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Automated Forex Trading System Using MQL5 Language

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Abstract

This research aims to develop a computerized FOREX trading system that matches the current economic state of North Sulawesi people as well as to evaluate the efficiency and effectiveness of technical analysis embedded in the developed Automated Trading System (ATS) in helping less sophisticated investors in making decisions by using prototyping. This ATS is built within MT5 (a software used in forex trading) by using MQL5 language used for trading strategies in order to analyze, manage, and execute trade autonomously while running in the background. It is built to trade with a small amount of money preferably $1,000. It is expected that investors with a small budget, minimum financial literacy, and mental grit in North Sulawesi could participate more actively in the foreign exchange market with the aid of this system. A test of the application also has been done on Android smartphone and successfully installed on Android 5.1 and higher versions.

Keywords *— Foreign Exchange, Automated Trading System, MetaTrader 5, MQL5*

1. INTRODUCTION

1.1. Introduction

The foreign exchange market (FX market) is a place where people around the world exchange currency with other currencies to gain profits from price fluctuations [1]. In order to gain profits investors should have an ability to interpret the movement of price, by using two approaches that are usually used namely technical analysis and fundamental analysis.

MT5 enables people to build and run their customized ATS on their computers or in a virtual private server (VPS) using the prebuilt MQL5 programming language [2]. By using MQL5, the trader can use the existing technical indicators provided by MT5 as a foundation in building the ATS. The ATS could make decisions based on the information and confirmation provided by the chosen technical indicator. Those decisions could be in the form of a transaction or a trading signal that the trader could use as a guide [3]. Therefore, we could conclude that technology has tremendous power in tackling the issue in the FOREX. Therefore, its implementation could benefit the investor, particularly in North Sulawesi.

We hypothesize that using ATS is helpful in tackling the limitations that investors and non-investors encounter in the financial market. The developed ATS would function as a trading robot to trade based on the formula that the researcher designed. It is expected that North Sulawesi people will be involved actively

in the FOREX market with a limited amount of experience and limited funds.

This study aims to develop an efficient and effective ATS to address the characteristics of investors and possible investors in North Sulawesi. The developed ATS would function as a trading robot to trade on behalf of the trader. It is expected that investors with small budgets, less financial literacy, and mental grit in North Sulawesi could participate more actively in the foreign exchange market with the aid of this system.

1.2. Literature Review

The foreign exchange market or so-called FX market / FOREX market is a place where people around the world exchange currency with other currencies for business purposes or just day-to-day transactions [1].

MetaTrader5 (MT5) offers a stable platform with enhanced security so that the trader can open and close FOREX positions without worry, and it has over fifty technical indicators pre-installed. So, the user can choose which fit their trading style and use it as a toolkit to build a trading robot [4].

MT5 can enable traders to participate in the FOREX market and a platform that will allow us to make and test a trading robot or expert advisor. Trading robot or expert advisor to perform some managerial and analytical processes in their trading account, with or without human intervention. Which build using MetaQuotes Language 5 (MQL5) that is a built-in language for programming trading strategies [5].

The technical indicator, at its core, is an analytical tool using a mathematical calculation based on historical price data, which used to predict movement of future prices and used as a guide to enter or exit the market [6]. Currently, there are four different types of technical indicators that traders can install in MT5. Those are: (1) Trend Indicator, (2) Oscillator Indicator, (3) Volume Indicator, (4) Bill Williams Indicator

The objective, which is to develop a computerized FOREX trading system meets the current economic state of North Sulawesi people, is based on two studies done by Liu and Xiao, in 2009 [7], and Abednego and Nugraheni, in 2018 [9]. Both produce two different AI, but both have the same problem, both AI use a large sum of money in both cases a $10,000 or roughly Rp. 137,240,000 (BCA rate on 10 February 2020), that basic requirement does not match North Sulawesi people's financial condition. However, numerous studies claimed that trading with $1,000 is the best bare minimum to participate in the FOREX market [8], [9] combined with the right leverage of 1:50 [10] and using a standard account [11].

This study mainly develop an ATS that decide on using only technical analysis decision making, which is supported by three reasons: (1) Previous study, all of the aforementioned study that this study were based upon is using only a certain or a variation of technical indicator without incorporating any fundamental analysis as a deciding factor for their system [7], [12], [13], [14]; (2) Technicality, our primary concern of this study is to develop an ATS that is sufficient in making profits and previous study suggest that using technical analysis is sufficient enough to do so, and to build a machine that support fundamental analysis is a different technology and different type of sophistication which we don’t include for the sake of this study; (3) Cost, numerous study claimed that trading with $1,000 is the best bare minimum to participate in the FOREX market [8], [9] and based on our findings that gathering and analyzing such extensive and confidential information of macro economy, not only difficult in term of technicality but also come with a price, in which we can’t afford for the sake of maintaining the $1,000 bare minimum.

2. RESEARCH METHOD

2.1. Research Conceptual Framework

The software engineering methodology used for this study is Evolutionary Prototyping. We use the software engineering prototyping model from Alan M. Davis from the University of Colorado which has multiple sets of actors in the development process [15]. The reason behind choosing evolutionary prototyping is because this study aims to build an ATS that is relevant to the current state of the financial market, the evolutionary approach helps seeks to develop a sophisticated system through a series of prototype iterations [16].

This study has two separate actors namely the software engineer and the financial expert. Both parties requires two separate data, the financial expert require: (1) information about the technical indicators characteristic and functionality from journals and internet publication, (2) the documentation about the ATS performance (like net profits, win rate percentage, et al.), and flaws in the current strategies which were reported by the software engineer. On the other hand, the data needed for the software engineer: (1) the strategy roadmap that the financial expert will provide based on his analysis from his findings or the past ATS performance, (2) The exchange rate movement, volume, and volatility of the currency pair chosen for this research.

Both actors follow a strict seven steps framework in every iteration (Figure 1), as follow:

1. Make a financial strategy design: In this part, the financial expert identifies the requirement (from the previous result or findings) that the system needs to perform, and then design a new system of financial strategy based on the requirement.
2. Send upgraded design or new design: In this part, the financial expert gives advice and a roadmap to the software engineer to make some changes in feature, adding a new feature to the current prototype/system, or give a new design. (See Appendix for an example of strategy roadmap)
3. Receive, prioritize, and schedule changes: In this part, the software engineer determines and schedules when and how to implement the roadmap sent by the financial expert.
4. Develop the system: In this section, the software engineer develops the system using the current known tool, and then the system will be tested through a series of simulations using the exchange rate movement from January 2010 to December 2019 with the configuration shown in Table 1. The testing is split on a yearly basis among ten years; this method was used to reduce the probability of ATS, making a profit only by sheer luck in a specific condition. This technique of testing can help analyze the ATS thoroughly.
5. Compile documentation: After the software engineer found the result, the software engineer proceeds on making documentation of the setup and performance for the current build.
6. Deliver documentation: In this section, the software engineer releases the documentation of the current build, so the financial expert can evaluate and make future design choices based on it.
7. Evaluate: After the financial expert receives the documentation, the financial expert will analyze the quantitative data sent by the software engineer, the analysis heavily focuses on the net income and the win rate of the system on a yearly basis from 2010 to 2019 (10 years).

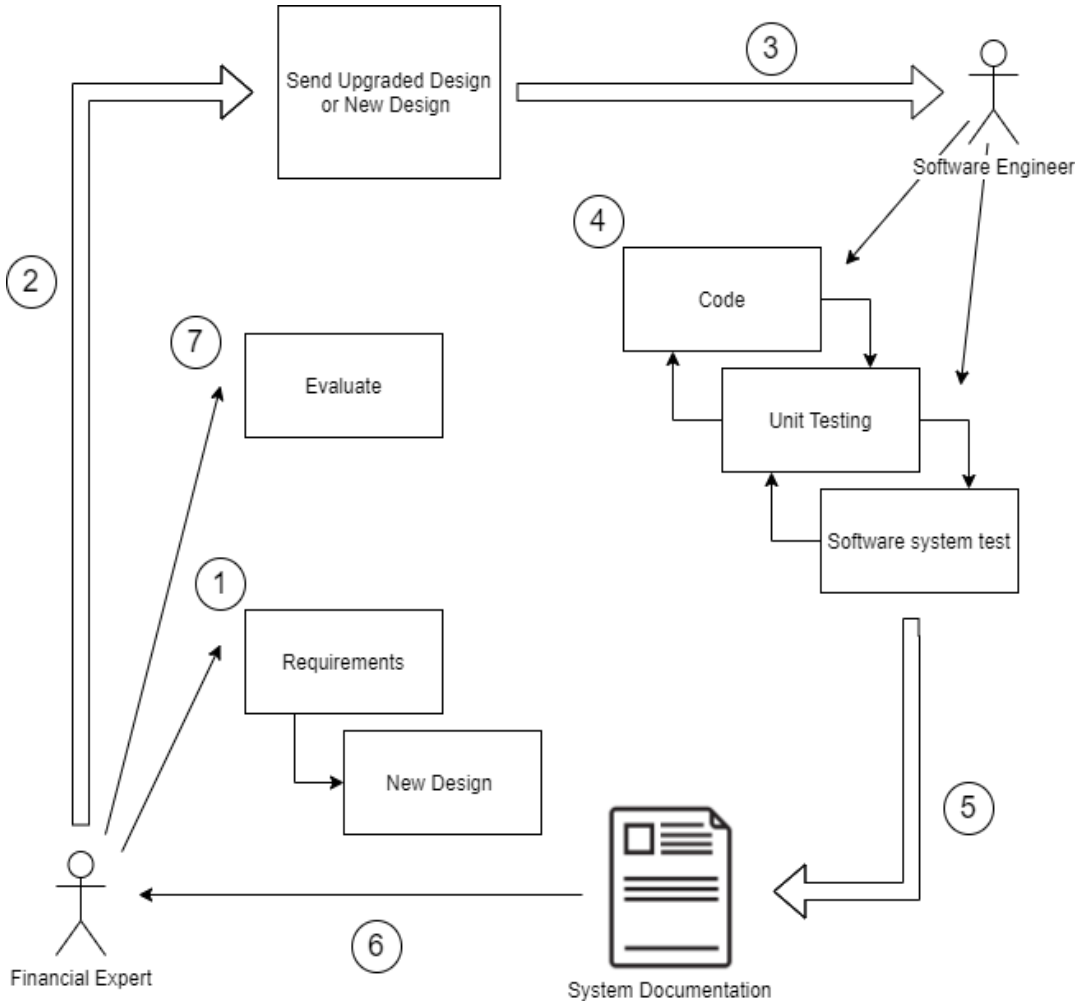

Figure 1. Conceptual Framework of The Research

2.2. Implementation

Figure 2 to Figure 9 shows the implementation of how the conceptual framework in Figure 1 is implemented. Figure 2 explains how the system will perform a series of actions that will produce a trading transaction, when the user activates the system. The system starts on checking whether the trading account has any active transactions. If it does, the system will wait until the transaction has been closed. Conversely, if there is no active trade opened, the analyzer will proceed to analyse trade possibilities given by the selected technical indicators as explained in Figure 3. If the system confirms a trade possibility on whether to buy or sell, the calculator calculates the appropriate value that parallels the researcher's money management strategy.

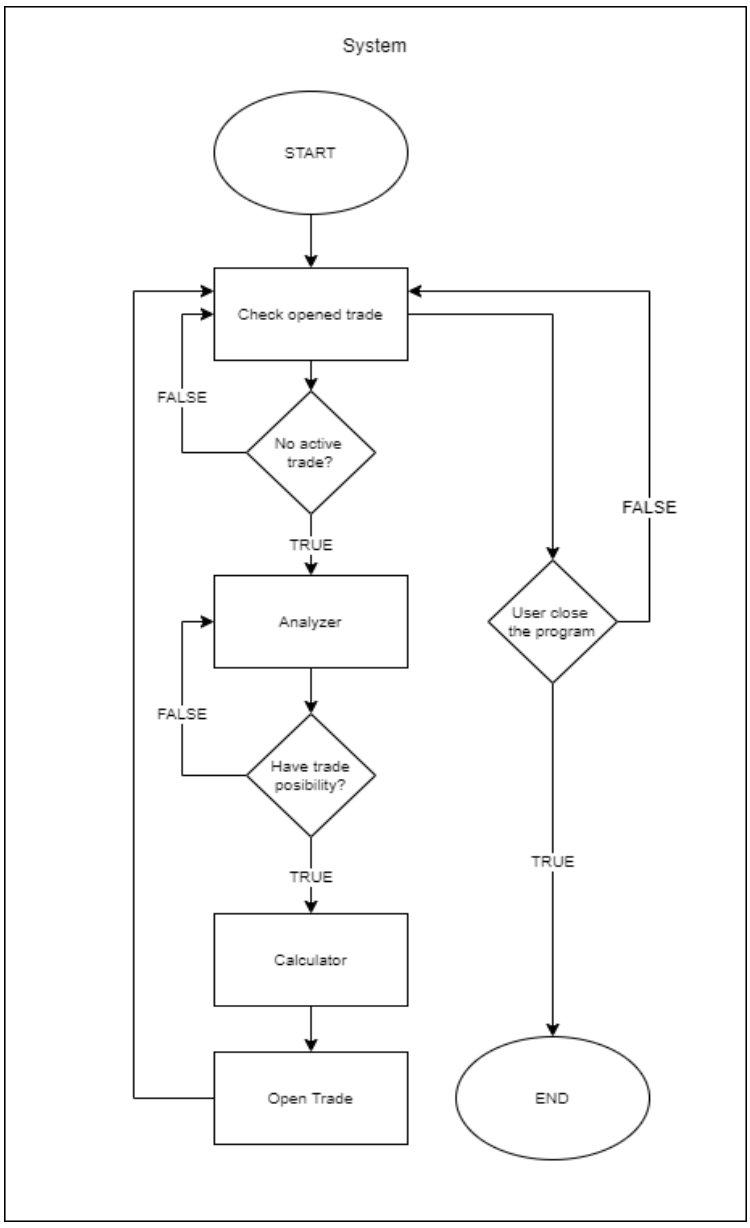

Figure 2. System Mechanism Flow Chart

This study adopts a money management approach called anti-martingale. The rule of thumb that the system must obey is to keep every transaction at a 1/3 risk-reward ratio, 2% risk for every trade, and a dynamic position size depending on the trading account's current balance. If the trading account continues growing, the trading size will grow as well, and it will go otherwise if the trading account is losing money. Figure 4 shows the monetary mechanism for defining entry price, stop loss level, take profit level, and lot or position size based on the trading signal produced in Figure 3.

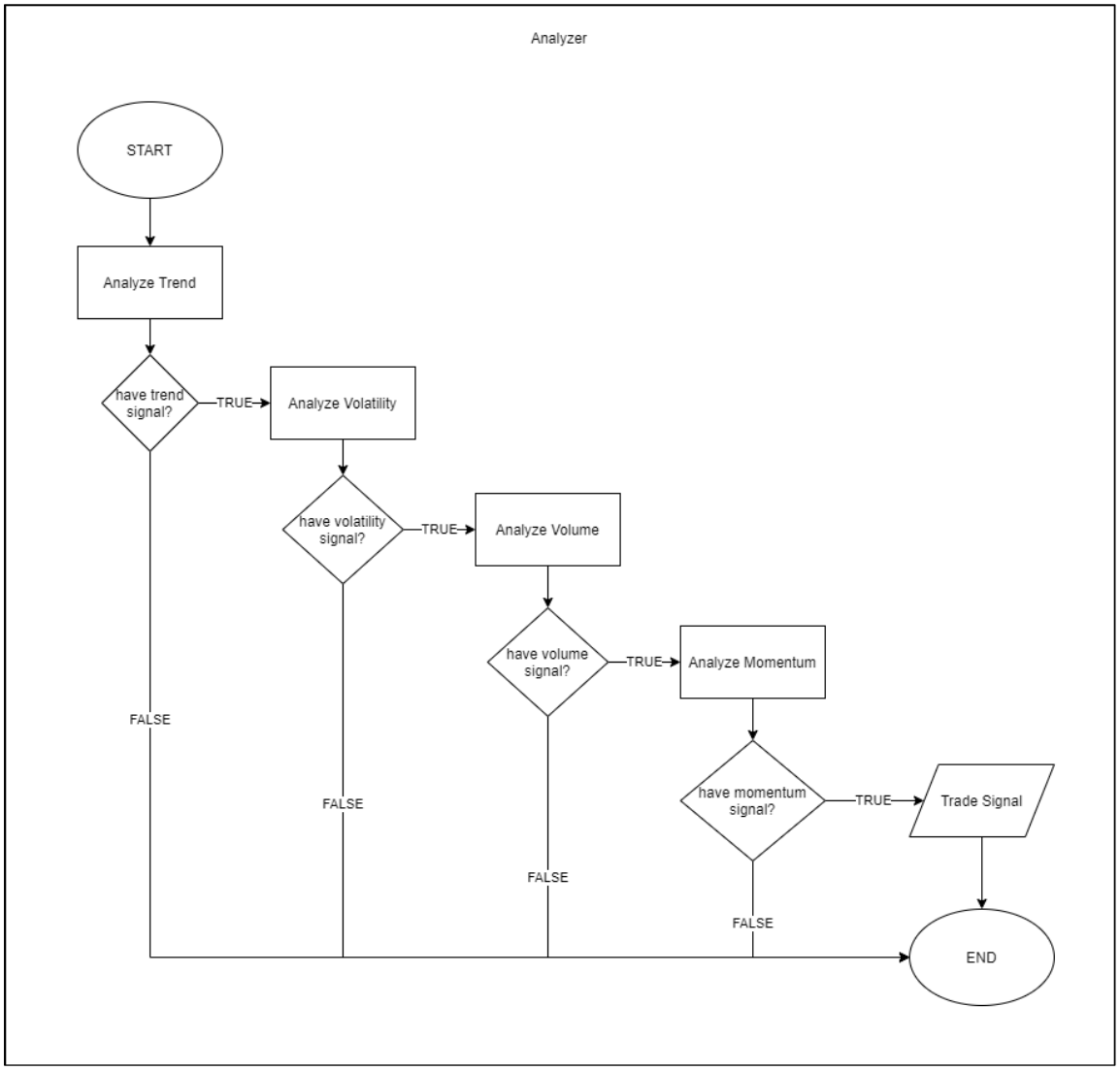

Figure 3. Decision-Making Mechanism

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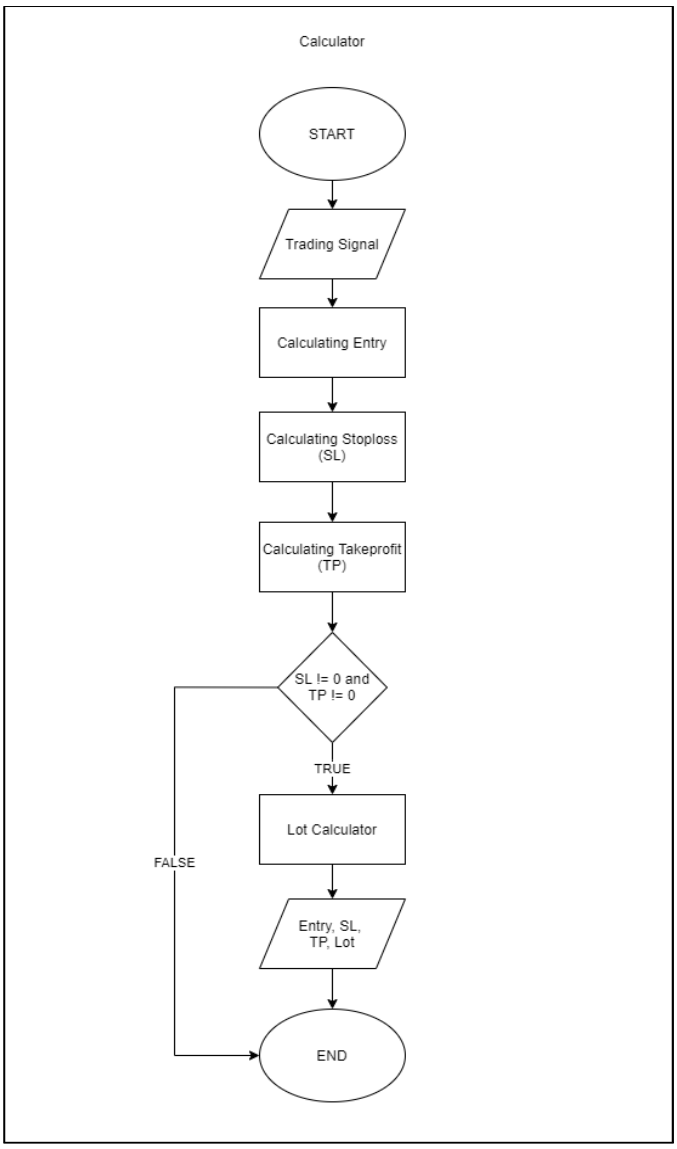

Figure 4. Monetary Mechanism - Calculator

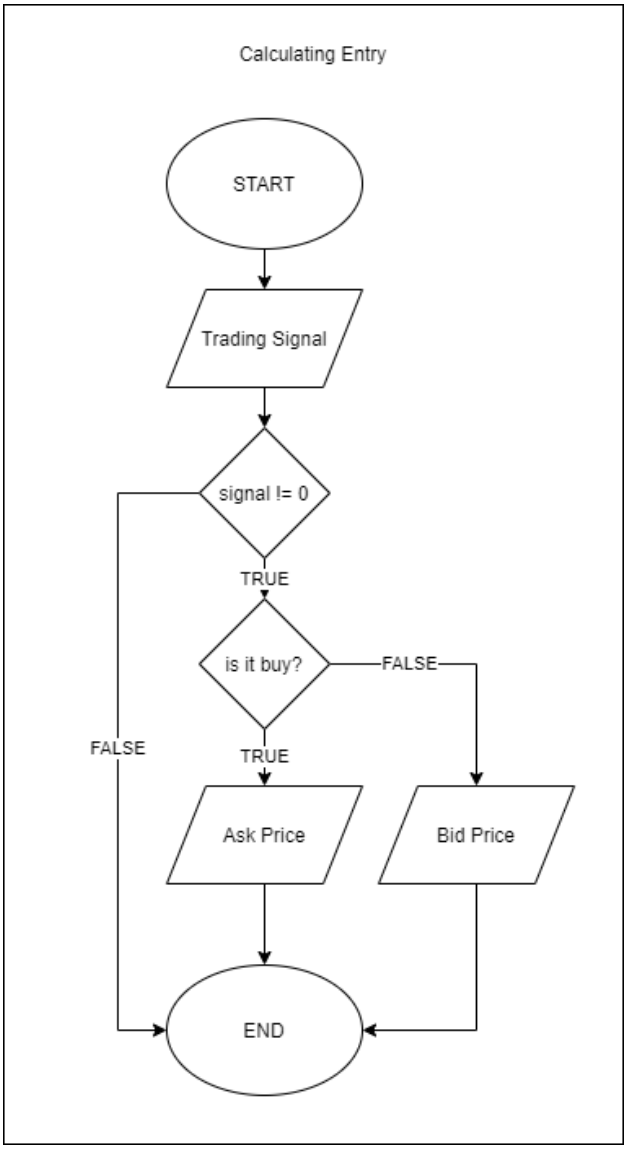

Figure 5. How The System Identify Entry Price

Figure 5 shows how the system identifies the entry price based on the trading signal produced in Figure 3. The system confirms whether the signal is a buy or sell, which are represented as a number 1 and 2, respectively if the value is not 1 or 2, the system will not generate an entry, but if the signal is 1 or 2, the system will output ask price or bid price respectively as the entry price. Once the process of identifying entry is done, the system will identify the stop-loss level, explained in detail in Figure 6 and identify take-profit, explained in detail in Figure 7.

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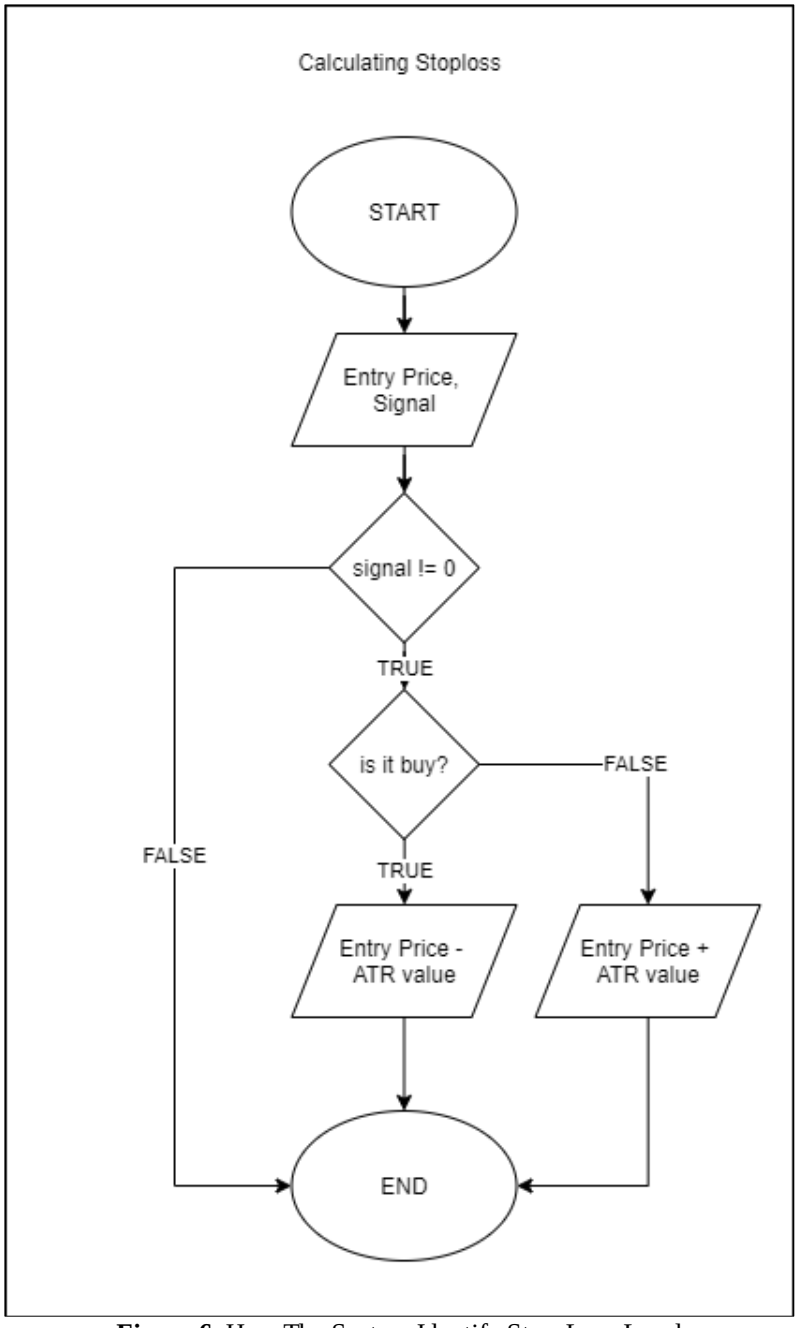

Figure 6. How The System Identify Stop-Loss Level

Figure 8 shows how the system identifies the lot or position size based on the trading signal produced in Figure 3, the entry price produced in Figure 5, and the stop-loss level produced in Figure 6 as the basis for deciding the lot size. The system confirmed whether the signal is a buy or sell, which are represented as a number 1 and 2, respectively. The system will not generate lot size if the signal is not 1 or 2, but if the signal is 1 or 2, the system will generate lot size according to the signal.

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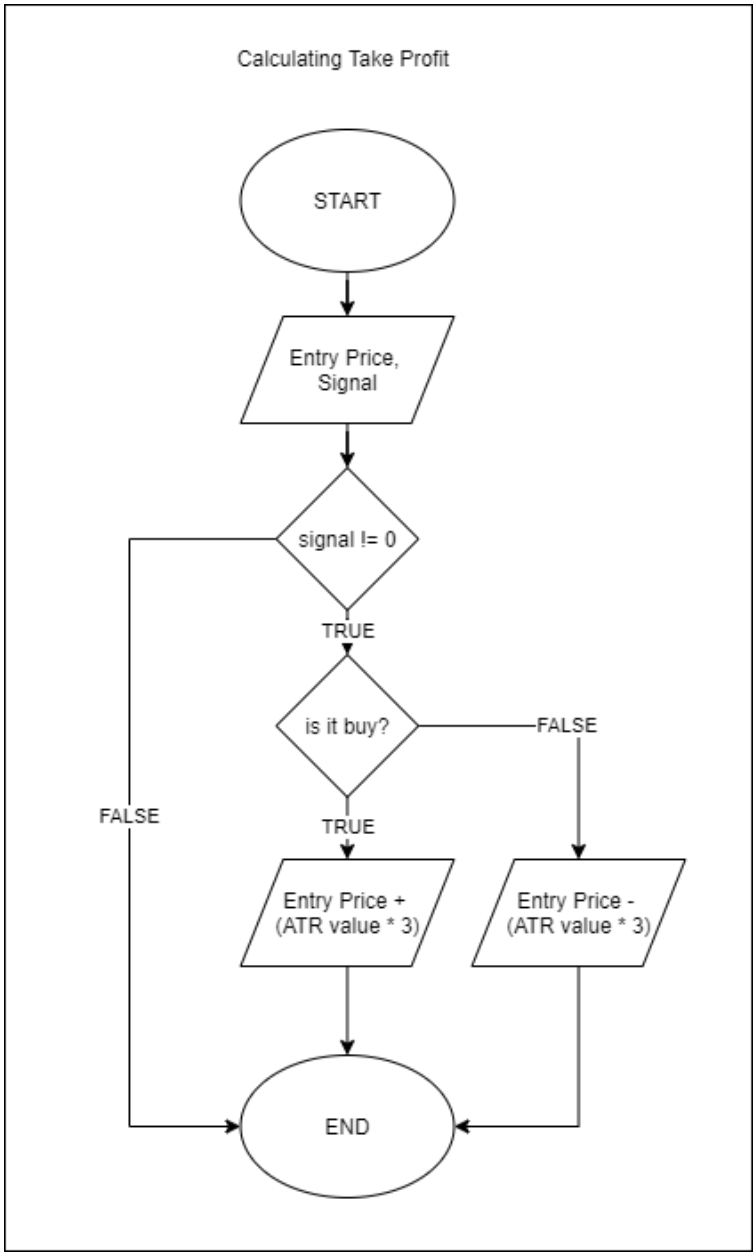

Figure 7. How The System Identify Take-Profit Level

After the system defines the signal, entry price, stop loss level, take profit level, and lot or position size, those values will be used to execute a trade. Once a trade is made, the system will revert to checking or waiting for the trade to be closed with a profit (hitting take profit level) or loss (hitting stop loss level). The system will stop waiting or analyzing if the user closes the MetaTrader5(MT5) window or deactivates the system inside the MT5. Figure 9 describes how the system can alter multiple platform of MT5.

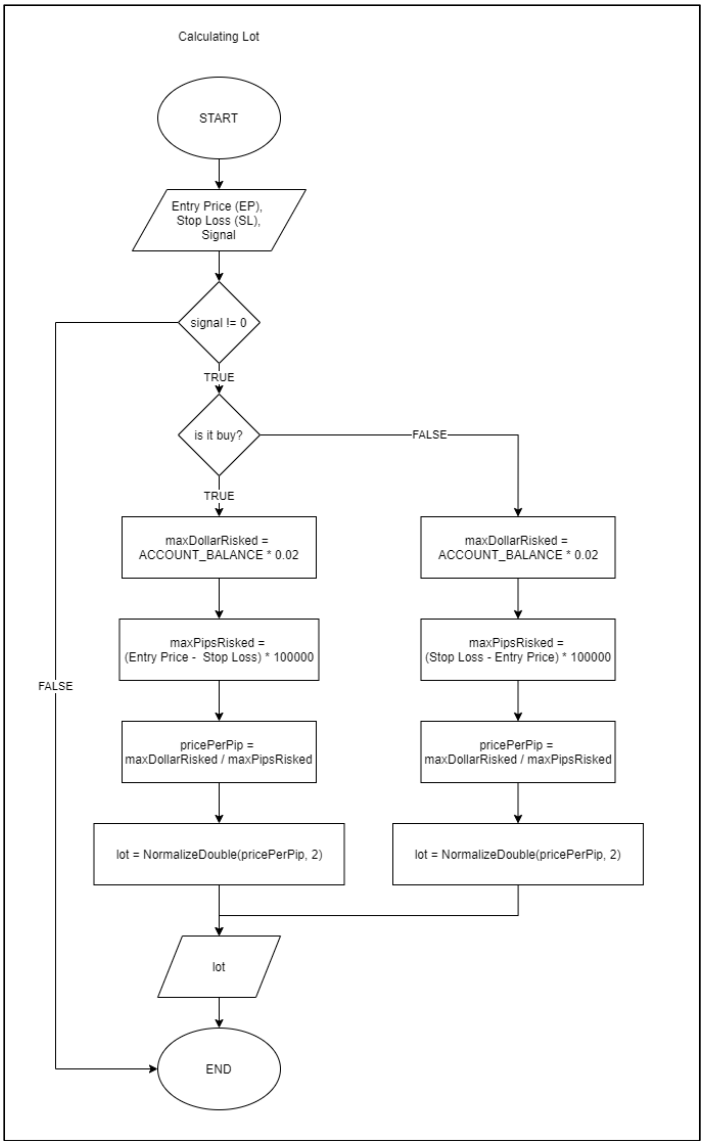

Figure 8. How The System Identify Lot or Position Size

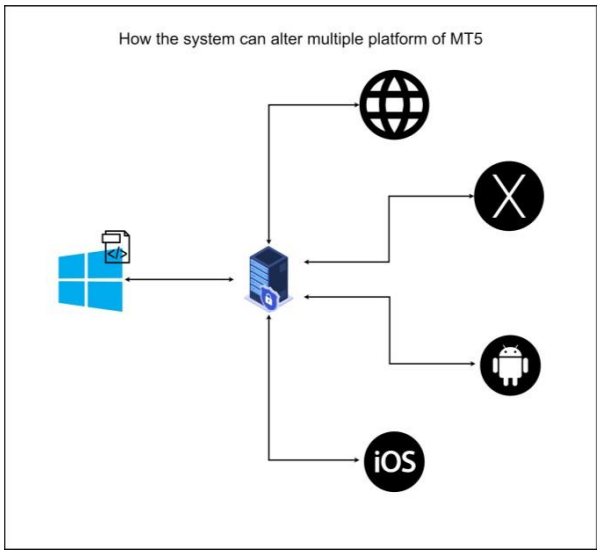

Figure 9. How The System Can Alter Multiple Platform of MT5

3. CONCLUSION

The conclusions of this study are as follow: (1) The ATS is built within MetaTrader 5 using MQL5 language to analyze,manage, and execute automatic trading (2) This ATS built totrade with a small amount of money preferably $1,000. (3) In the untabulated simulation, the developed system can produce on average 5.886% annually, and at maximum 52.53% returnannually.

Some of the limitations are (1) This trading robot trades only in the FOREX market. (2) This trading robot only makes analyses based on historical price data. (3) This trading robot only trades a USD based currency pair. (4) This trading robotcould not perform any information search on the internet. (5)This trading

robot could not learn on its own or make tradingexecution outside the predetermined trading strategy.

We recommend that future research to to incorporate machine learning approach to make a system that is more flexible and adaptive to the unpredictable nature of the FOREX market

4. FUTURE STUDY

For future study, we recommend that, developer might:

1. Limit the indicators of trading
2. Incorporate machine learning approach in making a more flexible and adaptive system the volatile FOREXmarket.

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