



UTM
UNIVERSITI TEKNOLOGI MALAYSIA

**INTERNATIONAL JOURNAL OF
INNOVATIVE COMPUTING**

ISSN 2180-4370

Journal Homepage : <https://ijic.utm.my/>

Elucidating Cryptocurrency with Trading Dashboard

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Submitted: 25/10/2022. Revised edition: 18/1/2023. Accepted: 15/2/2023. Published online: 30/5/2023

DOI: <https://doi.org/10.11113/ijic.v13n1.391>

Abstract—With the rise of interest in cryptocurrency in the recent decade, an ocean of financial news data has surfaced in articles, tweets, and even Reddit posts. Due to the sheer volume, it is not practical for the casual trader to read through all these news sources manually. However, only going through one or two sources alone may result in receiving biased information, or no useful information at all. With the current rise in cryptocurrency, accurately predicting market trends becomes highly beneficial to the user, providing a major opportunity for lower-income households to have a higher chance of profiting and living a substantially more comfortable lifestyle. In this study, a developer's API key was obtained for three news sources to scrape financial news from. Then, the TensorFlow Keras model and Gensim model's doc2vec NLP tool were utilized to process the data scraped online. The data is then saved as a .model and .sav file, and a website was constructed using the Flask framework. The website is now deployed and is available for all users. However, because the data obtained was too small to be utilized well, only a weak linear model that could give us a correlation between price and news sentiment was able to be constructed. The dashboard passed its functional and UAT tests with 100%, and via the usability test with SUS, the dashboard is considered to be easy to use. In all, the website summarizes the main details and sentiment of the coins and will benefit users who are just being introduced to the cryptocurrency space.

Keywords—Cryptocurrency, news data, trading, news scraping, Flask

I. INTRODUCTION

Considering the economy and the COVID-19 pandemic from the year 2020 to 2022, many families and social sectors have fallen victim to the economic crisis that Malaysia was and still is currently struggling with. With the current rise in cryptocurrency, being able to accurately predict trends in the market becomes highly beneficial to the user, providing a major opportunity for the lower-income households to have a higher chance of profiting and living a substantially more comfortable lifestyle [1, 2]. The guarantee of a virtual currency's success is

ultimately based on gaining public acceptance. While companies and stock players are starting to officially respond to the virtual currency market, the existence of public trust still holds extreme importance as without it, virtual currency is not sustainable in any way.

Recently, cryptocurrency is slowly gaining a presence in the global market through waves of news stories and pioneering individuals sharing their stories about their successes in cryptocurrency investment. However, even with the surge in media coverage, cryptocurrencies are still widely unknown to the general public, especially in a country like Malaysia. The skeptical public will require a large and assuaging amount of education and assurance, particularly with the volatile characteristic of the cryptocurrency market [3, 4, 5]. The primary objective of this paper is to produce a cryptocurrency assistant website that will summarize, at the same time, elucidate, all the basics of cryptocurrency and help new, interested users be more affiliated with the space.

The following Section II discusses the related works on existing research and highlights the gap that exists within the related works. Section III discusses the design methodology that is used to develop the system. Section IV reports the implementation of the system while Section V discusses the testing. Finally, Section VI concludes the study and discusses future works that would improve this study.

II. RELATED WORKS

Out of the multitude of stock tracking systems on the internet, the website named unbiastock.com [6] is utilized as the current system that provides cryptocurrency trading insights. The reason for choosing this system over the others is because it has a closer relationship to this study, and also has a useful filter that can enable the user to focus only on cryptocurrencies. The website was created by a reddit user named Swiss-Rock, and no other information is readily available on the creator of this website. It functions as an investment tool that allows

traders to go through different sentiments of stocks extracted from different public data sources, such as Reddit, Twitter and Google. The website is driven by public fundraisers that help fund the creators to develop their APIs, improve computational capabilities and create a mobile application of the system. In our project, as no fundings were provided, nor any computational capabilities beyond a local laptop, the only focus that could be implemented was the portion of the website that provides 'reddit trending crypto' information, which can be found from its website¹.

Other than that, CoinDesk [7, 8] and CoinMarketCap [9] media platforms are used for reference for investors to explore how cryptocurrency and digital assets are evolving in the scene of global finance. Their priority is to inform, educate and connect the global investment community through sharing news, data, events, and education.

To illustrate one of the challenges of current cryptocurrency data display, Fig. 1 shows the key metrics that CoinDesk calculates for the user, as well as a short summary about the crypto in general. While these metrics are useful to the experienced eye, they might come across as a little overwhelming for the casual trader, and not very useful for users who are not advanced in the field. From this, the visual strength of the graphic overview will be imported to be implemented in our proposed system; of CryptoCurrency Trading Dashboard (CTD).

Key metrics			
24 HOUR LOW	24 HOUR HIGH	NET CHANGE	24 HOUR OPEN
\$30,201.96	\$41,007.49	-\$482.87	\$40,266.17
ALL TIME HIGH	TOTAL SUPPLY	RETURNS (24H)	RETURNS (YTD)
\$64,829.14	18.71M	-1.20%	39.66%
VOLATILITY (30D)	TRANSACTION COUNT (24H)	AVERAGE TRANSACTION FEE (24H)	VALUE TRANSACTED (24H)
0.83	264,932	\$17.74	\$21.43B

Fig. 1. Key Metrics in CoinDesk

III. METHODOLOGY

Agile method is found to be the most suitable and straightforward method for the CryptoCurrency Trading Dashboard. There are a few reasons behind choosing the agile method over others, particularly over the waterfall method [10]. The agile methodology provides a more flexible environment which is important for the development of the algorithms and methodology behind scraping and processing the data that is needed in this system. Furthermore, while no user requirements are aimed to be changed in the process, the system needs to be tested concurrently with the software development. This is especially important as there is a need to test the machine learning process.

Before developing the system, the requirements gathering phase was conducted to ensure the preliminary specifications and user requirements align with what the user wants. The

features of the system were developed, tested and released multiple times in different iterations. Validation and verifications were performed during testing to make sure that the functionalities are according to what the user imagined, and to make sure all functionalities are working properly. If any changes occurred to the requirements during development, the features of the system would be tweaked again to fit the latest requirements. This is illustrated as such in Fig. 2.

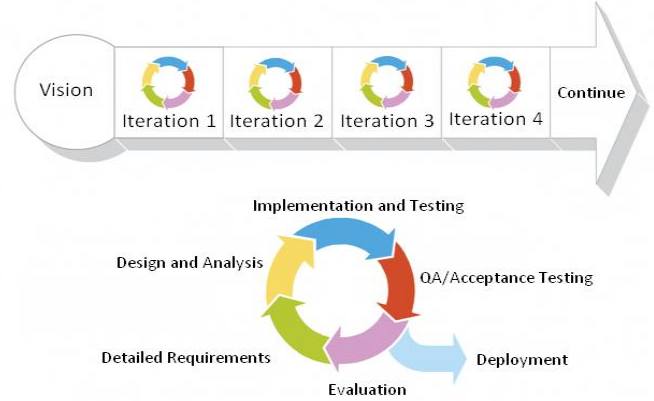


Fig. 2. The Agile Process

IV. SYSTEM ARCHITECTURE AND DESIGN

A. MVC Architecture

In the proposed CTD system, the architectural design pattern chosen is the model view controller (MVC). The users of this system are casual and beginner traders. The MVC architecture divides the system into 3 major components, which are model, view and controller and each component interacts with the others. This architectural design allows the data to be changed independently from its representation. The model component manages the data of the system and associated operations on that data. The view component defines and manages how the data will be presented to the user. The controller component manages user interaction and passes the interaction to the view and model component. Fig. 3 shows the system architecture of the CTD system.

¹ Their service discontinued from the second half of 2021

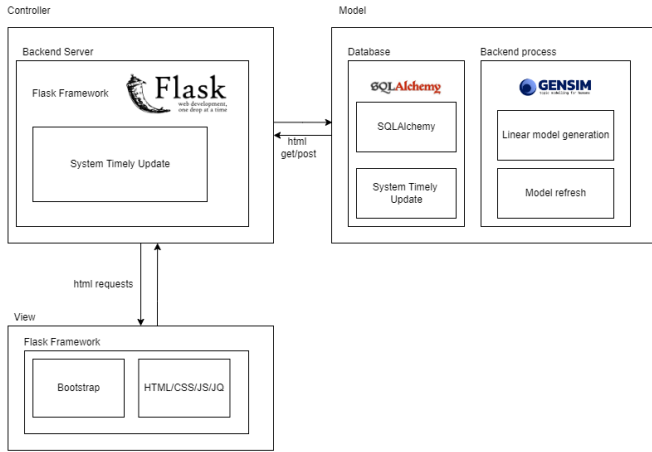


Fig. 3. MVC Architecture of CTD

B. Back-End Web Services Development

The backend web services were developed using Python with the Flask framework. Flask is used for the backend, but it makes use of a templating language known as Jinja2, which is used to create HTML, XML or other formats that are returned to the frontend.

C. Dataset via News Scraper Development

The new scraper was developed with python and by applying for developer API keys from sources such as The Guardian, New York Times and Google News. Data from these sources were obtained according to their API documentation instructions and then saved as .json files in folders labeled by their respective dates. As the developer key was only free and had a limited number of call requests, less than 5000 pieces of articles were able to be scrapped in the time period of a week, making for a dataset that was too small.

D. Model Development

To develop the model, the space of all possible news articles (title space) as \mathcal{T} and embedding space as \mathcal{V} was first denoted. Then, an embedding layer E to perform the mapping of: $E:\mathcal{T}\rightarrow\mathcal{V}$ as shown in Eq. 1 was trained. This was performed via the Doc2Vec model in the gensim python library [11]. We then construct a monthly vector, m_i , where:

$$m_i = \frac{1}{N_i} \sum v_t \tag{1}$$

where v_t is all the title vectors and N_i is the number of news articles published in the i -th month. As the number of articles related to the crypto space vary from month to month, this is a way to keep the model inputs consistent. Other than that, there is the problem of not having enough data as the project only has a developers account for the API to scrape data with. A model F that maps the *monthly vector* to the price returns of that month was then trained. Price returns is given by Eq. 2.

$$r_i = \frac{S_{close} - S_{open}}{S_{open}} \tag{2}$$

We chose F to be a linear model as shown in Eq. 3 and optimize the following ordinary least squared (OLS) cost with Eq. 4, where m_i and r_i are the *monthly_title_vector* and *monthly_returns* for month i [12]. Model F represents a wide class of models that are available to fit the *monthly_title_vectors* to the *monthly_returns*. In this study, F is selected to be a linear regressor but can be generalised into other kinds of models (e.g. a neural network, polynomial regressor).

$$F(m) = Am + b \tag{3}$$

$$\frac{1}{N} \sum_i^N (F(m_i) - r_i)^2 \tag{4}$$

E. RNN Implementation

In the beginning, the implementation of a neural network with the keras tutorial was attempted. The first 8 months of data for training and the last 4 months for test data were split as such. We used 60:40 ratio as this is among the common practice in data splitting [13]. Then, the neural network was saved and trained. The performance is evaluated by calculating the mean squared error and the absolute error, and then scaling it to the standard deviation of the actual price movement, as it gives us a more accurate error. On average, it can be deduced that each predicted value is about 4 standard deviations off the actual value, which would be determined as too much of a fluctuation, causing the predicted values to be unreliable. Fig. 4 shows an example of the produced output. Thus, a linear model was decided upon instead for the system.

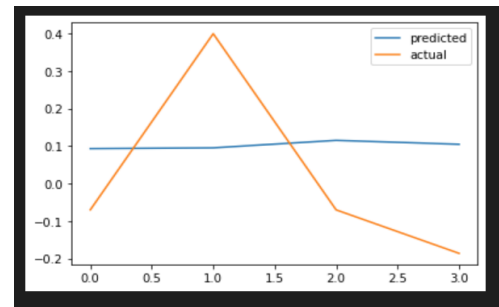


Fig. 4. Example output from neural network

F. Dashboard UI Development

A total of 14 use cases were derived based on the requirements gathered, which are: register, login, view preference, edit preferences, subscribe to newsletter, view overall trend, view specific coin page, view latest news, search latest news by query, view word cloud, view word cloud for specific query, view reddit data, view reddit posts, and view Twitter data. These functions are incorporated in the dashboard functions.

The structure of the user interfaces is modelled after the aforementioned site, such as Coindesk. This is to maintain

consistency for standard cryptocurrency applications, where users are able to recognize the patterns that are traditionally displayed on other sites. A convention of a majority of websites will be easily recognizable by the users, instead of a new looking design pattern for the cryptocurrency.

Furthermore, the design is kept to a bare minimum. Sections of the website are designed minimally with a limited colour palette. This is to ensure that the user gets to pay close attention to relevant information only, while being provided clear and visible functions.

For efficiency, the navigation of the site is designed to be simple and fast. Navigation keys are provided throughout the header and footer of the website, as well as on the page content itself. This is also modeled after many basic websites for user familiarity, for example clicking on the logo to redirect back to the main index page and so on. Fig. 5 and Fig. 6 show the main index page and the interface for specific cryptocurrency pages respectively.

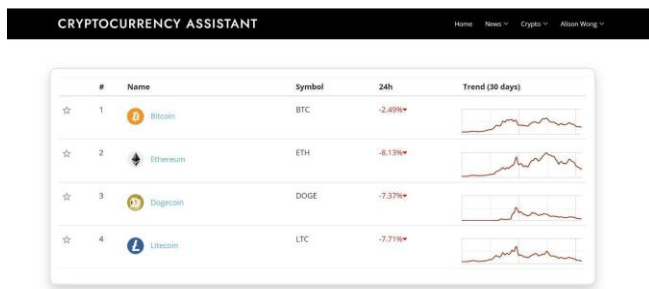


Fig. 5. CTD Index Page



Fig. 6. Specific cryptocurrency page of CTD

V. SYSTEM TESTING AND RESULTS

As the CTD is highly relied on the compilation of data, its visual, and how it perceived by viewers, the testing conducted for the CTD are functional testing and user acceptance testing (UAT), along with system usability test. The fundamental goal of system testing is to validate and verify the system with the stakeholders.

A. Functional Testing

Functional testing in a black box testing method that involves testing the functions of software applications without knowing the internal code structure, implementation details or

internal routes. It focuses on the input and output of the system and is usually conducted by the developers. Table I shows a sample of a test case design for CTD login. Each of the 14 use cases has its own test case suite.

TABLE I. CTD LOGIN FUNCTIONAL TEST CASE

Test Case ID	Input data	Expected result	Actual result	Pass / Fail
TC002_01_01	Invalid email in database	System displays message that indicates user does not exist	As expected	Pass
TC002_01_02	Valid email in database	System does not show any error message	As expected	Pass
TC002_01_03	<empty>	System displays error message that prompts user to fill in field	As expected	Pass

The coverage of the functional testing is 100% where all designed test cases in the test suites are executed. In addition, all test cases passed the tests, i.e. the actual results met the expected results.

B. User Acceptance Testing (UAT)

User Acceptance Testing (UAT) is a type of testing performed by the customer or the end user of the system verifies and accepts the software system before it is moved to the production environment. A total of 7 users interviewed for the elicitation of requirements participated in the UAT testing. Due to some of the interviewee's personal time restrictions, a set of 10 university students from University Teknologi Malaysia were also asked to participate in the UAT, who presented as the new cryptocurrency users.

The participants were asked to follow some instructions to achieve the instructed tasks, such as, search latest news by query, and view word cloud for specific query. From the results, all participants were able to complete the assigned functions, i.e., the UAT is 100% passed.

C. Usability Test

The System Usability Scale (SUS) [14] was used to measure the usability of the CTD. The same participants participated from User Acceptance Testing (UAT) were involved in this session. The standard questions of SUS, which consists of 10 questions, are applied and given to the participants to answer. The result is very promising as the highest score of the system was 87.5% and the lowest score was 82.5%, and according to the SUS score scale, this is an A scale. Question 3 of the SUS.: "I found the system easy to use" was rated the highest at "strongly agree", while Question 2 of the SUS, "I found the system unnecessarily complex" was rated the lowest at "strongly disagree". This shows that the participants feel the system has a high usability.

VI. DISCUSSION AND CONCLUSION

The CTD is developed to help to elucidate the understanding of cryptocurrency on one dashboard, specifically to facilitate those who are new in cryptocurrency. The limitation that was faced during the development was the data collection, where it could be improved for better performance of the linear model and potentially a neural network model. A meager amount of data such as the amount collected in this study was not enough to provide sufficient guidelines or accurate graph predictions. However, in order to keep the development low cost, it would be advisable to manually set a system to scrape the data every day at a fixed time and do a lot of post processing to clean the data of redundancies. With this, the dataset could be grown to a slightly more respectable amount, but it may still not prove enough for a neural network. Having said this, the best option would be to pay for premium price plans for better scraping functions from the APIs used.

In a nutshell, the development of the cryptocurrency trading dashboard system will help new and interested users venture into the space with higher confidence and promote the importance of trading and investing finances. As time passes, the importance of learning how to grow our money safely only becomes more important, thus the existence of this system can somewhat help the people in learning about the cryptocurrency space. In summary, a proper utilization and widespread growth of this system will be an excellent outcome for Malaysians to learn and grow their wealth and prosper into a better economy for the future.

ACKNOWLEDGMENT

Special thanks to project panelists for their guidance and advice. Without their continued support and interest, this would not have been the same as presented here. And the volunteers who participated in the study from day 1, for their views and insights.

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