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# i-JaMCSIIX 2022

International Jasin Multimedia & Computer Science Invention and Innovation Exhibition

## EXTENDED ABSTRACT BOOK

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# **i-JaMCSIIX** **2022**

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Extended abstract

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## Gold Price Forecasting by Using ARIMA

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**Abstract**—Gold is the most popular investment in the world because it has shown to be the most effective safe haven in a lot of countries. It is difficult to use method such as technical analysis to predict the gold value. Many prediction problems that contain a time component require time series forecasting, which is an important topic of machine learning. This is a study of gold rate that will predict the gold price by using one of the time series methods which is Autoregressive Integrated Moving Average (ARIMA). The main feature of the system is to predict the gold price and visualize the predicted value in a line chart. This will help users to know the future trend and can help them to make a decision for the right time to buy or sell the gold. The system will provide other features to help users in gold investment such as get the latest gold news, calculator of gold investment and gold branch location around Malaysia.

**Keywords**— Gold, Machine Learning, ARIMA, Time Series Forecasting

### I. INTRODUCTION

Financial markets are very important to increase growth and opportunities in economic activities such as trade and investment. There are many types of financial markets such as stock markets, commodities markets, forex markets and cryptocurrency markets. The markets also can go wrong when the financial crisis happened [1]. Financial crises already happened repeatedly over the past two decades. The unstable in stock and foreign exchange market during economic crisis make investors worried and find other investment. This made gold as an alternative investment asset that must have in investor's financial portfolio [2].

Gold has been regarded as a commodity that has been use in transactions that provides dollar and financial safe haven for all people or investors around the world [3]. Gold is an effective long-run inflation again US dollar exchange rate. In other word, gold prices will rise when the US dollar is weak. Global positioning system (GPS) is one of the important technologies in this era. Usually, people will use GPS to determine the location of a place. This system will help them to by showing a direction to the place that they already choose. U.S Department of Defense (DoD) had developed this GPS system in 1970 as a military system but now can be access by military and civilian users. Based on the survey that had been conducted, only 46 respondents that have a knowledge of fundamental or technical analysis as shown in Figure 1.

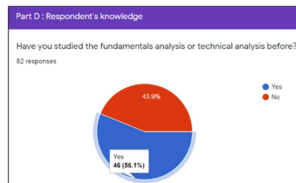


Fig. 1. Survey Question 1

Machine learning is a branch of computer science that enable computers to do a task through learning of experience and not directly programmed [4]. Manual Statistics, Technical Analysis, Fundamental Analysis and Expertise Analysis are the method of prediction. Usually, people that buying physical gold will not doing any Fundamental or Technical Analysis because they do not buy gold every day. But it is different for people that trade gold every day. They need to do an analysis. There is no scientific or academic for the technical analysis and cannot be confirmed by any logic statement [5]. For this project, it focused on machine

learning to make gold price prediction and location to find nearest gold branch location by using GPS. Gold price prediction is still an important topic until today either for the traders or investors. It helped them to get an image of future gold price and easier for them to make a decision.

## II. MATERIALS

### A. Data Collection

For this project, it used secondary data that was published from the World Gold Council (WGC), which is the market development organization for the gold 50 industry. The data known as quantitative data because it is recorded as numerical. It provided many data from different period of time but this project only focuses on weekly and monthly timeframe. The data provided since year 1978 and has different currencies. But the not all data used and it need to go through the data pre-processing phases. This project not use data since year 1978 because the revolution of internet still not happen.

For weekly timeframe, the gold price data collected from 1st January 2010 until 25th December 2020 which contains about 575 rows of data. While for monthly, the gold price data collected from year 1st January 2000 until 1st December 2020 which contains about 253 rows of data. It only has two columns which are date and value of the gold. Even though the data only have two variables, but it is enough to make a prediction in time series. It is called Univariate Time Series Forecasting because the model only used previous values of the time series to predict its future values.

## III. METHODS

### A. Methodology

In order to complete this study, waterfall model has been applied to this research. The waterfall model was the first process model or the pioneer of the SDLC processes that introduced by Winston Royce in 1970. It also known as linear sequential model that splits software development into several phases. It called as waterfall because the model designed to complete each step before moving on to the next in downward way, with no overlap between them. All of these phases are interconnected, with progress appearing to flow downhill gently through them. During the SDLC phase, each phase is meant to execute a certain activity. This method does not need project managers or staff to get any qualifications or special training and it prioritizes accessible information so that new team members may come up to speed fast if necessary [6].

### B. ARIMA Modelling

Autoregressive Integrated Moving Average (ARIMA) model is a statistical and economic model for measuring events that occur over a period of time. This model usually will use the past data to predict future data of the series. ARIMA model build from three terms: p, d, q. ARIMA has three components ARIMA (p, d, q) which are Autoregression (AR) and Moving Average (MA) and Integrated (I).

- p - Refer to Autoregression (AR)
- q - Refer to Moving Average (MA)
- d - Number of differencing required to make the data stationary (I)

ARIMA model can applied to stationary data only [7]. Stationary means properties that do not depend on time at which the series is observed. If there has a trend or seasonality from the data, it shows that the data is not stationary. Visual test or ADF (Augmented Dickey Fuller) used in this project to check the stationarity. It can be stationary if the result of p-value is less than 0.05 while it is not stationary if the p-value is more than 0.05 [8].

Normally in an ARIMA model, either the autoregressive (AR) term or the moving average (MA) term will be used. Both of these terms only used on rare situation. Partial Autocorrelation (PACF) plot will help to decide what required number of AR term while Autocorrelation (ACF) plot will help to decide what required number of MA term. After done this process, it can apply to the AR or MA formula. In Eq. (1) shows the formula of autoregressive and (2) shows formula of moving average.

$$Y_t = \alpha + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \dots + \beta_p Y_{t-p} + \epsilon_t \quad (1)$$

$$Y_t = \alpha + \epsilon_t + \theta_1 \epsilon_{t-1} + \theta_2 \epsilon_{t-2} + \dots + \theta_q \epsilon_{t-q} \quad (2)$$

## IV. RESULTS AND FINDINGS

The data's random error, which is not explained by the prediction method or by trend and seasonal patterns, is one component of any time-series forecast. Fitting points for the time periods with historical data and then comparing the fitted points to the historical data is how the error is calculated. The absolute error or squared errors are the most widely used scale-dependent measurements such as mean square error, root mean square error, mean absolute error and median absolute error but RMSE and MSE are the most popular because of their theoretical relevance in statistical [9]. Equation (3) shows the formula of median squared error and equation (4) shows formula of root mean squared error.

$$MSE = \sum(\hat{y}_i - y_i)^2 / n \quad (3)$$

$$RMSE = \sqrt{\sum(\hat{y}_i - y_i)^2 / n} \quad (4)$$

From figure above,  $\hat{y}_i$  referred as the predicted value that already fit on the model while  $y_i$  is the observed value which is price of the gold.  $\Sigma$  known as sum. Then, the formula applied in the program. The model's performance will become better if the value is smaller or decreases (Kambezidis, 2012). It means if the value is closer to zero, the model was good.

Table 1. Result of MSE and RMSE test

<i>Model of gold</i>	<i>Medium Square Error (MSE)</i>	<i>Root Mean Square Error (RMSE)</i>
Weekly	0.0005	0.0223
Monthly	0.0013	0.0363

From table above, it shows that the value of MSE and RMSE are small and closer to zero. The value of the both testing is small because there a lot of historical data trained. Figure 2 shows user input to customize the duration of the prediction and figure 3 shows the visualisation of the predicted gold value based on developed project.

Fig. 2. User input



Fig. 3. Visualisation of predicted gold value

Next, this project also provides other features such as provide latest gold news as shown in figure 4, gold calculator as shown in figure 5, gold branch location around Malaysia as shown in figure 6 and its google map location as shown in figure 7.

Fig. 4. Latest gold news

Fig. 5. Gold calculator

Company	City	Address
LA Gold	London	100 Broad Street, The Old Bank Building, London, EC2R 2EJ, United Kingdom
Goldcorp	London	100 Broad Street, The Old Bank Building, London, EC2R 2EJ, United Kingdom
Goldcorp	London	100 Broad Street, The Old Bank Building, London, EC2R 2EJ, United Kingdom
Goldcorp	London	100 Broad Street, The Old Bank Building, London, EC2R 2EJ, United Kingdom
Goldcorp	London	100 Broad Street, The Old Bank Building, London, EC2R 2EJ, United Kingdom
Goldcorp	London	100 Broad Street, The Old Bank Building, London, EC2R 2EJ, United Kingdom
Goldcorp	London	100 Broad Street, The Old Bank Building, London, EC2R 2EJ, United Kingdom
Goldcorp	London	100 Broad Street, The Old Bank Building, London, EC2R 2EJ, United Kingdom
Goldcorp	London	100 Broad Street, The Old Bank Building, London, EC2R 2EJ, United Kingdom
Goldcorp	London	100 Broad Street, The Old Bank Building, London, EC2R 2EJ, United Kingdom

Fig. 6. Gold branch location around Malaysia

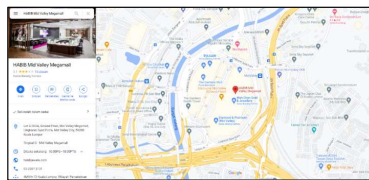


Fig. 7. Google Map location for the gold branch

## V. CONCLUSIONS

MainGold is a system that provide a prediction model of time series which is Autoregressive Integrated Moving Average (ARIMA). It predicts the value of gold for two timeframe which are weekly timeframe and monthly timeframe. The predicted value listed in a table and it visualized in a line chart to help investors to understand the future trend of gold. This process of prediction were done by admin because it is continuous data and need to be fetch if want to make a new prediction. There also

other features provided to users such as gold news. Admin will continue updating latest news of gold to make sure users get the latest information about the gold.

The system also provided a calculator to help investors to calculate their gold investment value. Users can choose their gold purity and insert the amount of gold in order to know the current investment. The calculation also shown to make users understand how the calculation of the investment done. Lastly, it also provided a feature like list of gold branch around Malaysia. All state listed except Putrajaya. This list will help user to find nearest location of gold branch 82 with help of google map location. The system also help admin by having a feature of data visualization of each model with the accuracy. Admin also can manage the gold news either to add new information, update or delete the news.

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