ALYAMAMAH UNIVERSITY

COLLEGE OF ENGINEERING AND ARCHITECTURE

DEPARTMENT OF SOFTWARE ENGINEERING

Project

Foreign Exchange Management System

(**FXMS**)

SWE 301 – Software Requirements Engineering

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Dr. Noureddine Abbadeni

Project's objectives and working conditions

Objectives

This project is related to the Foreign Exchange area in financial institutions and aims to develop a Foreign Exchange Management System (FXMS) for an investment bank. The FXMS system is fed with data coming from multiple data sources including the FX data sources and the FX coverage database. The FXMS system, unlike The FX data sources, aims at providing support for decision-makers to better understand their business and consequently take better decisions.

The main objective of this project is to allow students to apply the knowledge acquired during the course in a project of a reasonable size to improve their Software Engineering skills, particularly the Requirements Engineering skills.

Rules and condition

In this project, the professor will act as:

- A **business user/sponsor** on the business side: If students have difficulties understanding requirements, they should discuss them with the professor.

- A **technical advisor** for students on the technical side: Students are responsible for validating their work for each part of the project with the professor to make sure they are taking the right direction.

The following rules and conditions apply to the project and must be respected:

- The realization of this project is mandatory (necessary but not sufficient) to succeed in this course. Its realization will help students understand the material presented in class and succeed in exams. A student who will not work on the project will be automatically given a failure in this course regardless of his marks in exams.

- Students must organize themselves in groups of 3-4 students. Each member of each group should make sure he is participating in the project. The professor will verify regularly if each student is involved in the project or not. The professor can decide to penalize students who are not working seriously on the project.

- Some requirements in this project are intentionally ambiguous, missing, unclear, or in contradiction with others. It is the responsibility of students to make sure they understand the requirements. In case they find any issue, it is their responsibility to resolve it and validate it with the professor.

- If there is a conflict in a group, either professional or interpersonal, the group's members are responsible for resolving it internally. If they really cannot and the conflict is stopping them from advancing in the project, they should talk to the professor.

- Teamwork is essential to succeed in the project. Each member of a group must work seriously and contribute to his colleagues. Respecting and valuing the contribution of each member of the group is extremely important.

- Students must deliver at the end of the semester one final report containing all the deliverables of each part of the project. More details on the final report will be given later.

1. Foreign exchange market

A financial market is a mechanism that allows people to easily buy and sell (trade) financial securities (such as stocks and bonds), commodities (such as precious metals or agricultural goods), foreign currencies, etc.

The foreign exchange (FOREX or FX) market exists wherever one currency is traded for another. It is by far the largest market in the world, in terms of cash value traded, and includes trading between large banks, central banks, multinational corporations, governments, etc. Retail traders (individuals) are currently a very small part of this market and may only participate indirectly through brokers or banks.

Unlike a stock market, where all participants have access to the same prices, the FX market is divided into levels of access. At the top is the interbank market, which is made up of the largest investment banking firms (JP Morgan, Morgan Stanley, etc.). After large investment banks, there are usually smaller investment banks, followed by large multi-national corporations (which need to hedge risk and pay employees in different countries), large hedge funds, and even some of the retail FX market makers.

Within the interbank market, rates (more specifically spreads) are not known to players outside the inner circle. As you descend the levels of access, the spread widens. This is due to volume. If a trader can guarantee large numbers of transactions for large amounts, they can ask for a smaller spread. The levels of access that make up the FX market are determined by the amount of money with which they are trading. The top-level interbank market accounts for 53% of all transactions. A large bank may trade billions of dollars daily. Some of this trading is undertaken on behalf of customers, but much is conducted by proprietary desks, trading for the bank's account.

Commercial companies may have some important financial activities and may seek foreign exchange to pay for goods or services. Commercial companies often trade small amounts compared to those of banks, and their trades have little short-term impact on market rates. Nevertheless, trade flows are an important factor in the long-term direction of a currency's exchange rate.

Investment management firms (who typically manage large accounts on behalf of customers such as retirement funds and endowments) use the foreign exchange market to facilitate

transactions in foreign securities. For example, an investment manager with an international equity portfolio will need to buy and sell foreign currencies in the spot market to pay for purchases of foreign equities.

Central banks also participate in the FX market to align currencies to their economic needs. National central banks try to control the money supply, inflation, and/or interest rates and often have official or unofficial target rates for their currencies. They can use their substantial foreign exchange reserves to stabilize the market.

2. Main Data sources

FX Trading databases. The investment bank we are considering is multinational and has offices around the world. The main locations are Riyadh, New York, London, Moscow, and Tokyo. In each of these main locations, we have an operational database in which all trades are stored and managed.

FX Coverage groups database. We have one central database in which we are managing traders and coverage groups that are responsible for handling the requests of clients.

In the following sections, we will explain the main content of these databases.

2.1. FX trades

A foreign exchange trade (transaction) involves trading a volume of one currency against another currency using the exchange rate (price). Each trade will be identified by a unique number (transaction number), will be executed on a specific date (trade date), and will settle on a specific date (settlement date) depending on the type of the trade (see below). In each trade, an amount (volume) of one currency (CCY1) is traded against another amount of a second currency (CCY2). On each trade, the trader may gain or lose money.

Usually, each trade will have amount 1 (corresponding to CCY1), amount 2 (corresponding to CCY2), and the volume: the volume of trade is converted to the local currency where the company is domiciled (in our case it will be SAR). However, the CCY1 amount and CCY2 amount will remain in the same currency pair in the original trade.

Different types (instruments) of FX trades can be used to accommodate different needs:

– Spot trade: A spot transaction is a two-day delivery transaction (settlement date in 2 business days in general). This trade represents a "direct exchange" between two currencies, has the shortest time frame, and involves cash immediately. Spot transactions have the largest share by volume in FX transactions among all instruments.

– Forward transaction: One way to deal with the FX risk is to engage in a forward transaction. In this transaction, money does not change hands until some agreed-upon future date. A buyer and seller agree on an exchange rate for any date in the future, and the transaction occurs on that date, regardless of what the market rates are then. The duration of the trade can be a few days, months, or years. Forward markets were created to hedge risks and speculate on future market conditions.

– Swap trade: The most common type of forward transaction is the currency swap. In a swap, two parties exchange currencies for a certain length of time and agree to reverse the transaction at a later date.

– Options: A foreign exchange option in an FX instrument where the owner has the right but not the obligation to exchange money denominated in one currency into another currency at a pre-agreed exchange rate on a specified date (expiry date). The owner can exercise his right before and up to the expiry date (So for options, we have an exercise/settlement date and an expiry date).

Most of countries will add regulations to force all FX trades to use their local currency. Let us suppose that we are in KSA and we want to perform a EUR/USD trade with a local bank. We need to split this trade into two sub-trades (legs) as follows: EUR/SAR and SAR/USD. So in this project, we will split all trades that do not involve Saudi Riyal into two legs; each leg must use the Saudi currency. For instance, trading the USD *versus* a non-KSA currency ZZZ will usually involve two trades: USD/SAR and SAFR/ZZZ. We may have some exceptions to this rule: We may allow the currencies of the GCC region (Kuwaiti Dinar, Qatari Riyal, etc.) to be traded directly against a non-Saudi currency (USD, JPY, EUR, etc.).

2.2. Currencies

A currency (CCY) is a unit of exchange facilitating the transfer of goods and services. A currency zone is a country or region in which a specific currency is the dominant medium of exchange. To facilitate trading between currency zones, there are exchange rates i.e. prices at which currencies can be exchanged against each other. Currencies can be classified as either floating currencies or fixed currencies based on their exchange rate regime.

We can distinguish major currencies (USD, CAD, EURO, JPY, GBP, AUD, NZD, and CHF) and emerging currencies (TWD, SGD, etc.). Although it is rare, a currency that belongs to the major currencies group may move to the emerging currencies group and *vice-versa*. Several countries can use the same name, each for their currency (e.g. Canadian dollars and US dollars), and several countries can use the same currency (e.g. Euro in several European countries).

Currencies are traded against one another. Each pair of currencies constitutes an individual product and is traditionally noted XXX/YYY, where YYY is a standard representation of a currency into which the price of one unit of XXX is expressed. For instance, USD/AED is the price of the USD expressed in AED, as in 1 USD = 3.67 AED. Usually, the first currency in the pair, the base currency, was the stronger currency at the creation of the pair. The second currency, counter currency, was the weaker currency at the creation of the pair.

On the spot market, the most heavily traded products are:

- **EUR/USD** - 28 %
- **USD/JPY** - 18 %
- **GBP/USD** - 14 %

The US currency is involved in 89% of transactions, followed by the Euro (37%), the Yen (20%) and Sterling (17%).

The following table gives the 6 most traded currencies in the world.

Top 6 Most Traded Currencies

Rank	Currency	ISO Code	Symbol
1	United States Dollar	USD	$
2	European Euro	EUR	€
3	Japanese Yen	JPY	¥
4	British Pound Sterling	GBP	£
5	Swiss Franc	CHF	-
6	Canadian Dollar	CAD	$

2.3. Rates

In finance, the exchange rate between two currencies specifies how much one currency is worth in terms of the other. For example, an exchange rate of 3.75 SAR to the United States dollar (USD, $) means that SAR 3.75 is worth USD 1.

We have two particular rates: the spot exchange rate and the forward exchange rate. The spot exchange rate refers to the current exchange rate. The forward exchange rate refers to an exchange rate that is quoted and traded today but for delivery and payment on a specific future date.

Although exchange rates are affected by many factors, in the end, currency prices are a result of supply and demand forces. Supply and demand for any given currency, and thus its value, are not influenced by several factors including economic factors and political conditions.

The exchange rate regime is the way a country manages its currency concerning foreign currencies and the FX market. The basic types are a floating exchange rate, where the market dictates the movements of the exchange rate, and a fixed exchange rate, which ties the currency to another major currency, such as the USD or the Euro.

2.4. Clients, accounts and client segments

Clients are in general companies or institutions and each client can have one or more accounts. Big companies usually are involved in different activities and projects and they

may need a different account to be used with a specific activity/project (oil, gas, IT, etc.). Data at the account level is available in the data sources. However, most of the business users interviewed think that they will never need the data at the account level. They said they will need data aggregated at the client level regardless of how many accounts the client has and in which account trades were done.

Clients are segmented in different segments including institutional clients, banks, commercial companies, etc. The current segmentation has 1 level only. Business users are expecting to have other levels added to the current segmentation. For the moment, they do not know exactly how many levels they will have in the new segmentation.

2.5. Regions

The multinational investment bank is present in all regions of the World. Trades can be done in most of the cities in the World but each city is attached to one main location: Riyadh, New York, Paris, Moscow, and Tokyo. Each of these main locations is responsible for handling and managing trades in the region around it: Riyadh for the Middle East region; New York for the Americas region, Paris for Western Europe; Moscow for the Eastern Europe region; And Tokyo for Japan and Eastern Asia region.

If a client is located in Riyadh, the main location responsible for serving that client is the Riyadh Office through traders and coverage groups. But, for some reason, the Riyadh Office may not be able to serve that client at a specific moment; in this case, another trader belonging to the same coverage group in another location (let's say Paris) will handle the request. In this case, we have two locations: the owning location (Riyadh) and the execution location (Paris). It is important to know both the owning and executing locations for each trade.

2.6. Channels

Trades can be done through multiple channels including phone and the web (electronically). Of course, it will be important for the bank to evaluate which channels are the most efficient for the business.

2.7. Traders and coverage groups

Traders are organized into different coverage groups. Each trader can belong to one or more coverage groups and specialize in some currencies. Each trader will have a role (primary or backup) in each coverage group. Each coverage group must contain 1 trader from each main 5 locations. Only one trader in each coverage group will have a primary role; the other traders in the same coverage group will have a backup role.
Of course, over time, a trader can move from one coverage group to another for different reasons.

2.8. Date and time

Each trade will have a trade date and a settlement date. Some trades can be updated and in this case, they will have also an update date. Business users want also to analyze their trades based on different time slots in the day. They want to know the busiest / most important hours for their business. It will be also important for the business to consider holidays in each region so that the analysis will not be biased when comparing regions based on the volume of trades per day for example.

2.9. Profit and loss

When trading, traders can gain (profit) or lose money (loss) depending on which rate they charge their clients and the market conditions. So, each transaction (trade) will have necessarily a profit or loss (P&L, P and L, or PnL).

3. Main Functionalities

The FX data sources and FX Covergage database have many services including:

1. Ability to manage clients and accounts (insert, update, delete)
2. Ability to manage trades (insert, update, and delete trades). Any trader can enter new trades while updating and deleting existing trades require specific privileges.
3. Ability to manage traders and coverage groups by assigning a trader to a coverage group, moving a trader from one coverage group to another, etc.

4. Ability to manage currencies and rates including daily updates of rates available in the market. We suppose that the system is connected with another system (such as Tadawul) which provides daily updates for exchange rates between all currencies.

The FXMS will offer the following main services to users:

1. Ability to search and retrieve specific trades, trades involving specific currencies, trades executed on a specific date or period, etc.
2. Ability to search and retrieve any information related to currencies, exchange rates, regions, dates, etc.
3. Ability to generate different reports from the system. Typical reports that business users need to generate include:

- What is the trade volume we are doing per currency pair, per region, per trader/coverage group per channel, per trade category, and per date /time?

- What is the PnL we are making per currency pair, per region, per trader/coverage group per channel, per trade category, and per date /time?

- Which currencies and which currency pairs are the most traded and in which regions?

- What is the Volume/PnL traded by group of currencies (major currencies versus emerging currencies)?

- What are the most popular trade types, in which regions these trades are done?

- Which coverage groups and traders are the most productive in terms of volume and PnL?

- Which channels are the most profitable to the organization?

- Who are the most valuable clients for the business?

- What is the most important period for our business?

- On which trades are we losing money?

Obviously, functionalities like data extraction, data cleaning, data transformation, and data load are performed to bring data from the data sources and load it into the FXMS system … but these functions work in the backend and users do not use them.

4. Constraints

The development of the system should consider various constraints.

General constraints

- The system should run on Windows 10.
- The system should be delivered by the end of the year.

Technical constraints

- A trade must be executed in a short time (or the number of trades per/second is 50).
- The system must be reliable enough to avoid problems. The system should run from 6 AM to 6 PM. Any maintenance work should be done after 6 p.m. If a bug happens during working hours, the mean time to repair (MTTR) should be very short – 30 minutes at most.
- Data (such as identity of customers, PnL …) is confidential and can be accessed by authorized users only.
- The system must ensure the integrity of the data.
- The system must manage access strictly. Each user, or a group of users, has access to specific things.
- The system must be user-friendly and easy to use.

Other constraints might apply to the system. You need to think and see if other constraints are relevant to your system