement Plan, Problem Research, Evaluation criteria
Jobin Bennet	Business Analyst	Business Analyst	Requirement gathering, documentation, Business Analysis Approach

Executive Summary:

Founded in 1817, BMO is a prominent financial institution in Canada with operations primarily focused across the commercial banking, wealth management, and capital market sectors.

The mission statement of BMO, **"To Boldly Grow the Good in Business and Life,"** guides our strategy, inspires our aspirations, and strengthens our dedication to doubling the good.

The Bank of Montreal's trading platform – InvestorLine, needs effective resources that can help in its enhancement procedures by improving the existing application features.

Overview:

Purpose and Mission:

The mission statement of BMO, ***"To Boldly Grow the Good in Business and Life,"*** guides our strategy, inspires our aspirations, and strengthens our dedication to doubling the good. It is how we are advancing our communities, consumers, and coworkers.

About:

Financial and banking services are offered by the Bank of Montreal to both private citizens and businesses.

The Canadian Personal and Commercial Banking (Canadian P&C), American Personal and Commercial Banking (U.S. P&C), Wealth Management, BMO Capital Markets, and Corporate Services sectors are how it does business.

Project Selected:

The Bank of Montreal has a trading platform called **InvestorLine.** To purchase and sell stocks, bonds, options, mutual funds, and other financial products, it offers a range of tools and services to investors and traders. After thorough research and analysis, although it is a safe and reliable platform, the BMO InvestorLine investing platform is not currently at the top of our list of the best Canadian online brokers for 2023.

Many compelling reasons support the proposal to improve the BMO Investor Line platform. Staying ahead is essential in the increasingly competitive Canadian online brokerage sector. BMO wants to surpass changing user expectations for accessibility, innovative technologies, and user-friendly interfaces by modernizing the platform.

Nowadays, Canada welcomes migrants from all over the world as permanent residents and international students. Making an inclusive platform catered to immigrants, international students, and permanent residents is also a crucial opportunity given Canada's varied and expanding population. So, there is an **opportunity to attract more customers to use InvestorLine by enhancing the platform by adding new features and updating the user interface to bring it up to the top of the list of Canada's best trading platforms.**

Competitive Analysis:

Heavy dependency on the North American economy and competition from other financial institutions may affect the market position. Has widespread services across various segments that can help in the continuous engagement of the international population immigrating to Canada.

SWOT

Strengths

Market Reach - The bank is the largest cap firm market capitalization of about $61.7 billion (about $190 per person in the US)

Global Presence - A strong focus on the North American region allows it to have good customer support.
Performance - Consistent income indicates a stable performance of the bank in the industry.
Service - It has diversified services across various sectors like risk and wealth management marketing, along with its ability to afford operational costs and support customer requirements.

Weakness

Dependency: The bank is heavily reliant on the standing of the North American economy and market, allowing it to be affected by any variations in the business/economy decline.
Operational Risk: The bank may need help managing its operational services due to its widespread locations.
Competitiveness: Because of its standing in the market as one of the BIG 4 banks in Canada, BMO faces significant competition from the rest of the banks, which may lead to a decline in its profits and market popularity.
Investment: Rapidly evolving technological needs require better investment in infrastructure/policies to offer good services to clients.

Opportunities

Inflation and supply chain disruption: It poses risks of reduced profit margins, heightened production costs, and potential supply shortages, impacting business stability
The Housing crisis in Canada poses a significant challenge, with soaring home prices and limited affordability, potentially leading to housing insecurity and financial instability for many Canadians.
New Competitors: The rise of innovative fintech companies presents a formidable competitive challenge to traditional financial institutions, necessitating adaptation and innovation to maintain market relevance.
Unacceptance from immigrant customers: The inability to effectively capture immigrant customers represents a missed growth opportunity, requiring targeted strategies to engage and serve this demographic effectively.

Threats

Dependency: The bank is heavily reliant on the standing of the North American economy and market, allowing it to be affected by any variations in the business/economy decline.

Operational Risk: The bank may need help managing its operational services due to its widespread locations.
Competitiveness: Because of its standing in the market as one of the BIG 4 banks in Canada, BMO faces significant competition from the rest of the banks, which may lead to a decline in its profits and market popularity.
Investment: Rapidly evolving technological needs require better investment in infrastructure/policies to offer good services to clients.

Problem to be solved - Description.

The problem to solve revolves around the underperformance of the BMO InvestorLine investing platform, despite being a part of the esteemed Bank of Montreal. Despite its reliability, the platform is not ranking as a top choice among Canadian online brokers in 2023. This presents an opportunity to enhance the platform's appeal and user experience, potentially attracting a larger customer base, including the growing population of migrants and international students arriving in Canada.

The current scenario highlights several key issues:

Competitive Lag: BMO InvestorLine is falling behind other Canadian online brokers in terms of user preference and market share. Despite being backed by a reputable financial institution, its features, user interface, or other aspects might not be aligned with the evolving needs and preferences of investors and traders.

Market Dynamics: Canada's financial landscape is robust, with the Toronto Stock Exchange (TSX) holding significant global assets. However, the concentration in cyclical industries might expose the platform's performance to economic fluctuations, necessitating a robust and versatile platform to navigate these dynamics effectively.

Untapped Customer Base: The influx of migrants and international students represents a sizable demographic that could potentially benefit from investment opportunities.

The solution lies in enhancing BMO InvestorLine's platform to address these challenges:

Feature Enhancement: Adding new features aligned with the diverse needs of investors, such as intuitive mobile trading options, educational resources for beginners, and advanced analytics tools for seasoned traders.

User Interface Revamp: Improving the platform's user interface to make it more intuitive, visually appealing, and easily navigable for a wider range of users, including those unfamiliar with trading platforms.

Cultural Sensitivity and Accessibility: Tailoring the platform to cater to the needs of diverse users, including migrants and international students, by offering multilingual support, culturally relevant investment guidance, and accessible educational materials.

By addressing these aspects, BMO InvestorLine can transform its platform into a frontrunner among Canadian online brokers, appealing not only to existing users but also tapping into the potential of a burgeoning demographic, thereby solidifying its position in Canada's thriving financial landscape.

Business Requirements

1 HIGH-LEVEL BUSINESS REQUIREMENTS

FUNCTIONAL REQUIREMENTS

User Registration and Profile Management:

Users should be able to register accounts securely and manage their profiles.

Trading Functionality:

Enable users to buy and sell stocks, bonds, options, and mutual funds seamlessly.

Watchlist and Alerts:

Allow users to create and customize watchlists and set alerts for price changes.

Portfolio Tracking:

Provide a feature for users to track their investment portfolios in real-time.

Educational Resources:

Include educational materials, such as training videos and seminars, to educate users about the platform and investment strategies.

AI-Driven Insights:

Implement AI-driven insights to provide users with personalized investment suggestions and market analyses.

Customer Support:

Offer effective customer service through various communication channels, ensuring prompt responses to user queries and issues.

INFORMATIVE SECURITY REQUIREMENTS AND PRIVACY PROTECTION

Data Privacy:

Ensure user data privacy by implementing robust data protection measures and adhering to relevant data privacy laws.

Security Regulations: Comply with government regulations related to online financial transactions, including debit and credit card security standards.

Secure Data Migration:
Safely migrate data from the old system to the upgraded platform, ensuring data integrity and security during the process.

PERFORMANCE REQUIREMENTS

Multi-Platform Support:

Ensure the platform is accessible on various browsers, Android, and iPhone devices for a seamless user experience.

UI/UX Design:

Create an intuitive, user-friendly interface with an attractive design to enhance user engagement and satisfaction.

Customization:

Allow users to customize their experience by saving research data and customizing their watchlists for a tailored user journey.

Data Security:

Implement a robust security framework to protect user data and financial transactions from unauthorized access and cyber threats.

AI-Driven Insights:

Develop an AI-driven system that provides valuable insights to users, enhancing their trading decisions and overall experience.

OVERVIEW OF AVAILABILITY REQUIREMENTS

System Availability:

Ensure the platform is available 24/7 with minimal downtime to cater to users in different time zones.

Redundancy and Backup:

Implement redundancy and regular data backups to prevent data loss and ensure continuous availability of services.

OVERVIEW OF TECHNICAL REQUIREMENTS

Data Privacy Compliance:

Adhere to data privacy regulations to protect user information and ensure it is not used for unauthorized purposes.

Security Regulation Adherence:

Uphold security regulations specified by the government to safeguard financial transactions and user data.

Marketing Regulations:

Ensure all promotional activities align with the actual services provided, preventing any conflicts with regulatory guidelines.

LEGAL REQUIREMENTS

Data Migration Protocols

Technology Stack

Integration with Financial Systems

OPTIONAL REQUIREMENTS

Social Media Integration:

Allow users to share their investment strategies, achievements, and market insights on social media platforms, enhancing platform visibility.

Advanced Charting Tools:

Offer advanced charting tools with technical analysis features for users interested in in-depth market analysis.

Virtual Trading Platform:

Provide a virtual trading environment where users can practice trading with virtual money, helping them learn without financial risk.

Tax Reporting Tools:

Develop tools to generate tax reports, help users track their investments for taxation purposes, and provide added value.

Voice Recognition:

Implement voice recognition technology for hands-free navigation and trading, catering to users with different accessibility needs.

Cryptocurrency Trading Support:

Introduce support for cryptocurrency trading, expanding the platform's offerings to include emerging investment opportunities.

Sustainability Investments:

Provide information and options for sustainable and socially responsible investments, aligning with the growing interest in ethical investing.

Solution requirements (functional and non-functional)

FUNCTIONAL REQUIREMENTS

Section	Category	Identifying Number	Description	Priority	Traceability	Notes
Functional Requirement	Management	TR1	To reduce the trading commission.	High	TR-MG1.1	
Functional Requirement	Management	TR2	To Reduce the Minimum Fund Requirement to 0	High	TR-MG1.2	
Functional Requireme	Management	TR3	To eliminate the account fee	High	TR-MG1.3	

nt			for small accounts			
Functional Requirement	User Profile	TR4	To Optimize the view of the portfolio	Medium	TR-UP1.1	For better diversification of investment.
Functional Requirement	User Profile	TR5	News section for the selected portfolio.	Low	TR-UP1.2	
Functional Requirement	Reports	TR6	To Provide Advanced trading analytical tools	High	TR-RP1.1	
Functional Requirement	Reports	TR7	To Provide an Advance Screener	Medium	TR-RP1.2	To shortlist the Stocks or commodity
Functional Requirement	Reports	TR8	To provide the Trade History of the User	Medium	TR-RP1.3	
Functional Requirement	Report	TR9	To Provide Deductions Reports	High	TR-RP1.4	Such As Trading Commission, Tax, and Other Fees.
Functional Requirement	Trading	TR10	To provide one Slide feature for trading the instruments	High	TR-TR1.1	

NON-FUNCTIONAL REQUIREMENTS

Section	Category	Identifying Number	Description	Prioritization	Traceability	Notes
Non-Functional Requirement	Performance	NFR1	The system should respond to user actions within 2 seconds under normal load conditions.	High	NFR-P1.1	
Non-	Performanc	NFR2	The platform	Medium	NFR-P1.2	-

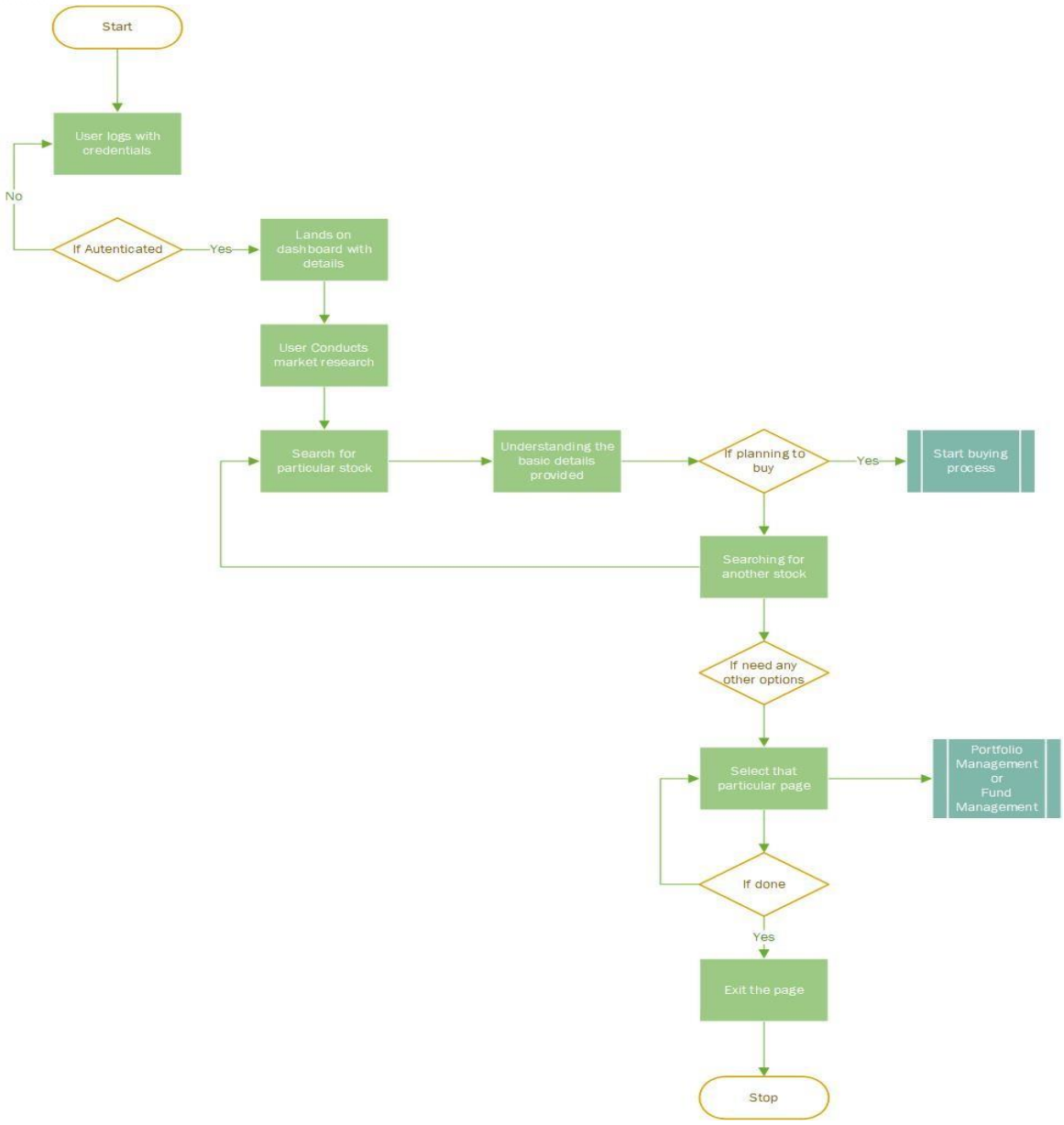
Functional Requirement	e		should handle a minimum of 10,000 concurrent users without significant degradation in performance.			
Non-Functional Requirement	Performance	NFR3	The platform should have a minimum uptime of 99.9% excluding scheduled maintenance.	Low	NFR-P1.3	-
Non-Functional Requirement	Security	NFR4	All user data, transactions, and communications should be encrypted using industry-standard encryption protocols.	High	NFR-S1.1	-
Non-Functional Requirement	Security	NFR5	Two-factor authentication should use methods like biometric verification or secure token generation for enhanced security.	High	NFR-S1.2	
Non-Functional	Security	NFR6	Access to sensitive	Medium	NFR-S1.3	

Requirement			functions and user data should be role-based, ensuring that users can only access what they are authorized for.			
Non-Functional Requirement	Security	NFR7	Maintain an audit trail for all user activities, including logins, trades, and account modifications.	High	NFR-S1.4	
Non-Functional Requirement	User Experience	NFR8	The platform should have an intuitive and user-friendly interface, allowing users to navigate and execute tasks with minimal training.	High	NFR-US1.1	
Non-Functional Requirement	User Experience	NFR9	The platform should be accessible to users with disabilities, adhering to WCAG guidelines for web accessibility.	High	NFR-US1.2	

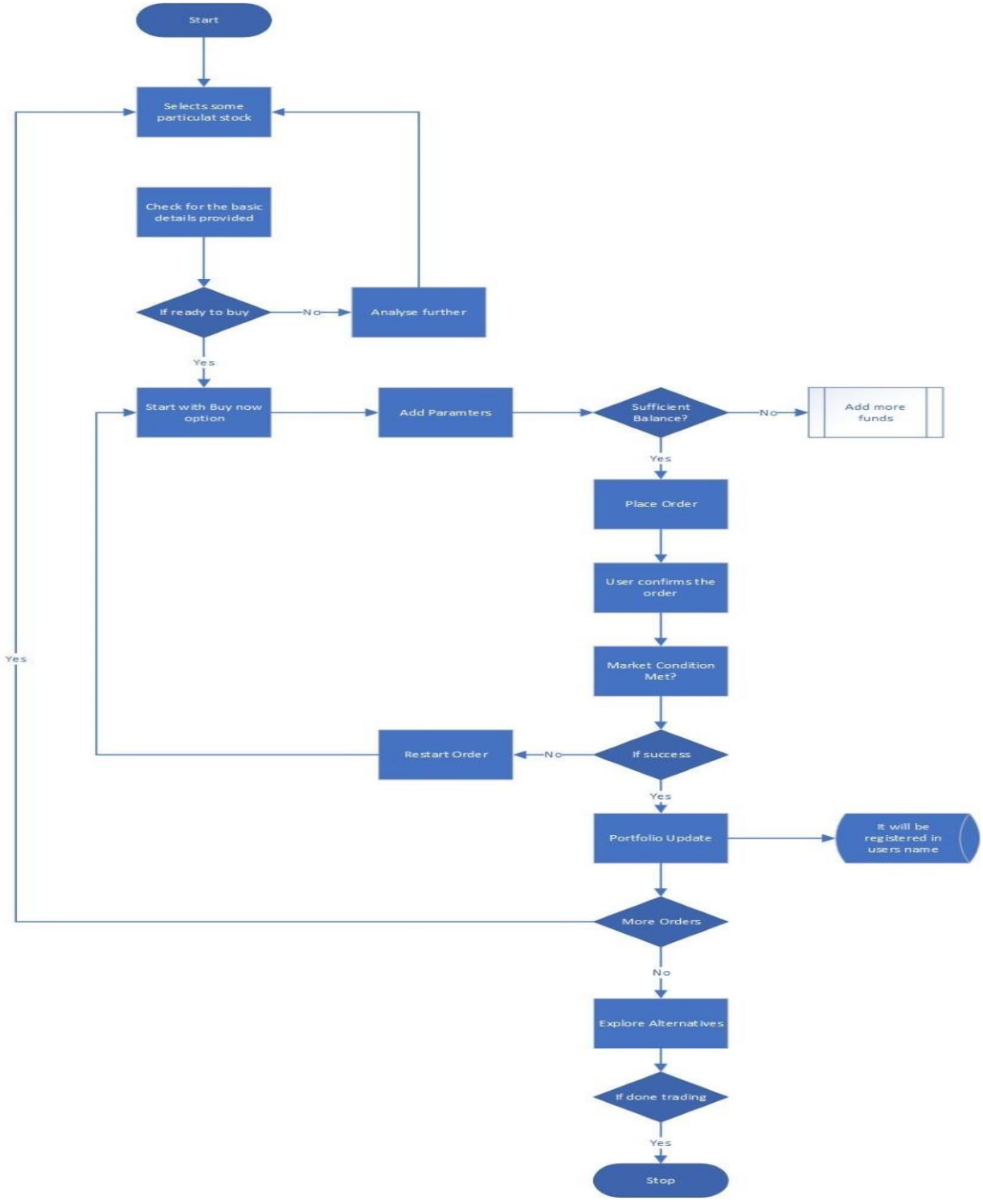
Non-Functional Requirement	User Experience	NFR10	Maintain consistent design elements and features across web and mobile platforms for a seamless user experience.	Medium	NFR-US1.3	

As-Is Process Flow

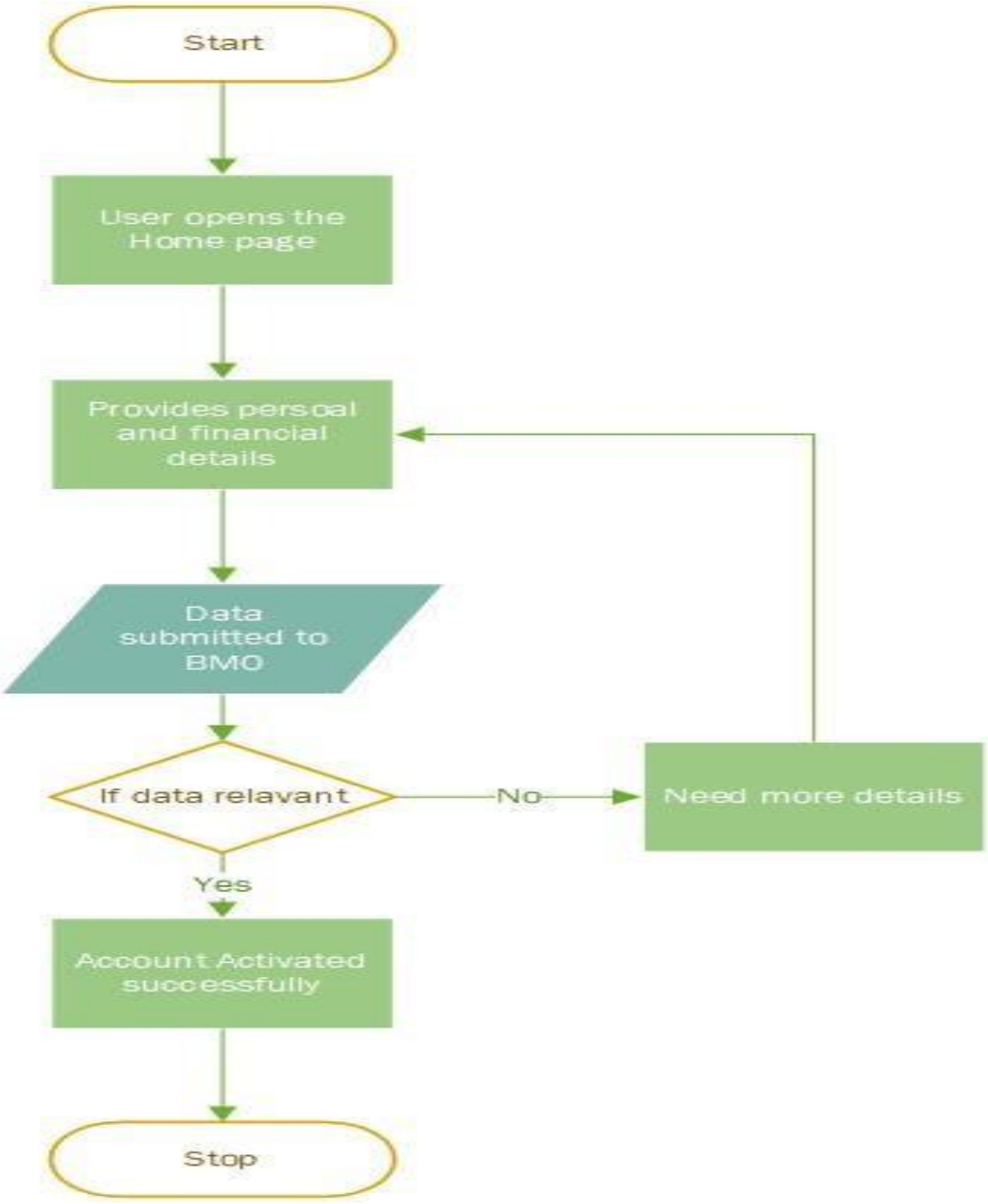
User Interaction



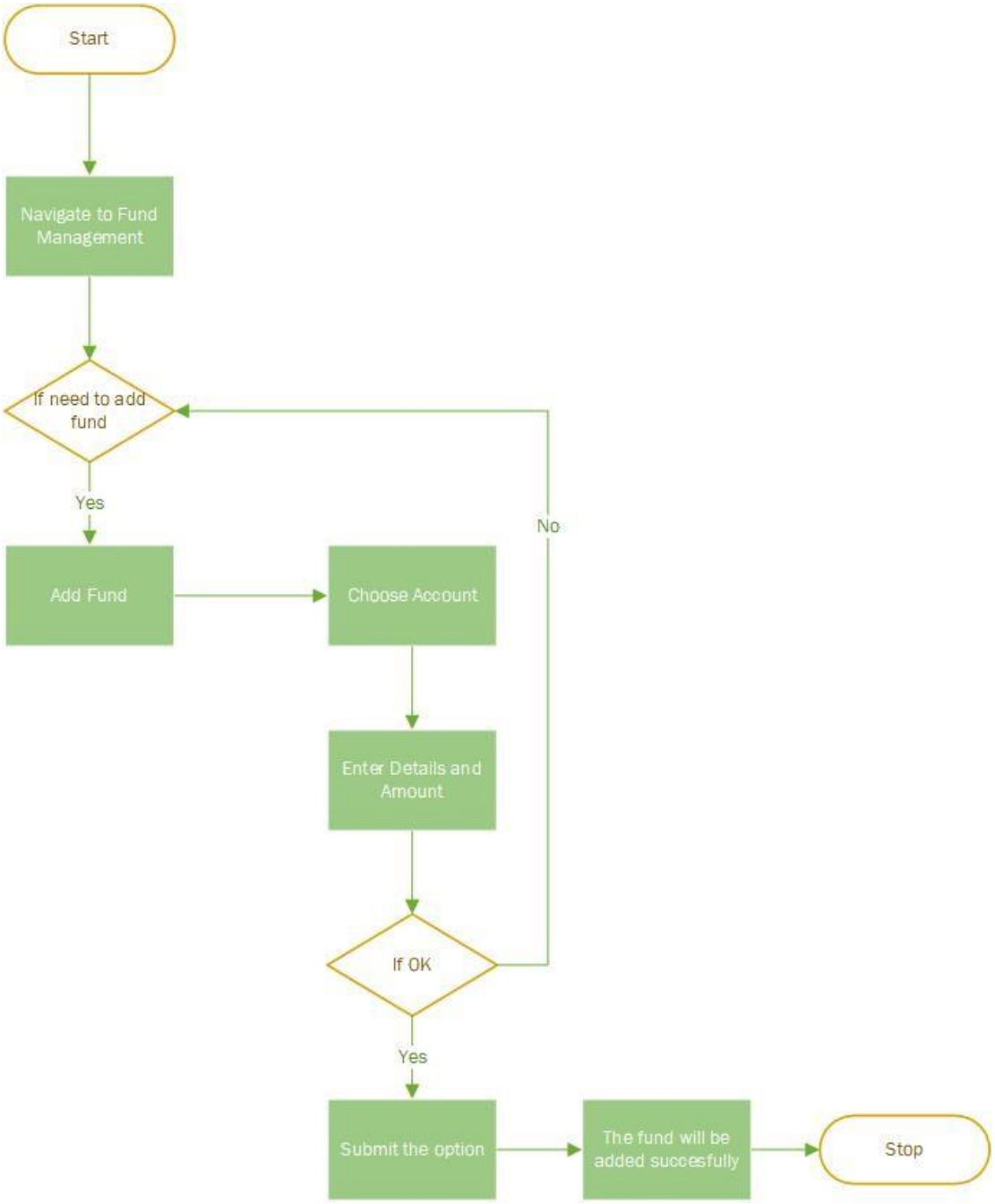
Order Processing

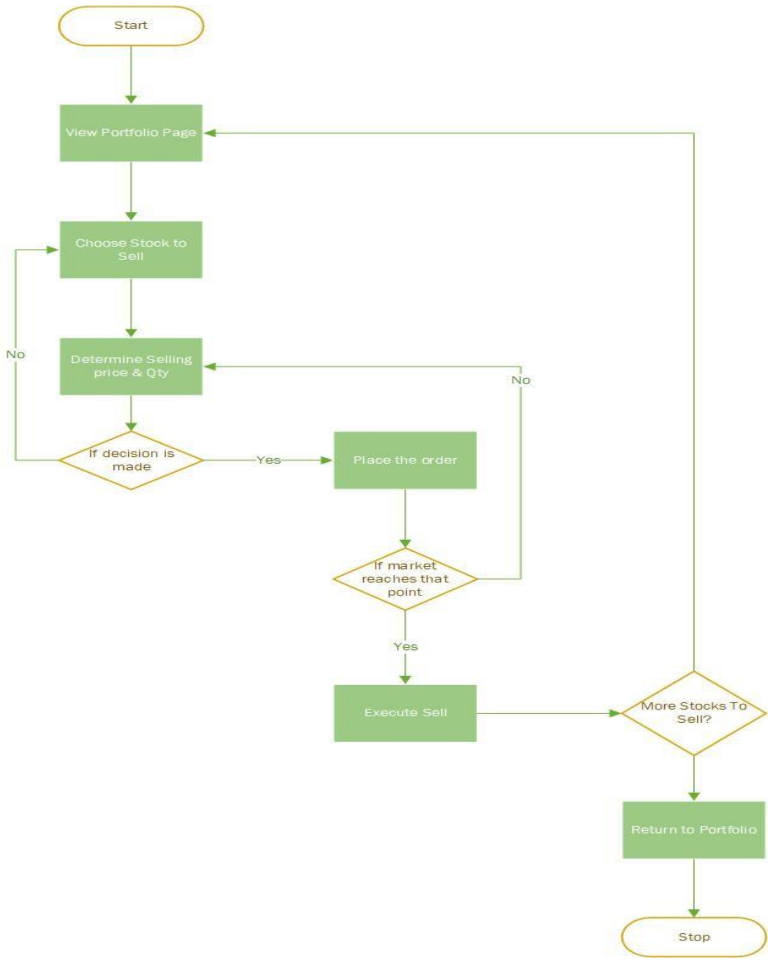


User Account Creation



Fund Management


Start
Navigate to Fund Management
If need to add fund
Yes
No
Add Fund
Choose Account
Enter Details and Amount
If OK
Yes
Submit the option
The fund will be added succesfully
Stop



Portfolio Management

Test Strategy

Revision History

Date	Version	Author	Description
12/01/2023	1.1	Alvin Johnson	This document outlines the Test Strategy of the project -Enhancement of InvestorLine

Scope

Who will review the document?

The testing strategy document will be reviewed by the Testing Team Lead, Project Manager, and relevant stakeholders.

Who will approve this document?

The final document approval will be granted by Mani Meghana Ammu (Project Manager) and Alvin Johnson (Associate Project Manager).

Testing activities carried out with timelines.

Requirement Analysis

Software requirements, which outline the goals of the project for the business, are the starting point for most development activities. Software requirements often consist of specific system requirements that developers use to build the product, high-level business demands, and architectural requirements that specify how the feature will be designed and supported.

Test Planning

The test plan outlines the scope, objectives, types of functional and non-functional tests (both automated and manual), and information about the test environments, among other aspects of the QA work that needs to be done.

Test Case Design and Development

In this activity, the quality assurance team refines the specifications of the structured tests they want to conduct, including any test data they will require to support those tests. To accomplish this work, testers might use their abilities and imagination, even though the areas defined by requirements must be validated in the end.

Test Environment Setup

The test environment provides the location where the actual testing takes place. Other organization members must assist with this critical software testing life cycle phase. Testers need to be able to report bugs and view the application architecture for the product to function.

Test Execution

Testers run every test case at this activity, or as many as they can in the time allocated. Automated scripts and QA experts carry out numerous functional and non-functional tests.

Test Cycle Closure

During this phase, the testing team shares its results with the rest of the team through a test closure report. Typically, this report includes an evaluation of the testing, the manager's approval, and summaries of the work and findings of the testing.

Test Approach

Process of testing

In the process of testing, there are different process models available. This testing strategy uses the **Agile Model**.

The new methodology for software development is called the Agile Model. Instead of having long-term planning, it primarily focuses on dividing tasks into smaller iterations. As novel issues are found, tests are regularly run and updated.

In this project, each module such as Fee schedule changes, Advanced trading tool integration, multiple platform integration etc, will be tested individually, and the impact and issues on the application will be reviewed and updated. It helps reduce the failure rates and continues the integration of each module.

Testing levels

The testing levels include Unit Testing, Integration Testing, System Testing, and User Acceptance Testing.

Unit Testing:

Unit testing is carried out at the code level, where each component is examined separately to verify its objectivity and assess its functioning.

According to the system modules following activities are included in Unit Testing.

- Verify pricing logic for various scenarios.
- Test the functionality of each trading tool.
- Verify accurate implementation of fee calculation changes.
- Test individual features in the mobile app.
- Verify functionality on each platform independently.

Integration Testing:

Software testers can find faults or issues resulting from coding errors or module integrations through group unit testing incorporated into a system or subsystems. Integration testing is capable of being automated.

According to the system modules following activities are included in Integration Testing.

- Validate interactions between pricing components and existing trading functionalities.
- Confirm seamless integration of advanced tools with the existing trading platform.
- Validate that fee changes do not negatively impact other system functionalities.
- Confirm seamless integration of new features with the existing mobile app.
- Validate consistent behaviour and functionality across multiple platforms.

System Testing:

When system testing is done, the entire program is tested in an integrated environment and each component is evaluated with certain business requirements. System testing can be done with automated technologies.

According to the system modules, the following activities are included in System Testing.

- Conduct comprehensive testing to ensure accurate commission calculations in real-world scenarios.
- Test the tools in a simulated trading environment to ensure they are accessible to all users.
- Test the system with different account types to ensure fees are correctly applied.
- Conduct end-to-end testing to ensure the upgraded mobile app functions smoothly.
- Test responsiveness and ensure a consistent experience for users on various platforms.

User Acceptance Testing (UAT):

Performance, security, usability, accessibility, compatibility, and dependability are just a few of the non-functional and functional components of the system that are tested during acceptance testing. Using automated tools or manual labour, depending on the intricacy of the system, is an option.

According to the system modules, the following activities are included in User Acceptance Testing.

- Involve actual users to validate the usability and satisfaction with the updated pricing model.
- Involve actual users to ensure the tools meet their expectations and needs.
- Involve actual users to ensure the fee changes meet their expectations and enhance financially.

Types of Testing

Functional Testing

This kind of testing verifies that the application operates in compliance with banking regulations. It includes the Pricing strategy, commission calculations, Functionality of advanced trading tools, Fee calculation changes for different account scenarios etc.

Usability Testing

It focuses on usability, user experience, interface design, and different experiences from multiple OS devices.

Performance Testing

In this testing, the application is tested with multiple scenarios and analyses the system's responsiveness, stability, scalability, and load balancing.

Security Testing

Through this kind of testing, banking protection against illegal access, data breaches, and other security concerns is guaranteed.

Compatibility Testing

This testing determines whether the application runs properly on various operating systems, devices, and browsers.

Testing approach

There are two approaches to testing: Manual Testing and Automation Testing. This project will use a combination of both for the testing. It is verified that the requirements match the current conditions

manually and some of them by automation testing tool. Detailed, step-by-step test cases may be part of manual testing during testing periods.

There are three methods available for that White Box Testing, Black Box Testing, and Grey Box Testing. This project will use the method of Black Box Testing.

It looks for errors in the behaviour, initialization, termination, data structures, interface, and functions. Black Box Testing is further classified into two categories:

- Functional Testing
- Non-Functional Testing

Defect Management Plan

Defect Management is an organized method for finding and resolving errors. The steps of a defect management cycle are as follows:

1. Discovery of Defect
2. Defect Categorization
3. Fixing of Defect by developers
4. Verification by Testers
5. Defect Closure
6. Defect Reports at the end of the project

Regression Testing

Software testing, known as regression testing, ensures that a code upgrade introduces no new bugs. This is because newly added code could introduce new logic that clashes with previously written code, resulting in errors.

Test Environment

The testing will be conducted on the web application across the following hardware and software configurations.

Operating systems: Windows, macOS, Linux, SUSE Linux®, AIX®, Solaris

CPU: x86

Browsers: Chrome, Firefox, Safari

Database systems: MySQL, Oracle, SQL Server

Backup of test data and restore strategy.

A test data backup plan will be developed, detailing the frequency of backups, storage locations, and data restoration procedures.

A full backup will be taken and retained in multiple locations to restore if needed.

An incremental backup will be run before deploying software for testing and will be retained for 7 days.

A differential backup will be run before deploying software for testing and will be retained for 7 days.

Testing Tools

Selenium

A web application testing tool is called Selenium. Complex and progressive automation scripts can be written with the aid of Selenium. Most software testing tools are often built around it.

Appium

Appium is a tool designed primarily for mobile application testing. Installing and using it is simple. It facilitates the automation of mobile web applications for iOS and Android as well as native and hybrid applications. One of the greatest tools for automating mobile testing in recent years is Appium.

Katalon Studio

It is a solution for automated testing that works with both mobile and online applications. It is compatible with several technologies, including qTest, Git, Slack, Jira, and others. Its compatibility with Windows, macOS, and Linux demonstrates its adaptability.

Cooler

It is a tool for behaviour-driven development. It has notable users including PayPal and Canon and is open-sourced. It works with multiple languages but only in an online setting. Code is written in Gherkin, or basic English, and can run on a variety of frameworks.

Release Control

There will be a release management strategy created that includes the version history. This approach will guarantee that all changes are recorded and that every release's tests are executed thoroughly.

Risk Analysis

Compatibility Issues Across Multiple Platforms:

Risk: Platform-dependent issues may arise, affecting the application's functionality on different devices and operating systems.

Mitigation: Prioritize Compatibility Testing:

Plan: Make compatibility testing a priority during the development stage.

Mitigation: Identify and address compatibility issues early in the development lifecycle.

Beta Testing Collaboration:

Plan: Collaborate with beta testers on various platforms.

Mitigation: Engage beta testers to discover and resolve incompatibilities before a public release.

Diversity in Test Environment:

Plan: Ensure a diverse test environment that represents the target user base.

Mitigation: Test on a wide range of devices and operating systems to proactively identify and fix compatibility issues.

Continuous Monitoring:

Plan: Implement continuous monitoring for compatibility after the public release.

Mitigation: Monitor user feedback and conduct post-release testing to address any emerging compatibility issues.

Contingency Plan:

Plan: Develop a contingency plan for addressing unforeseen compatibility challenges.

Mitigation: Have predefined steps to follow if unexpected issues arise, including communication plans with users.

Review and Approvals

Key stakeholders including the development team, project management, and business team go through a rigorous evaluation process for InvestorLine's hybrid development. To make sure the suggested improvements are in line with company goals, project schedules, and technical viability, each participant is essential.

Review Process: The business team, project management, development team, and other pertinent stakeholders are required to thoroughly review all actions associated with the hybrid development.

Approval stage: There are several steps in the approval process. After assessing a change proposal for alignment with financial viability and business objectives, the business team issues an official sign-off. Project managers evaluate the suggested design considering the project's objectives and limitations, and if it is found to be workable, they issue formal approval.

Potential Solutions

Internal Development:

In this approach, BMO will hire several IT (Information Technology) professionals with expertise to build the platform in-house. However, it may cost them more and have its challenges. Their benefits are attractive as compared to drawbacks:

Benefit:

Better Control Over the System:

Because the platform is built in-house, all the changes will be documented, so the following changes will be easy to implement.

- Easy Development of new features:
  - AS BMO has already hired professionals, the Development of the new features will become easy to implement.
- Able to add more customized features:
  - The best thing about developing the project in-house is customizing the feature according to the users, resulting in higher customer satisfaction.
- Easy to scale the application:
  - The BMO has strong financials to support the scalability if it is not dependent on another vendor for IT service; in this case, it is possible.
- Better Security
  - As the project is built in-house, there is a low chance that someone can tamper with their systems as everything is under their Control.
- Easy maintenance:
  - Reports can be monitored for the in-house system, and necessary measures can be placed.

Hybrid Development

- In this approach, the core platform for trading and user management will be developed in-house, and the advanced analytics and security will be integrated from a third-party vendor.
- Their benefits are listed below.
- Reduced Development and Integration Time:
  - A project's overall timeline will be reduced as only some services will be available for integration.
- Familiar and advanced analytical tools:
  - These vendors that will provide the services are well known for their services, and users are already using these tools with other platforms, so it will be easy for them to switch from one to another.
- Reduced development cost:

- The project's overall cost will be reduced as BMO no longer needs to hire additional professionals.

- Reduced Maintenance cost and resources:
  - They only need to focus on their core platform, which performs essential functions, so they do not need to worry about maintaining the complicated features and services.

- Subject Matter Experts:
  - The firms that provide these services have already hired experts who are continuously working to provide their expertise via tools that are going to be integrated with the BMO platform.

Status Quo

If BMO chooses not to upgrade their platform right now, it will not lose any money as the current platform is stable, but it might be missing the opportunity. However, if the upgraded platform experiences legal complications or its functionality does not deliver the expected outcomes, INVESTORLINE might lose some customer base. However, these are not major risks. They should not be ignored.

Implementation Strategy

1. Deployment approach

After carefully discussing and considering all the strategies for deployment, we suggest that a phased approach will be better suited for this project, given the scale and complexity.

As the project consists of various essential features, we need to make sure that every one of them works fine; another reason is that most of them are independent, so it is easy for us to compartmentalize and solve the problems.

The modules dependent on each other will be released concurrently and observed so that the user can describe the whole story in case of any incident.

2. Training

The basic functionality of the project is the same as the old one, and the features we added will have a link to the educational video on the top right corner of the screen, providing a clear idea of how to use a product.

3. Roll out Plan:

3.1 First phase:

This phase consists of the User's basic operations like profile management, buy-sell operation, funding operation and other essential functions.

It will also consist of a third-party tool for providing advanced analysis data and availing the paper trading feature for building the customization of the strategy based on these data.

Advanced cyber security, which the third party provides, will also be added during this initialization phase.

3.2 Second Phase

Customize the news alert according to the user's portfolio. And send only relevant alerts.

3.3 Third Phase

AI features will be deployed to generate predictions of the market based on the user's portfolios and create a forecast for the stocks in which heavy movement is about to be expected.

4. Fallback option

As I mentioned earlier, all features are independent, and the dependent ones are grouped in a deployment. All databases are backed up promptly, and it is easy to restore the data.

5. ITIL Procedure

Every change will be documented before the update's release, and in the post-release scenario, each change will be assessed carefully before going into the production environment again.

6. Deployment method

6.1 Pull Method:

This method will be used when we add minor features to the platform.

6.2 Push Method

This method will be used when a mandatory update needs to be sent, such as a security update or operational update.

7. Timing and Cost

The timing and cost will be very much aligned with the said budget of the project and planning.

ROI CALCULATION

We are proceeding with solution 2 which proposes a hybrid approach to upgrading the BMO InvestorLine platform. The high-level design includes a strategic reduction in trading commissions, aligning pricing with, or going below industry standards to attract budget-conscious investors. Significant changes to the fee schedule involve the removal or drastic reduction of fees for specific account types, making the platform more cost-effective for users. The mobile app undergoes a comprehensive upgrade, incorporating additional trading tools, real-time information, enhanced flexibility, and an improved user interface and navigation.

Furthermore, the hybrid approach ensures multiple platform support, guaranteeing compatibility across a range of devices and operating systems. The low-level design delves into user role management for a personalized experience, API development for dynamic pricing adjustments, and enhancements to the online support tool to improve user assistance. This integrated approach aims to create a competitive and user-friendly InvestorLine platform, addressing pricing concerns, improving tools, and enhancing overall

user experience across multiple devices.

Assumptions:

- Implementation Period: 1 year
- Evaluation Period: 5 years
- User Acquisition Growth Rate: 10% annually
- Average Revenue per User (ARPU): $20 per month

Costs:

- Development Costs: $500,000
- Initial development, testing, and deployment expenses.
- Operational Costs: $100,000 per year
- Ongoing maintenance, server costs, and other operational expenses.
- Marketing Costs: $200,000
- Costs associated with promoting the upgraded platform.

Benefits:

- Revenue Increase: $1,000,000 over 5 years
- Projected increase in revenue due to new features attracting more users.
- Cost Savings: $300,000 over 5 years
- Reduction in support costs with an improved user interface and advanced tools.

ROI Calculation:

NetBenefit = $1,000,000−$300,000−$500,000−($100,000×5) − $200,000

TotalCosts = $500,000+($100,000×5) + $200,000

ROI = (NetBenefit / Total Costs) * 100

ROI = (($1,000,000−$300,000−$500,000−($100,000×5) −$200,000) / ($500,000+($100,000×5) +$200,000)) * 100

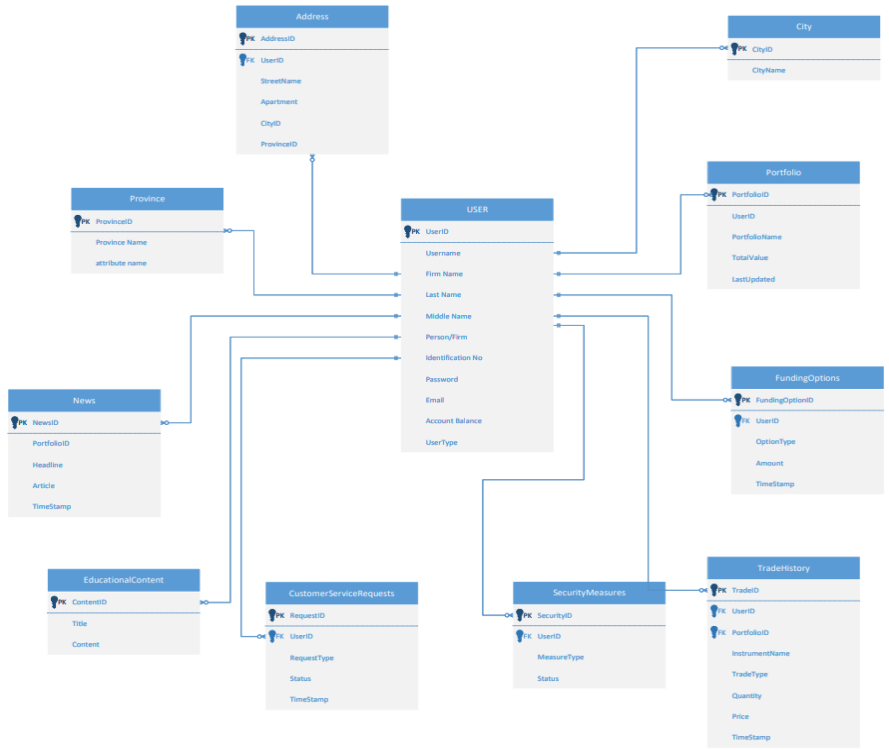
Yearly Projection:

Year	Costs	Revenue Increase	Cost Savings	Net Benefit	ROI (%)
1	$800,000	$50,000	$60,000	$-810,000	-162%
2	$100,000	$150,000	$60,000	$10,000	10%
3	$100,000	$200,000	$60,000	$140,000	28%
4	$100,000	$250,000	$60,000	$240,000	48%

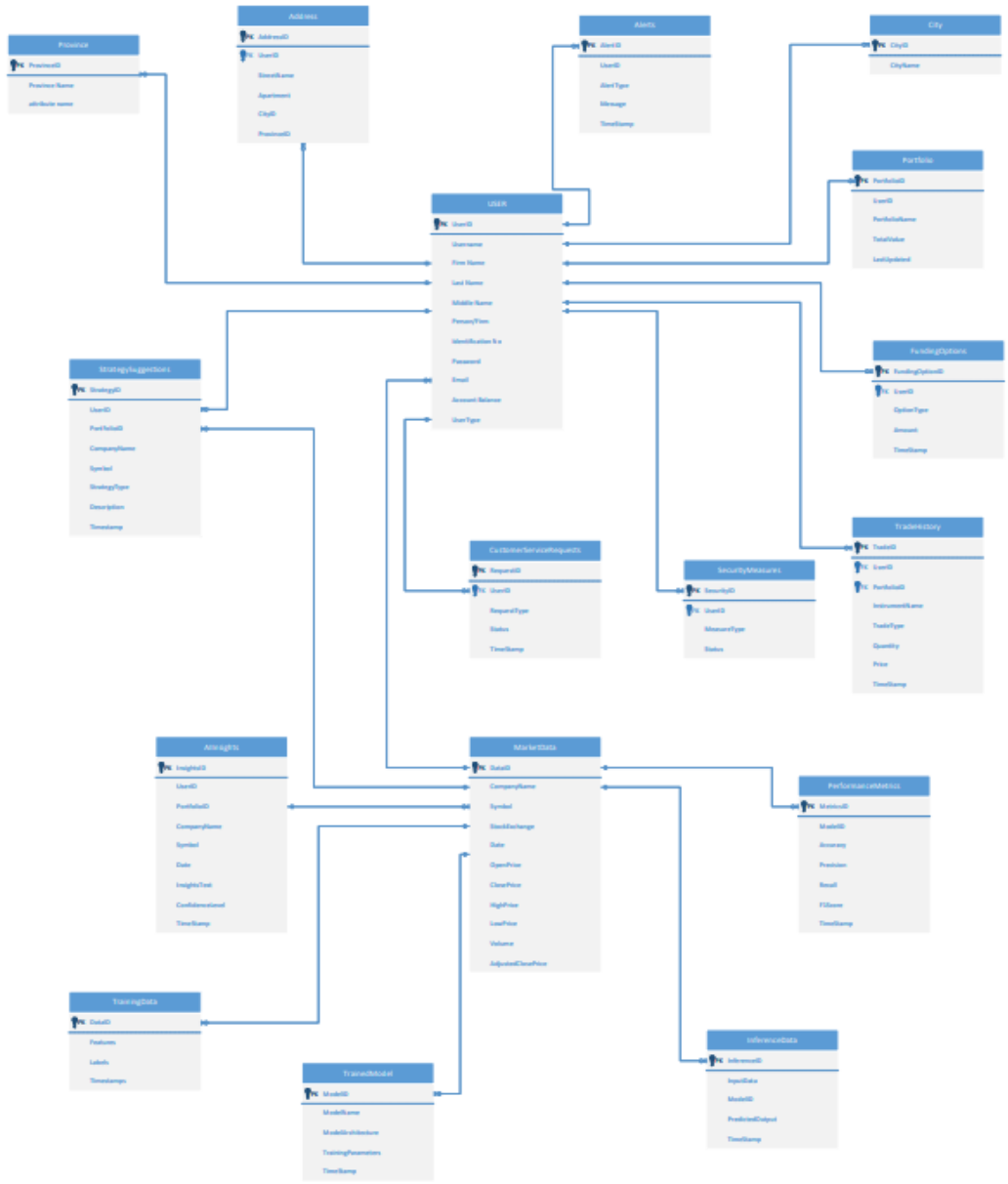
5	$100,000	$350,000	$60,000	$540,000	108%

Database Design

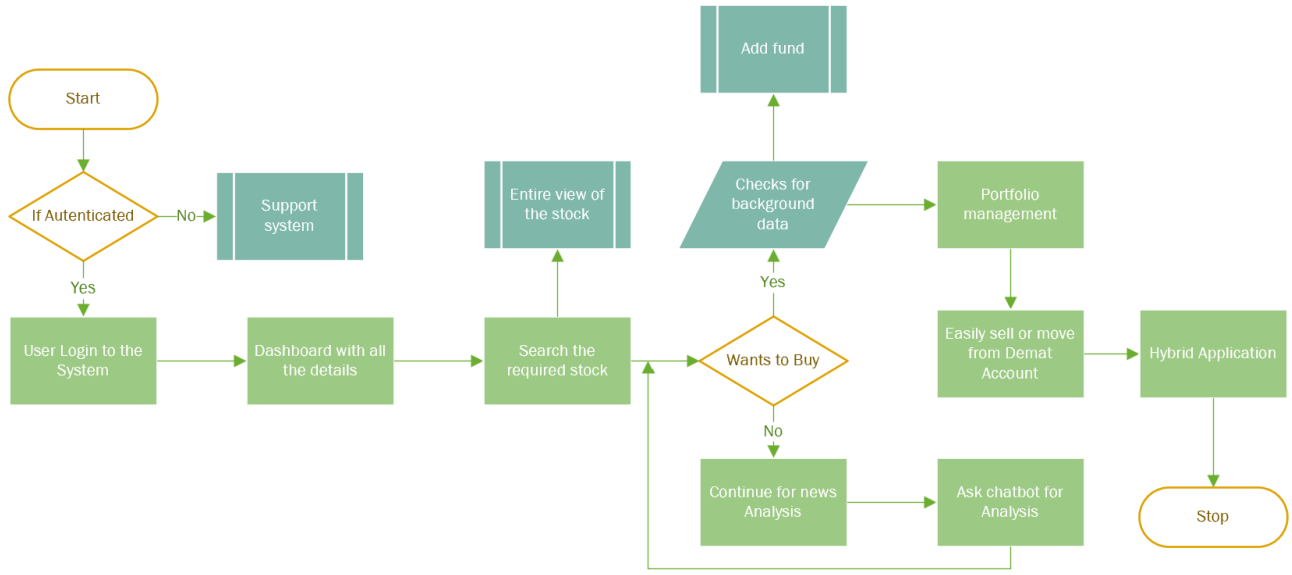
Solution –1 (Internal Development)



Solution – 2 (Hybrid Development)



To-Be Process Flow



Transition Requirements

- **Communication Plan:**

  Develop a comprehensive communication plan to inform all stakeholders about the upcoming changes, including customers, employees, and relevant third parties. Clearly articulate the benefits of the upgrade and provide a timeline for the transition.

- **Training Program:**

  Implement a training program for both internal staff and end-users to familiarize them with the new features, functionalities, and any changes in the user interface. Provide training materials, tutorials, and support resources for ongoing learning.

- **Data Migration Strategy:**

  Develop a robust strategy for migrating existing user data from the old system to the upgraded platform. Ensure data integrity and accuracy during the migration process.

- **Fallback Plan:**

  Establish a fallback plan in case unexpected issues arise during or after the implementation. Define clear criteria for when to execute the fallback plan and ensure the team is prepared to revert to the previous state if necessary.

- **User Support Channels:**

  Enhance customer support channels to handle inquiries and issues related to the

transition. Implement dedicated support teams for an initial period to address any challenges users may face.

- **Parallel Operations:**

  If feasible, run the old and new systems in parallel for a transitional period to minimize disruptions. Gradually shift operations to the upgraded platform once stakeholders are comfortable with the new system.

- **Feedback Mechanism:**

  Establish a feedback mechanism to gather input from users during and after the transition. Use feedback to identify and address any issues, concerns, or additional training needs.

- **Vendor and Third-Party Coordination:**

  If external vendors or third parties are involved, coordinate with them to ensure seamless integration and transition. Communicate the upgrade plan and timeline to external partners and establish points of contact for collaboration.

- **Performance Monitoring:**

  Implement tools and processes for monitoring the performance of the upgraded platform. Identify key performance indicators (KPIs) and regularly assess them to ensure the new system meets expectations.
- **Security Measures:**

  Enhance security measures during the transition to safeguard user data and prevent any vulnerabilities associated with the upgrade. Conduct thorough security testing before and after implementation.

- **Regulatory Compliance:**

  Ensure that the upgraded platform complies with all relevant regulations and standards. Conduct audits or assessments to confirm adherence to legal requirements.

- **Phased Rollout:**

  Consider a phased rollout approach, gradually introducing the upgraded features and functionalities rather than all at once. Evaluate user feedback and adjust as needed between phases.

References

1. Bank of Montreal. (2023, September). About BMO.
https://www.bmo.com/main/about-bmo/

2. Money.ca. (n.d.). BMO InvestorLine Self-Directed Review. Money.Ca. Retrieved September 22, 2023, from
https://money.ca/credit-cards/reviews/bmo-investorline-self-directed-review

3. ITIL Release and Deployment Management | ITIL Tutorial | ITSM. (2017, November 9). *CertGuidance*.
https://www.certguidance.com/release-deployment-management-itil-itsm/

4. EMBA Pro. *Bank of Montreal (Canada). PESTEL/PEST/STEP Analysis.*
https://embapro.com/frontpage/pestelcoanalysis/2569-bank-of-montreal

5. http://fernfortuniversity.com/term-papers/pestel/nyse4/1032-bank-of-montreal.php

6. Bank of Montreal. (2023, September). *About BMO.*
https://www.bmo.com/main/about-bmo/

7. Forbes. (2023, September 12). *Bank of Montreal (NYSE: BMO)*
https://www.forbes.com/companies/bank-of-montreal/?sh=3bc7aed067bb

8. Crunchbase. (2023, September). *Bank of Montreal, Organization.*
https://www.crunchbase.com/organization/bank-of-montreal

9. https://www.valueresearchonline.com/stocks/300249/bank-of-montreal-bmo/

10. King, R. (2020, June 18). *Statistics and Facts about the Stock Market 2023*. Finder Canada.
https://www.finder.com/ca/stock-trading-statistics

11. *BMO Financial Group 2018 Environmental, Social and Governance Report and Public Accountability Statement*. (n.d.).
https://our-impact.bmo.com/us/wp-content/themes/bmo-corp/resources/pdfs/Engaging_Stakeholders.pdf

12. (*16) PMBoK: Ch 13. Stakeholder Management - LinkedIn*. (n.d.). Retrieved September 22, 2023, from
https://www.linkedin.com/pulse/pmbok-ch-13-stakeholder-management-eddie-barrett/

13. BMO Home Page, *Investor Relations, Reasons to Invest in BMO.*
https://www.bmo.com/main/about-bmo/banking/investor-relations/home