CRYPTOCURRENCY ANALYSIS & TRADING BOT

A PROJECT REPORT

Submitted by

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In partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING

in

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Gujarat Technological University, Ahmedabad

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G. H. Patel College of Engineering & Technology

Bakrol Road, Vallabh Vidyanagar, Anand

CERTIFICATE

This is to certify that the project report submitted along with the project entitled **Cryptocurrency Analysis & Trading Bot** has been carried out by **Suraj Rajendra Jaiswal** and **Dharm Dipak Rana** under my guidance in partial fulfillment for the degree of Bachelor of Engineering in Computer Engineering, 8th Semester of Gujarat Technological University, Ahmedabad during the academic year 2021-22.

_____	_____
Prof. Krushna Pandit	Dr. Maulika S. Patel
Internal Guide	Head of the Department

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Name of Guide : Mr.Pandit Krushna Jagdeepbhai

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DECLARATION

We hereby declare that the Project Report submitted along with the Project entitled **Cryptocurrency Analysis & Trading Bot** submitted in partial fulfillment for the degree of Bachelor of Engineering in Computer Engineering to Gujarat Technological University, Ahmedabad, is a Bonafide record of original project work carried out by us at G. H. Patel College of Engineering & Technology under the supervision of **Prof. Krushna Pandit** and that no part of this report has been directly copied from any students' reports or taken from any other source, without providing due reference.

	Name of the Student	Sign of Student
1	Suraj Rajendra Jaiswal	_____
2	Dharm Dipak Rana	_____

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We are extremely grateful to my department staff members and friends who helped & supported us both morally & technically in successful completion of this project.

Yours Sincerely

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ABSTRACT

The objective of this project was to make a bot in python to facilitate the automating of trading in cryptocurrencies. The bot will run on autonomously, analyzing the sentiment of the selected subreddit(s) and try to make accurate trades that will result in an accumulation of profit for the user. It does so by fetching the subreddit information through the praw library & the reddit API & trading of cryptocurrency using the Binance API & library. The trading strategy involves the use of Bollinger Bands. The trading bot makes multiple buys and sell calls based on the information that it gets from the Bollinger Bands, and tries to maximize profit while limiting risks. The bot can also use various financial performance indicators using the technical analysis library. It is set to do trades based on the RSI indicator by default.

Bot performs tokenization and lemmatization using Regular Expressions, Emoji, Contractions & NLTK libraries on the posts & comments of the subreddit page. Using TF-IDF Vectorization and Random Forest Classifier it predicts the sentiment of data. Then every 10 minutes it checks the sentiment of new comments, takes average with the previous sentiment, and checks the change in the price of the cryptocurrency. If both sentiment and change in price are positive then bot buys, if both are negative it sells else it retains.

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CHAPTER 1
INTRODUCTION

In the last couple of years, Cryptocurrencies have experienced broad market acceptance and fast development despite their relatively recent conception. They have become the latest fad in investment and money management. The field that was once reserved for trading stocks or other traditional market equities has seen competition from an upcoming cryptocurrency market with Bitcoin leading the way as the biggest storage of wealth. Currently, there are hundreds of different cryptocurrencies that are available to trade. This leads to a lot of volatility, which means that money can be made and lost easily. Many hedge funds and asset managers have also begun to include cryptocurrency-related assets into their portfolios and trading strategies. The academic community has thus spent considerable efforts in researching cryptocurrency trading.

Since human emotions are usually one of the biggest barriers to successful trading pedigree. The market is sometimes irrational and doesn't follow expected paths. It is usually our greed that takes over and causes us to lose money and not make profits when they should be made. So, in order to become better traders, we must rid ourselves of our emotions. The only we can do that with any sense of finality is by getting rid of the human variable trading the cryptos itself and let the raw market analysis to the trading.

This paper seeks to automate the trades by using a python script to make do the trading on behalf of a user. The strategy is based on two well-known indicators, called Bollinger bands and RSI. The bot will check at these two indicators, and make appropriate moves, and take appropriate strategy in order to maximize profit.
RSI is used as the default indicator cause it is a popular momentum indicator used by arm-chair traders, however other indicators of various types including volatility, volume and trend like EMV, MFI, ATR, Donchain etc. can also be used to make the trades according to the users prefrences.

We are thus making a real-time automated trading system that uses machine learning and statistics; that take into account the market sentiment, does technical analysis on the crypto price, and then makes a decision to buy or sell a particular cryptocurrency.

However, the bot may or may not be able to predict extreme market condition like bubbles or crash reliably, and human intervention might be required in such cases.

There has been related literary work that discusses the profitability of cryptocurrency trading. Kyriazis et al. [3] investigated the efficiency and profitable trading opportunities in the cryptocurrency market.

This report is organized as follows. Chapter 2 discusses Reddit. It goes over the decision of why we choose to use Reddit as our source and not various news sites or other social media platforms like Twitter or Facebook. Chapter 3 discusses related work. It goes over the related work in the field that inspired the idea of this project. It also shows how this project relates to it by discussing the differences and similarities. Chapter 4 discusses the design and implementation of the project. It discusses the different frameworks involved as well as the different technologies and technical vocabulary needed to understand the intricacies of the project. Chapter 5 discusses the data analysis portion of this project. It goes over the data gathered from different time frames. Chapter 6 deals with the conclusions of the project. It goes over the limitations of the project and proposes solutions to fix them in future iterations.

CHAPTER 2
REDDIT

2.1. Introduction to Reddit

Reddit is an American social news aggregation, web content rating, and discussion website. Registered members submit content to the site such as links, text posts, images, and videos, which are then voted up or down by other members. Posts are organized by subject into user-created boards called "communities" or "subreddits". Submissions with more upvotes appear towards the top of their subreddit and, if they receive enough upvotes, ultimately on the site's front page. Reddit administrators moderate the communities. Moderation is also conducted by community-specific moderators, who are not Reddit employees.

As of September 2021, Reddit ranks as the 19th-most-visited website in the world and 7th most-visited website in the U.S. About 42–49.3% of its user base comes from the United States, followed by the United Kingdom and Canada. Twenty-two percent of U.S. adults aged 18 to 29 years, and 14 percent of U.S. adults aged 30 to 49 years, regularly use Reddit.

Reddit is a website comprising user-generated content—including photos, videos, links, and text-based posts—and discussions of this content in what is essentially a bulletin board system. The name "Reddit" is a play-on-words with the phrase "read it", i.e., "I read it on Reddit." According to Reddit, in 2019, there were approximately 430 million monthly users, who are known as "redditors". The site's content is divided into categories or communities known on-site as "subreddits", of which there are more than 138,000 active communities.

As a network of communities, Reddit's core content consists of posts from its users. Users can comment on others' posts to continue the conversation. A key feature to Reddit is that users can cast positive or negative votes, called upvotes and downvotes respectively, for each post and comment on the site. The number of upvotes or downvotes determines the posts' visibility on the site, so the most popular content is displayed to the most people. Users can also earn "karma" for their posts and comments, a status that reflects their standing within the community and their

contributions to Reddit. Posts are automatically archived after six months, meaning they can no longer be commented or voted on.

Front-page rank—for both the general front page and for individual subreddits—is determined by a combination of factors, including the age of the submission, positive ("upvoted") to negative ("downvoted") feedback ratio, and the total vote-count.

2.2. Sub-Reddits

Subreddits are user-created areas of interest where discussions on Reddit are organized. There are about 138,000 active subreddits (among a total of 1.2 million) as of July 2018. Subreddit names begin with "r/"; for instance, "r/science" is a community devoted to discussing scientific topics, while "r/television" is a community devoted to discussing TV shows, and "r/bitcoin " is a community dedicated for Bitcoin-oriented topics.

In a 2014 interview with Memeburn, Erik Martin, then general manager of Reddit, remarked that their "approach is to give the community moderators or curators as much control as possible so that they can shape and cultivate the type of communities they want". Subreddits often use themed variants of Reddit's alien mascot, Snoo, in the visual styling of their communities.

2.3. Community and Culture of Reddit

The website is known for its open nature and diverse user community that generate its content. Its demographics allows for wide-ranging subject areas, as well as the ability for smaller subreddits to serve more niche purposes. The possibilities that subreddits provide create new opportunities for raising attention and fostering discussion across various areas. In gaining popularity in terms of unique users per day, Reddit has been a platform to raise publicity for a number of causes. Additionally, the user base of Reddit has given birth to other websites, including image sharing community and image host Imgur, which started in 2009 as a gift

to Reddit's community. In its first five months, it jumped from a thousand hits per day to a million total page views.

Statistics from Google Ad Planner suggest that 74% of Reddit users are male. In 2016, the Pew Research Center published research showing that 4% of U.S. adults use Reddit, of which 67% are men. 78% of users get news from Reddit. Users tend to be significantly younger than average with less than 1% of users being 65 or over.

Reddit is known in part for its passionate user base, which has been described as "offbeat, quirky, and anti-establishment". Similar to the "Slashdot effect", the Reddit effect occurs when a smaller website crashes due to a high influx of traffic after being linked to on Reddit; this is also called the Reddit "hug of death"

Reddit has been used for a wide variety of political engagement including the presidential campaigns of Barack Obama, Donald Trump, Hillary Clinton, and Bernie Sanders. It has also been used for self-organizing sociopolitical activism such as protests, communication with politicians and active communities. Reddit has become a popular place for worldwide political discussions.

There are also a significant number of subreddits dedicated to real-world issues and topics ranging from Internet Privacy, neutrality and anonymity; climate change; providing justice to victims to various wars and famines.

2.4.Science and Reddit

There is also scientific research that has studied the influence of Reddit posts on the popularity of Wikipedia content. A participant-observation study of April Fools' Day 2017 social experiment on r/place identified top-down and bottom-up coordination mechanisms, rules and emergence, and analyze their relative impact on the collaboratively created artwork, revealing cooperation and conflict, using qualitative and quantitative methods.

Data from Reddit can also be used to assess academic publications.

If you’re interested in a more general discussion on science, start with r/EverythingScience. It’s a place for people to talk about anything and

everything having to do with science. You can filter by field, add your thoughts to discussions already taking place, or start a new discussion by submitting a link to something you are interested in – a blog post, video, news article, editorial, etc.

If you're looking for a more defined discussion on peer-reviewed science, head on over to The New Reddit Journal of Science at r/science. There you may only submit links to published peer-reviewed research. Get the conversation started on your work or a peer's work!

An AMA is short for "Ask Me Anything." A scientist arranges a time with Reddit moderators to discuss a specific topic related to their research or interests. You submit a brief bio and summary of what you would like to discuss, and the Reddit community is given the chance to submit questions before the AMA start time. There is a submission guide with detailed information on how to get started with setting one up. An AMA is a great way to get a conversation started on items that are of particular interest to you, and a way to share your expertise with people interested in studying or working in the same field, or just interested in learning something new.

2.5.Reddit over other websites

Reddit gives you the opportunity to share your knowledge and expertise in a more detailed, conversational way. You can find people discussing topics at length that you are interested in and can contribute meaningfully to. Unlike social media platforms that are centered around creating a personalized profile that is all about you, Reddit prides itself on being a community. The things you share should not be overly promotional, but should contribute to the discussion as a whole. Joining the discussion can help serve to expand your network and reach.

It is like a melting pot of information coming from every other social media while also being a place where people have a discussion on each piece of news, article, opinion and media that make it on the website. Although active participation in the discussions is encouraged, each subreddit has enough moderators to keeps the content in check and prevent false and fake news from spreading on the website. Active discussions and voting policy also makes sure that such posts are taken

down quickly while the readers are made aware of it being fake. This makes helps reddit be a thoroughly content moderated platform while being a platform for all types of content including unconventional and taboo content. This makes sure that the platform remains an outlet for free speech as well as decentralized.

2.6. Content moderation on the website.

The home page of Reddit, as well as each individual subreddit, uses a user-driven voting system that determines the ranking of content posted on each given page. Reddit utilizes a primarily decentralized and hybrid approach to content moderation. The company has a set of overarching content policies regarding acceptable content that are high-level and prohibit illegal content such as CSAM, as well as objectionable behaviors such as harassment and content that encourages or incites violence. In order to broadly enforce these content policies, Reddit has a small, centralized team of moderators (known to users as administrators or admins), who comprise approximately 10 percent of Reddit's 400 person workforce. However, the majority of content moderation on the platform is carried out by the moderators of individual subreddits, who are known as mods. Mods are users who volunteer to moderate content on a particular subreddit. They have significant editorial discretion and can choose to remove content that violates Reddit's rules or that they deem objectionable or off-topic. They can also temporarily mute or ban users from their subreddit. Mods are also empowered to create additional content policies that define acceptable content and use for their subreddits as long as they do not conflict with Reddit's global set of content policies. All of the mods on a subreddit can also collectively create guidelines that outline their own responsibilities and codes of conduct. Mods may also have additional roles, such as fostering discussions, depending on the subreddit. Admins rarely intervene in content moderation decisions unless it is to remove objectionable content that is illegal or clearly prohibited by Reddit's content policies, or to ban users from the site as a whole. According to researchers from Microsoft, there are approximately 91,563 unique mods on the platform, with an average of five mods per subreddit.

By employing a decentralized approach to content moderation, Reddit is able to save time and resources by relying on its users to aid with content moderation.

This approach keeps users engaged and serves the overall business aims of the company. In addition, it positions the company as a promoter of diverse viewpoints, since each individual subreddit has its own content policies that are tailored to the needs of each specific subreddit community. This decentralized approach to content moderation has also resulted in users self-policing to ensure they do not violate specific content policies and has fostered an environment in which users call one another out for violating policies or posting objectionable content. Further, this decentralized model enables localized and context-specific moderation decisions as mods set and enforce content guidelines that are appropriate to the particular nuances, norms, and variations attributed to different discussion topics.

In addition to employing a small number of human moderators to engage in ex-post reactive content moderation, Reddit admins also employ some automated tools in order to identify and remove objectionable content such as CSAM. However, because the majority of content moderation is carried out by users, Reddit has also developed an automated tool, known as the AutoModerator, that mods can use to moderate content on their subreddits at scale. The AutoModerator is a built-in, customizable bot that provides basic algorithmic tools to proactively identify, filter, and remove objectionable content during the ex-ante moderation stage. The bot operates based on mod-chosen parameters such as keywords, content that has a high number of reports, website links, and specific users, etc. that are not permitted in a particular subreddit. The AutoModerator can automatically remove this objectionable content, but mods also have the opportunity to review this removed content later and can reverse any erroneous removals. In addition to using the AutoModerator, many Reddit mods have turned to creating their own bots or tools, or using free versions available online, in order to flag custom words and enhance their moderation practices. The decentralized approach to content moderation empowers users to manage their own speech and helps democratize expression and enable localized and diverse viewpoints, as well as context-specific content moderation practices. However, it does raise a number of questions regarding accuracy and reliability, bias, and transparency and accountability. There is little insight into how accurate the AutoModerator is across different subreddits and categories of content or violations. In addition,

because mods create the content policies for subreddits and define the parameters that the AutoModerator operates on, the deployment of automated tools for content moderation will undoubtedly reflect the personal biases of the mods. There is little transparency around this process, and because Reddit operates in a decentralized manner, there is a lack of a clear accountability mechanism.

Reddit also offers notice to users who have had their content removed or accounts suspended. It also offers an appeals process to users who feel their content or accounts have been erroneously impacted by content moderation activities.

2.7. Cryptocurrency and Reddit

In 2021, there were a lot of conversations on Reddit, but there was one topic that cut through the online chatter this year: cryptocurrency. People mentioned 'crypto' 6.6 million times on Reddit in 2021, according to 'Reddit Recap 2021', which rounds up the most popular posts, topics and conversations on its platform over the past year.

For more than 10 years, Reddit has been home to over 500 cryptocurrency communities. "As more redditors (reddit users) participate in conversation, whether it be for information, help, or to share major successes, Reddit continues to be the hub for cryptocurrency enthusiasts," the company said in its report.

The top-five most-viewed cryptocurrency communities in 2021 were: Dogecoin, Superstonk, Cryptocurrency, Amcstock, and Bitcoin.

Reddit group "Dogecoin: Who's still holding $DOGE?" had 80.3K upvotes, while Reddit group "bitcoin: Tesla buys $1.5b in Bitcoin" had 45.5k upvotes on the platform. Upvote, as we discussed in previous chapters, is when users show their approval for a post by clicking an "up" arrow, which pushes the post toward the top of the site so that more people can see it.

It should be noted that cryptocurrencies including Dogecoin, Ethereum and Shiba Inu also topped 'Google's 2021 Year in Search', which the Alphabet-owned search engine released. "Dogecoin" and "Ethereum price" were the top 10 most-Googled news stories of the past year, across the globe.

Meanwhile, Shiba Inu was the most discussed cryptocurrency on Twitter during October, as per the data compiled by ICO Analytics. The analysis firm revealed the 20 most discussed cryptocurrencies on Twitter and Shiba Inu has emerged as a clear winner, receiving a 22 percent share of all crypto assets discussions on the platform, dwarfing Ethereum by 8.1 percent and Bitcoin by 7.2 percent.

CHAPTER 3
RELATED WORK IN THE FIELD

There are a few trading bots available in the market for use; for example, one popular trading bot is called Zenbot. It can be run on your personal computer or hosted on the cloud. There are a lot of useful features including SMS, Discord notifications and paper and live trading however the technical experience required to use it is high. Another popular trading bot is Catalyst which has good documentation and a good community for statistical analysis and machine learning support. Unfortunately, it is relatively difficult to set up in our opinion. It does not support live trading and installation process is very tedious and lengthy.

Overall, the best product we found was Brad Lindblad's Trading Bot. In the article, "Build A Cryptocurrency Trading Bot with R", Brad Lindblad, a data scientist, talks about building his Trading Bot using the statistical programing language R using the rgdax package which was an R wrapper for the GDAX API. His work is similar to this project but instead, Python wrapper for the Binance API is used in this project. It should be noted that GDAX and Binance are third-party cryptocurrency wallets and exchange platforms used to store and exchange various listed cryptocurrencies. For his strategy, Lindblad uses the Ethereum USD pair. The strategy adopted by him uses the Relative Strength Index (RSI) indicator in order for the bot to find a good place to enter the market. If the indicator tells the bot that the market was being oversold, then the bot kicks in and takes a position. The more interesting part takes place during the selling phase. Lindblad's strategy relies on three limits to sell orders. He sells a part of his standings at various profit goals: 1% profit, 4% profit and 7% profit such that by the end of the 7% mark all his stake has been completely sold.

To automate the above strategy, Lindblad used Windows Task Scheduler for this task. He chooses the script to run every 10 minutes. Overall Lindblad added a few other variables, such as, only running the script when the balance of his account was $20 or greater, and when the RSI was 30 in the current period and the previous 3 periods at least once. This tied up all the loose ends in his strategy and made it profitable.

Our project is heavily inspired by his work in the field with significant changes made by us in order to make it even more accessible and easier for a layman to use the script. First of all, we decided to change the language of the script from R to Python as Python is much more semantically understandable and easy to use as well as modify. Along with that we used YAML python wrapper to hold majority of parameters so that it is dead simple for a layman to setup the script without interacting with any code whatsoever. Our work is also heavily inspired by the Gamestop Fiasco done by the users of r/wallstreetbets on January 22, 2021 and the month long storm proceeding it where a coordinated group of arm chair traders were able to out-play various big Hedge funds successfully.

We also made sure to keep everything on the local machine and give the order directly to the secure Binance API which talks with the server in order to make sure no useless user data is ever transmitted to any server and any and all data transmitted is done so securely only with the trusted Binance server in an encrypted format. We kept the default currency pairs as Etherium/USD and Bitcoin/USD, since these are some of the highest market cap cryptocurrencies that are trusted by majority of stakeholders and are relatively a safe bet in case the whole market crashes. At the same time, they fluctuate enough throughout the day in order to have decent profit margins without taking any risky bets, making the endeavor worthwhile for a user.

We made these decisions to make sure an entry level trader doesn't immediately get burnt, however we made sure to keep all the parameters, including which cryptocurrencies to trade as simple as possible for a user to select, in case he wants to take any risky bets.

We went with Binance since it is a trusted platform that also acts like a popular and trusted cryptocurrency wallet and it provided us with real time data, including the Bollinger bands used in the project through simple API calls.

CHAPTER 4
DESIGN AND IMPLEMENTATION

This chapter discusses the design and implementation of the Crypto Trading Bot in detail. It goes over all the Sentiment Analysis Bot used by us. It then gives background information on Bollinger Bands and then it goes into detail about RSI indicators and the LTC/USD trading pair and it discusses a few charts and how they relate to the project.

4.1. Sentiment Analysis

After each 10-minute interval, the bot checks for new posts on the targeted subreddits and upon arrival of new comments or posts, it logs the data and performs a sentiment- analysis on the posts and comments. This provides the sentiment of the market towards our targeted coins which helps us predict the future rise or fall in prices.

We have 2 options for sentiment analysis, one of the bots was made by myself which was trained on twitter conversations, thus it having a better grasp of lingo people use, however it has an accuracy of only 88.57%. The other option being the Sentiment Intensity Analyzer built into the NLTK library which has a much better accuracy but doesn't cover the lingo of these social culture. Users can choose any of them.

My sentiment analysis bot was written in python to analyze the sentiment of the given tweet (or any text). I designed an AI Bot using the SciKit Learn library's Linear Regression module on a tweet data set preprocessed on positive/Negative, Count Vector & TF-IDF Vectorization. The tokenization & stemming was done by me using regular expressions, emoji, contractions & NLTK libraries.

In both cases the analyzer gives a value from 0-1 to each post, corresponding to the positivity of the post. 50%(.5 points) means the post is neutral, 0 being extremely negative and 100%(1) being extremely positive. These posts are correlated by the cryptocurrency written in it, so these points are logged into the system as sentiment for respective currency. Upon receiving 10 new entries, an average is taken and if the average has a changed, further steps are taken.

4.2. Background for Bollinger Bands

The main trading strategy used for this experiment was the Bollinger bands. The premise behind Bollinger bands was to look for proper places to take an entry. Bollinger Bands are quite simple. They are composed of three different bands. These bands are dynamic and adjust themselves to changes in price. The most important band is the center line which is called the exponential moving average. The exponential moving average is used to signal a trend in the market. For example, when the market is strong then the Exponential Moving Average (EMA) will show a line going up and when the market trend is down the EMA will show a line going down. On top and below the center line there are two more bands, upper band, and lower band. They are located two standards deviations above and below the center band respectively. The simplest strategy to take using Bollinger bands is tracking when prices cross the upper or lower band. For example, when price action crosses the upper band the stock can be considered overbought.

Therefore, this would be a good time to sell since the market is probably due for a correction; therefore, it will probably be on the way down soon. The converse is also true; for example, if the price action crosses the lower band to the downside, then the stock is due for the other type of correction, and it could soon see a rise in price action. This is also tied to an indicator called the Relative Strength Index (RSI). The chart in figure 1 is an example of a Bollinger Band. It includes the places to sell and to buy.

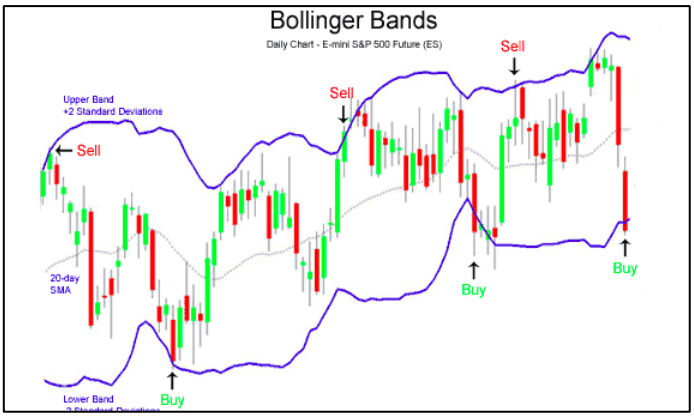

Fig 1: Bollinger Band Example

4.3. RSI Indicators

Relative Strength Index is what's called a momentum indicator. It shows you in what direction the market is heading towards. It compares the number of times that the price closed in an upwards trend vs the number of times it closed in a downward trend. From this information, the Relative Strength Index is assigned a score from 0-100. The Relative Strength Index (RSI) tells you if something is being oversold or overbought. For example, if the RSI score is over 70 then the stock can be thought of as being overbought. This means it would be a good time to sell. However, if the RSI score is below 30 then the stock can be thought of as oversold [4]. In this case, it would be a good time to think about entering into a position.

This is very similar to what the Bollinger Band Indicators say. So both the Bollinger bands and the RSI Indicators can be used in conjunction to determine whether to enter into a trade or to leave it.

If the price is touching the lower Bollinger Band and the RSI is under 30 then the stock is probably oversold. This is where it would be a good idea to make a buy. The opposite is also true. For example, if the RSI is over 70 and the price is touching or approaching the upper band then it is probably under bought. This would be a good opportunity to make a sell.

4.4. Binance

The place where the trades for this experiment took place is on the Binance. It a third-party cryptocurrency wallet and exchange platform trusted and used by many people. While there are many different exchanges this is a relatively large platform which is trusted to many and has secure yet easy to use API & API policy with plenty of documentation easily available. It also has it's own Python wrapper class for trading and research purposes. It provides all past data of all currencies listed on it's website though the API. What you would have to do is go to the BTC/USD trading pair sell your BTC there.

Some of the best features of Binance include being able to use multiple devices to trade and look at real-time order books. Binance also has a wide variety of feature including getting real-time data and address whitelisting. Address whitelisting is useful for security. Basically, it lets you limit crypto withdrawals to only addresses that you specify. In dealing with security Binance offers something unique, for

example, 98 percent of its assets are locked in cold storage the rest are privately insured against theft and FDIC insured up to $250k. Overall Binance is one of the most successful and secure exchanges for cryptocurrency.

4.5. Binance Python Client

To communicate with binance servers, this project utilizes the Binance library made and maintained by themselves. This library made is easy to connect to use and has a secure connction to it's sccount using a private security key provided for development pourposes. You can also access a lot of the functions provided by the Binance API. For example, through this library, all buys and sells can be made from the trading bot program created in this project without ever being required to log in to the actual binance website. The key functions available in the client include functions such as the buy and sell functions. These functions lower the price, enter the size of the position, the type of order limit and the current wished to trade. Overall this was very helpful because it helped mimic actual user interface conditions like trading on the actual website.

4.6. LTC/USD Trading Pair

Cryptocurrency is a relatively new thing in the world. Basically, it is a form of digital currency. Overall, there a few reasons for the existence of cryptocurrency but ultimately it's a way of taking power away from the major banks and institutions and giving it back to the people. This is known as decentrialization. Basically, with cryptocurrency, everyone is part of a network instead of relying on a single server. The biggest and the first of all cryptocurrencies is Bitcoin. Bitcoin is the market leader which pretty much controls over 50 percent of the market. The top five cryptocurrencies are Bitcoin, Ethereum, Ripple, Bitcoin Cash, and Litecoin. The cryptocurrency that was chosen for this project was Litecoin. Litecoin is basically a form of digital currency similar to Bitcoin. The benefits are that it supports faster payments and it has a greater total of maximum coins. For example, Bitcoin has a total maximum of 21 million coins whereas Litecoin has a maximum of 84 million coins. Overall if compared to traditional markets, then Bitcoin is gold and Litecoin is silver. Litecoin was chosen for a variety of reasons. This project is based on Brad Lindblad's work. In his work, ETH/USD pair is used. To explore and investigate

new scenarios, the present project chooses the LTC/USD pair. Another reason for using Litecoin as the currency is due to the lower price of LTC and the greater amount of volatility. Volatility is often associated with big swings in either direction. For example, when the stock market rises and falls more than one percent over a sustained period of time, it is called a "volatile" market. Usually, volatility is very helpful in making a profit. If there is a greater price disparity between the lows and peaks of the price of a stock, then there is more profit to make since the maximum of buy low sell high still holds true.

4.7. Different Time Frames

When looking at a price chart, there is one important thing that must be considered. That is to see what time frame the chart is in. There are several time frames. If you're looking at the Daily chart then you're looking at one day in price action. It creates a new candlestick on the chart every day. There several different time frames that go down all the way to the minute time frame. Lower time frames are good for scalping, but it is always important to go on larger time frames. Besides dailies, there are time frames that are bigger than itself. There are weekly and monthly charts. When looking to see where price action is going towards, it is important to look at bigger time frames because the lower time frames are more erratic and not as reliable.

4.8. Setting up the Bollinger Band with LTC Chart

Overall, some form of intuition is needed to see where the price is heading for a specific currency. The way of doing this is to look at the price charts for that specific currency. From the price chart, we are able to draw the proper conclusions. The first step in doing this project is getting the Bollinger band charts for the price of Litecoin. The 1D time frame is used for this information. A Bollinger band chart is illustrated in Figure 1. In the figure, the blue line is the actual price, the green band represents the upper band, the red represents the lower band, and the middle band represents the 30-Day Moving Average.

There were two different graphs we need to view; one is the recent monthly chart represented in Figure 2, and the other is the yearly chart. The yearly chart allows us

to see a wider view of how the price has changed and fluctuated as depicted in Figure 3.

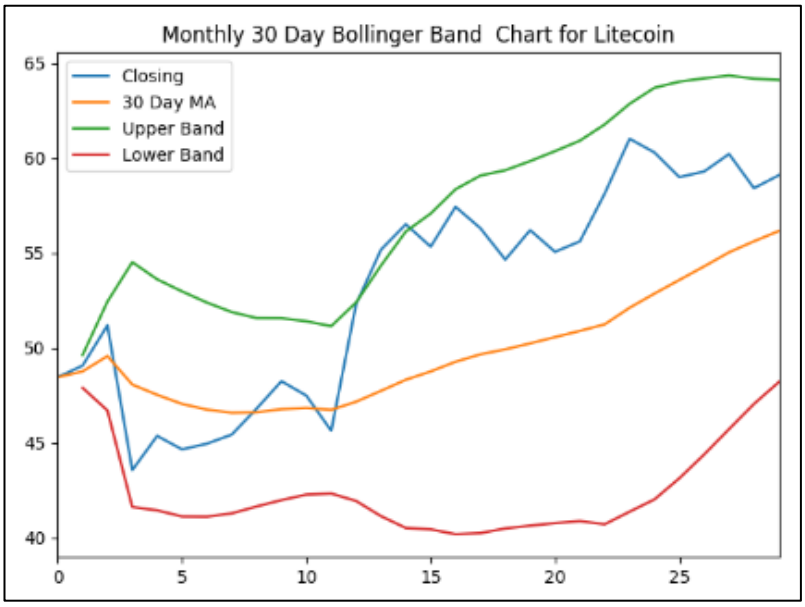

Figure 2:30 Day Bollinger Band

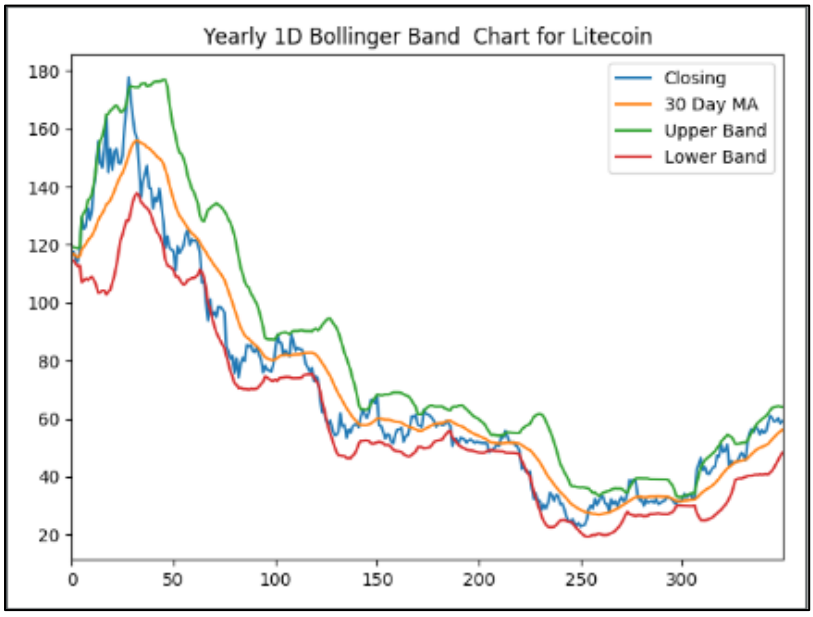

Figure 3: Yearly 30-Day Bollinger Band

4.9. Setting up the RSI calculations

In order to get the calculation of the RSI indicator, a specific formula is used. Basically, one needs to use the RSI calculations of the previous 30 days. Here, we used the RSI which goes as follows. RSI=100-100(1+RS) where RS is the average gain over the average loss of the last 30 days. The RSI basically relies on the fluctuations in the price of the cryptocurrency. It measures the average gain over the average loss.

$$RSI_{\text{step one}} = 100 - \left[\frac{100}{1+\frac{\text{Average gain}}{\text{Average loss}}}\right]$$

RSI formula

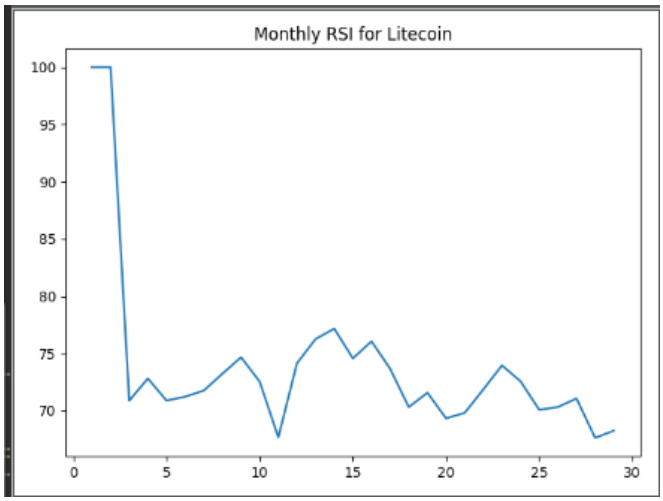

Fig 4: Monthly RS

4.10. Automating Script

In order for the python program written in this project to run in the background, the user only has to start the script and leave the computer running, the user can also use the device without any problems since no significant bandwith or cpu-power is used for this application. However an active internet connection is required for this script to run. The script can be auto-started by sampling adding this script to the startup folder located at this location:

C:\Users\current_user\AppData\Roaming\Microsoft\Windows\Start Menu\Programs\Startup

CHAPTER 5
DATA ANALYSIS

This section deals with the data analysis of all the different variables. It looks at the results of the trading bot from a variety of different timeframes.

5.1.Daily Time Frame

The table 1 below shows the results of the Bollinger band for the last thirty days. It is based on the daily time frame since every row in the table represent a different day.

	Closing	30 Day MA	Upper Band	Lower Band	RSI
1	51.19	50.129999999999995	53.128132752230954	47.13186724776904	100
2	43.57	47.94333333333333	55.809242901421	40.077423765245655	88.6234696924455
3	45.37	47.3	54.21884383405204	40.38115616594796	88.93154323421385
4	44.66	46.772	53.21237887084292	40.33162112915708	87.95846440867983
5	44.96	46.47	52.41740952011882	40.52259047988118	88.01584992652342
6	45.44	46.32285714285714	51.80762045328618	40.8380938324281	88.10975116581521
7	46.81	46.38375	51.4733240770436	41.2941759229564	88.37892308866745
8	48.25	46.59111111111111	51.511857441135085	41.67036478108714	88.65843083631086
9	47.49	46.681	51.355027052648374	42.00697294735162	87.50793257853282
10	45.64	46.58636363636364	51.06474970929012	42.10797756343717	84.73569514082338
11	52.3	47.0625	52.45829044677001	41.66670955322999	86.34824766308068
12	55.17	47.68615384615384	54.535492200873655	40.83681549143403	86.96294856558404
13	56.51	48.31642857142857	56.4127548309798	40.22010231187733	87.24076814362712
14	55.33	48.784	57.385494222351305	40.18250577764869	85.57750762821509
15	57.43	49.324374999999996	58.69142638593072	39.957323614069274	86.06712714932554
16	56.3	49.734705882352934	59.4149463691566	40.054465395549265	84.46898719554528
17	54.65	50.00777777777777	59.68061556457401	40.334939990981525	82.16174790194091
18	56.2	50.333684210526314	60.15397660383409	40.51339181721854	82.62353780487868
19	55.06	50.56999999999999	60.35928307680877	40.780716923191214	81.02571676057921
20	55.61	50.896999999999984	60.90968479690163	40.88431520309834	81.20731473294902
21	58.13	51.243999999999986	61.7674383014398	40.72056169856017	82.02375139650238
22	61.01	52.115999999999985	62.85015483398668	41.38184516601329	82.90294954668607
23	60.29	52.86199999999999	63.695479491591634	42.02852050840834	81.86620364604711
24	58.99	53.578499999999984	64.01620951885516	43.140790481144805	79.99544220288885
25	59.29	54.29499999999998	64.19521477704289	44.39478522295707	80.10410854066862
26	60.21	55.03349999999998	64.3381253919333	45.728874608066654	80.44155657490509

Table 1: Daily Table

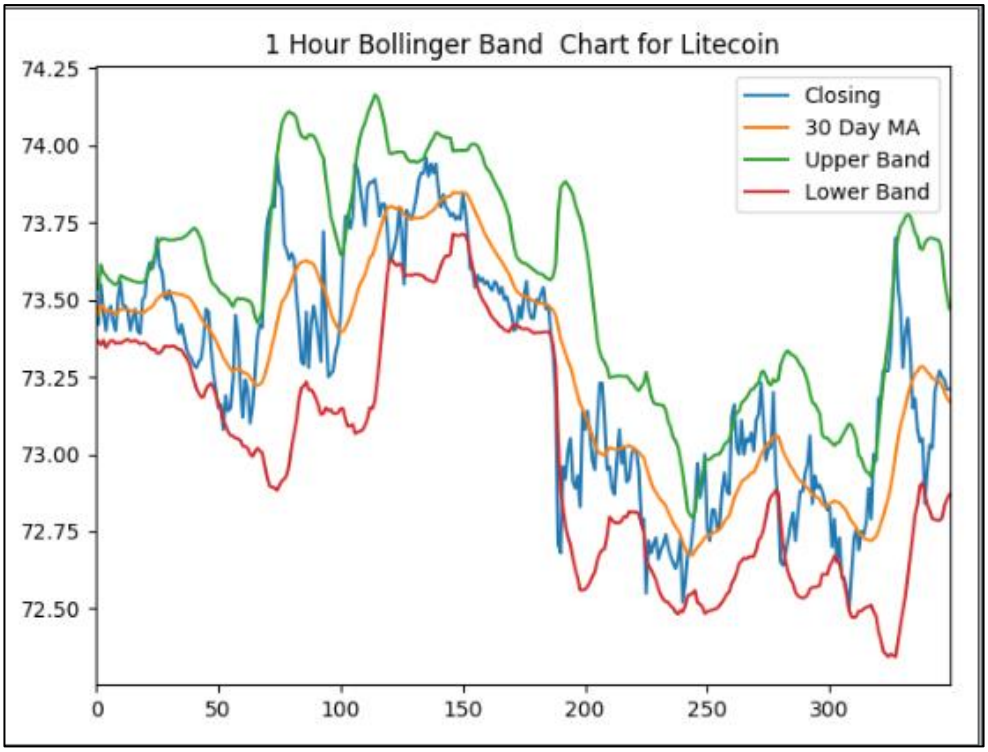

Fig 5:1hr Bolinger Band Chart

From looking at this chart we can see overall the RSI is quite high for this time frame. Together from the Table chart and from the Bollinger band, we can see that price action is a bit high from the mean; therefore, it is a bit oversold, so taking a daily trade won't be a good idea. However, there is still profit to be made in the lower time frames. Together from the table chart in table 1 and from the Bollinger band we can reaffirm our hypothesis of the currency being oversold since it is touching the top band the RSI is quite high.

5.2.Hourly Time Frame

From Figure 5, we can see that the RSI situation has changed in the hourly time frame. For example, the RSI score has stopped being in the upper 70s and moved down under to the 50 and 60s. This is a good sign because now we can see that the momentum has slowed down a bit. Therefore, it is a good place to enter into a position.

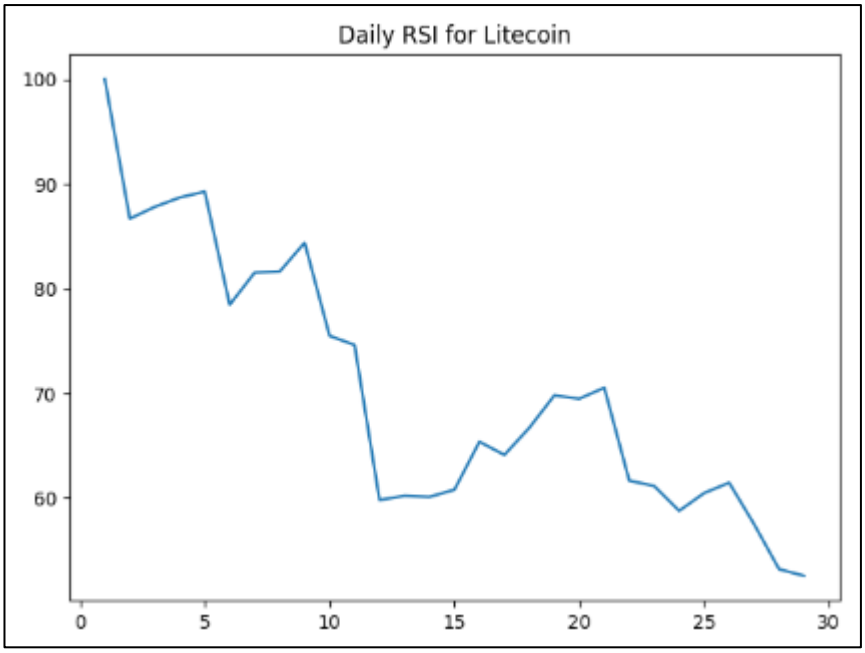

Fig 6: Daily RSI of LTC

If we take a look at the Bollinger band, we can see that the price is also falling so we can see that the upwards momentum has stopped, and the market is entering a correction. Therefore, this is another good sign to enter into a proper position. As you can see from figure 6, the closing price is getting ready to hit the lower band. This is good because optimal trading conditions are price touching the lower band and RSI is between 30-50.

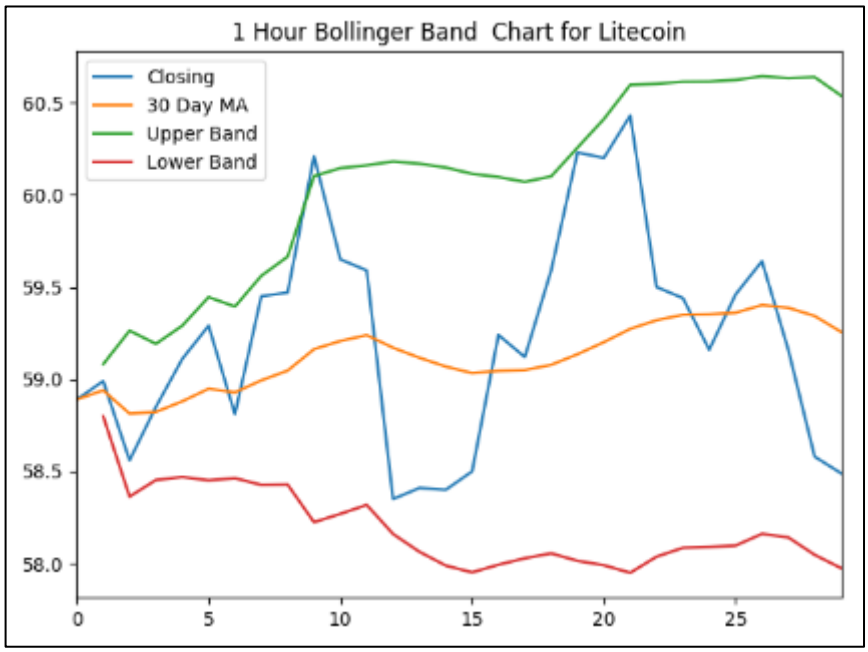

Fig 7: 1hr Bollinger Band

Table 2 confirms the appropriate market conditions. If we look at the chart, we can see that the RSI is falling as the closing price gets closer to the lower band.

	Closing	30 Day MA	Upper Band	Lower Band	RSI
0	58.89	58.89			
1	58.99	58.94	59.08142135623731	58.79857864376269	100
2	58.56	58.81333333333333	59.26337036884633	58.363296297820334	86.68730650154816
3	58.85	58.8225	59.191778575964896	58.4532214240351	87.81992918563495
4	59.11	58.879999999999995	59.29036569057366	58.46963430942633	88.71171889126268
5	59.29	58.94833333333333	59.44510960759234	58.45155705907432	89.27478300983184
6	58.81	58.92857142857143	59.39396424780103	58.46317860934183	78.46504947670901
7	59.45	58.99375	59.56084157738663	58.426658422613365	81.55007945475214
8	59.47	59.04666666666666	59.66488992730961	58.42844340602371	81.63523069455371
9	60.21	59.163	60.1016538824887	58.224346117511296	84.39515745271548
10	59.65	59.20727272727272	60.144933258983045	58.2696121955624	75.50180163220757
11	59.59	59.23916666666667	60.16009340675301	58.318239926580326	74.62911242025214
12	58.35	59.17076923076923	60.181064947823124	58.16047351371534	59.82737647195635
13	58.41	59.11642857142857	60.16882823645373	58.064028906403415	60.22275096862506
14	58.4	59.068666666666665	60.148160375155356	57.989172958177974	60.12061221175658
15	58.5	59.033125	60.11408059575775	57.95216940424225	60.80903603351667
16	59.24	59.04529411764706	60.09672451589173	57.99386371940239	65.3883590928589
17	59.12	59.04944444444444	60.070089505114055	58.028799383774825	64.12982528411536
18	59.59	59.0778947368421	60.10032276087483	58.05546671280936	66.72762035821822
19	60.23	59.13549999999999	60.25612905266827	58.014870947331715	69.81109795754999
20	60.2	59.200999999999986	60.41080033150319	57.99119966849678	69.49840864144736
21	60.43	59.27299999999999	60.596028423929845	57.94997157607013	70.54597087731388
22	59.5	59.31999999999999	60.60254680842044	58.037453191579544	61.67517108697119
23	59.44	59.3495	60.613536558432	58.085463441567995	61.161274940445836
24	59.16	59.35200000000001	60.614238612857925	58.0897613871421	58.79349664285423
25	59.46	59.360500000000016	60.62327013785276	58.097729862147276	60.490824212236284
26	59.64	59.40200000000002	60.64296057870296	58.16103942129708	61.47690454259495
27	59.16	59.387500000000024	60.63286826090246	58.142131739097586	57.512437607860335
28	58.58	59.34300000000002	60.63854865435055	58.047451345649485	53.21752616841233

Table 2: Hourly Table

As the marketing conditions are right, this would be the appropriate time to enter a trade. Therefore, the bot enters into a trade at the price of 59.08. I hold the price for a few hours and then sells the price of 59.67. Therefore, it exits its position at the 1% profit margin. Therefore, it was a successful trade. It made another trader at 59.34 when the market made a pullback. It then sold at 59.55.

CHAPTER 6
ARCHITECTURE AND IMPLIMENTATION

This chapter goes over the overall architecture and implementation of the application. It goes over the walkthrough of the entire process as well as providing an architecture drawing.

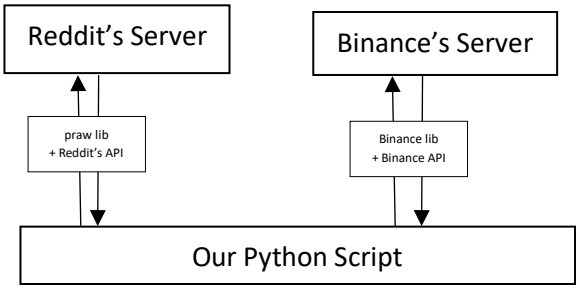

Fig 8: Flowchart 1- Basic Flow of Program

6.1.Walkthrough of the Process

Overall, the way that this project works is that the python script communicates with the Reddit API every 10 minutes to fetch any new posts or comments that have been made on the targeted sub-reddits from the last successful fetch. This is a back-and-forth process. If any such new posts or comments are found, all of it are downloaded and checked if the posts are talking about any of our targeted cryptocurrencies. If yes, they are added to our list of data for sentiment analysis. Once we gather a threshold amount (10 by default) of new posts, a sentiment analysis is performed on the gathered data and an average of the public sentiment is taken and stored.

If the average sentiment of the users has changed from the last time, we fetch the current price of that particular currency and compare it with the last price that we had delt with. After this is done the trading bot checks to see where the price is based on the Bollinger bands and the RSI. The trading bot checks the RSI and it checks to see if the current price is closer to the middle band the upper band or the lower band.

If both the average sentiment and technical analysis is positive, we buy the currency, and if the sentiment and technical analysis is negative we sell the currency by giving API orders to our Binance Account using our secret key.

The price data is also pulled from the Binance exchange using the same API used for giving trading orders, which gives us the benefit of buying and selling at the same price we get for our analysis purposes.

There is also a safeguard built in. Whenever the profit reaches at least 1% then the bot automatically executes a trade and if the price drops less than 1% then the bot automatically executes a trade. This is to avoid staying in a position too long and losing too much money without any hope of recovery.

6.2.Three Different Cases

There are three different cases that are essential to the algorithm of the trading bot. Overall the trading bot looks at five different variables. First it looks at the the change in the average sentiment value, then it looks at the current closing price, then it looks at the value in the upper band and the value of the lower band and finally it looks at the RSI. From these five values, it is able to make decisions.

The first case is when the RSI is greater than 30 but less than 70 and also when the final closing price is touching the final upper band and the sentiment delta has increased, i.e., the sentiment is tuning positive towards the target cryptocurrencies.. This case causes the bot to enter into a buy.

The second case occurs when the rise is over 70 and the difference between the final closing price is less than .5 and the sentiment has decreased from its last standing, i.e. delta negative. This specifies that the price is touching the upper band, so it’s almost run out of momentum.

The third case occurs when it is not beneficial to trade, i.e., there has been no significant change in sentiment of the user or the market prices have not moved favourably. In this case, the program chooses to wait and not enter a trade.

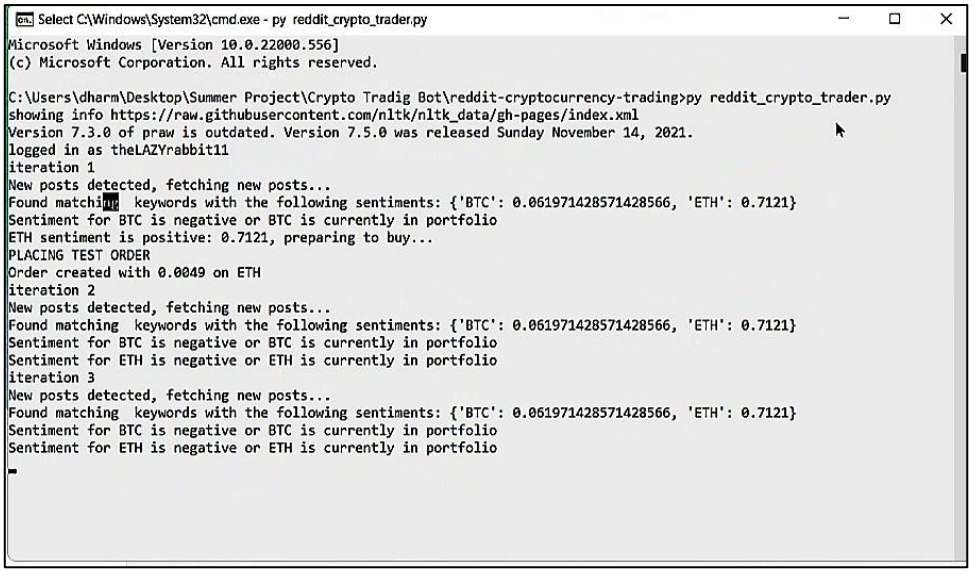

Fig 9: CLI Implementation screenshot

6.3.Portfolio Management

There is a term in trading called portfolio management. Portfolio management is making sure that you don't get too greedy and lose all your money. The way that the bot accomplishes this is by using limits. For example, after a buy has been set the bot checks to see if a profit has been made by looking at the price.

It also includes having a solid list of cryptocurrencies to trade and hold positions in. These cryptos are selected according to the amount of risky positions the user is willing to take.

CHAPTER 7
CONCLUSION

Overall, our findings while testing the robots in sandbox environment is that the trading bot did end up making a profit however, they were small and infrequent. In order to improve the profitability of the bot, a few things had to be done. Trades could have been done frequently, on higher volumes or using other technical indicators. Newer currencies which have higher margins even on low volume could have been used, they being a high risk ordeal.

This can be done by trying to day trade in smaller time zones. If we go to the minute time frames, then we can set the profit margin at an even lower ceiling. For example, we can exit a trade when it is about .05% in profit. This makes it much easier to take advantage of volatility in the market, therefore, making it easier to exit and enter trades.

In a future implementation, multiple technical indicators can be adopted such as madcow indicator to get a more reliable reading of the market.

The biggest change we can make is to introduce Time-Series Analysis that can be done on targeted cryptocurrencies with the help of the past data available to us, which can greatly improve the performance of the AI. If a classifier that keeps a track of the change in targeted cryptocurrency based on the change in public sentiment of other currencies can be trained to work in tandem with the TSA predictions, then even the high-risk trades can be made much more confidently, profitably and frequently.

Also all these trades can be remotely monitored as well as canceled on the Binance app in case of emergency but future integrations, say on discord, which notifies the user a few minutes before making trades or when making high volume margin trades can help in irregular or undesirable trades that can cause deficiency of funds.

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APPENDIX

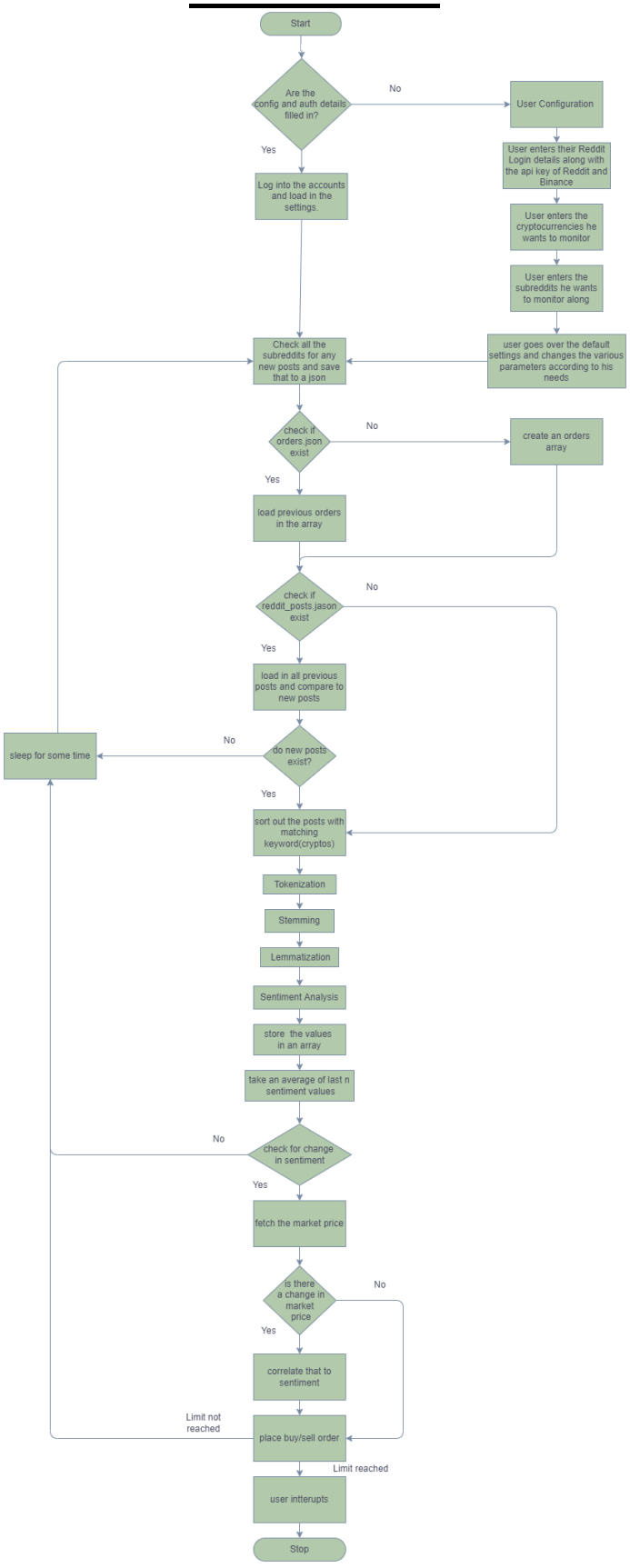

Fig 10: Flowchart 2- Detailed Flow of the Program