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Web Platform for SaaS Applications

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Abstract

Reviews play an important role for customers while buying any product. It is one of the deciding factors for customers. Software as a Service (SaaS) is a way of delivering applications over the internet as a service. Instead of installing and maintaining software it can be simply accessed via internet, freeing client from complex software and hardware management. For any client, to choose a SaaS application becomes difficult as there are 1000s of reviews with each review containing 100 to 200 words for a single application. The authors are going to create a web platform which will provide concise reviews using machine learning algorithms and analytical data of that application through graphs and charts. Customer can buy facilities such as application usage tracker, application spend tracker from website through blockchain based payment gateway. This paper also talks about the various works carried by other researchers in this domain.

Keywords— SaaS, Machine Learning, Web Scraping, Sentiment Analysis, Blockchain.

I. INTRODUCTION

Machine Learning (ML) is an application of artificial intelligence that provides system the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning focuses on the development of computer programs that can access data and use it learn for themselves. Natural Language Processing (NLP), component of ML, can help machines to automatically understand text. Sentiment analysis, an application of NLP, is used to extract sentiment from any text (e.g. social media reviews or tweets) indicating positivity or negativity. Similarly NLP can be used to generate summarized text from large amount of text.

There are various review sites which contain reviews of different products (e.g. SaaS, Electronics, etc.). Users can refer these reviews while buying the products. The purpose of web-platform being developed is to help the customer to choose the best SaaS product among the various available products. The web-platform will provide user a single concise review for a SaaS product along with its analytics which will tell everything about the product using several machine learning algorithms. User can compare and purchase products easily without having to go through each and every review on different websites. Above all, the web-platform will provide a comfortable user experience including subscription for application usage tracker and application spend tracker using a secured payment gateway.

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II. MOTIVATION

Users now-a-days want everything to be simplified and due to their fast track life they don't have enough time to read and compare all reviews for something they want from different sites. For any client, to choose a SaaS application becomes difficult as there are 1000s of reviews with each review containing 100 to 200 words for a single SaaS application and that too on different sites. Thus a reliable platform can provide a single concise review along with its analysis which will tell everything about the product. This can be provided using reliable machine learning algorithms so that users can compare and purchase products easily without having to go through each and every review on different websites.

Another challenge the user faces using the traditional way of online purchasing is concerning trust, reliability, and value. Traditional banking is now deemed outdated and somewhat unreliable as consumers and businesses are seeking alternative options for their transactions and assets. As a result, blockchain technology and cryptocurrencies can change the way payments are conducted and fulfilled.

Not only user but the companies also faces problems such as over spending on public cloud services and infrastructure. Companies cloud expenses are predicted to be more than double from US$229 billion in 2019 to nearly US$500 billion in 2023. According to the results of a survey by Cloudability, 58 percent of respondents said they overspend on cloud resources. This makes managing cloud services like SaaS more important than ever to reach its full potential.

III.RELATED WORK

Sani Kamis et. al. [1] evaluated performances of different deep learning techniques in sentiment analysis using twitter data. This provided an insight of the working of the deep learning techniques. Different algorithms like Convolutional Neural Network (CNN) and Recurrent Neural Network (RNN) are used for comparison. They suggested use of two different word embedding systems. The combination of CNN and LSTM can be used for better sentiment analysis.

Julija Golosova et. al. [2], in their paper discussed the advantages and disadvantages surrounding the Blockchain Technology. They also gave ideas about the use cases of Blockchain and what advantages it provides in different domains.

Finding aspect terms and the different stages in sentiment analysis is highlighted by Satuluri Vanaja et. al. [3]. The authors explained the process of finding sentiment polarity in simple terms and it can be used to understand the whole process.

Dona Kaid et. al. [4] described the various advantages of blockchain and effects of integrating the blockchain system with supply chain parties. The purpose of integration is benefiting from trust, confidentiality and data transparency that blockchain offers. It also includes the utilization of QR codes to handle in supply chain industry between distributers and retailers. To illustrate the advantages of blockchain on supply chain a prototype is implemented and developed using Hyperledger composer. The prototype is developed to benefit from REST server ability in providing APIs that can be easily integrated with any other system.

Web Scarping Methodology and its designing is described by Deepak Kumar Mahto et. al. [5]. Web scraping involves indexing the information on the web with the help of a bot or web crawler. The proposed implementation is divided into two main parts:

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1. The web crawler to fetch the desired links.
2.The data extractor to fetch data from these links.

The authors have also discussed the different crawling policies which give the behaviour of a web crawler taking into account the legal as well as illegal aspects. They have used Python as a programming language for implementation of the web scraper. Beautiful Soup is used which is a web crawling framework available in Python.

X. Fang et. al. [6] proposed general process for sentiment polarity categorization with detailed process descriptions. Data used are online product reviews collected from Amazon website. The authors focused on Phase 2 and 3 of sentiment polarity extraction. For Phase 2, an algorithm is provided for negation phrase identification, a mathematical formula is also proposed for calculation of polarity and a method to generate feature vector. In Phase 3, two sentiment polarity experiments are carried out based on two types of categorization: Sentence-level categorization, Review-level categorization. At last, the performance of three classification models is evaluated and compared based on their results. Software used for this study is Scikit-learn, an open source machine learning software package in Python. The classification models selected for categorization are: Naïve Bayesian, Random Forest and Support Vector Machine.

A brief explanation of the concepts that can be used for the implementation of the proposed system is given by Sanjay Kumar Malik et. al. [7]. They explained extracting useful information from the web using Web Usage Mining, Web Scrapping and Semantic Annotation. In the Scraper implementation, the discovery pattern is used in the website for extraction of fields. API is used to define the formal structure to data sets.

Christian Wartena Novay et. al. [8] proposed most important criteria for a word to be selected as keyword is its relevance for the text. They also included the use of tf.idf relevance measure to easy computing without considering relations between words.
There are different relevance measure that uses relations between words. They are computed by defining co-occurrence distributions for words and comparing these distributions with the document.

A brief description about the powerful and flexible plug-in architecture is proposed by Dia Kharrat et. al. [9] which builds upon the pluggable factories design pattern. In factory pattern, object is created without exposing the creation logic to client and the client use the same common interface to create new type of object. The idea is to use a static member-function (static factory method) which creates & returns instances, hiding the details of class modules from user.

Table I summarizes highlights and observations of the related work discussed above.

TABLE I
SUMMARY

Ref. No.	**Highlights**	**Observations**
[1]	Improved performance of Deep learning techniques over Machine learning techniques in sentiment analysis.	• It was observed that when CNN and LSTM networks are combined together they perform better than when used alone. • Proper implementation is not provided.

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[2]	Advantages and disadvantages of Blockchain technology	• Blockchain provides transparency, trusty, decentralized digital ledger, reliability and non-destructibility. • Performance of Blockchain outperforms its challenges.
[3]	Aspect-Level sentiment analysis using SVM and NB classifiers.	• Very little is talked about the sentiment polarity extraction and no method is provided for it.
[4]	Effects of integrating blockchain and ERP systems and supply chain parties.	• It address the problem of trust between distributers and retailers.
[5]	Scraping the data from web using web crawler and data extractor.	• Beautiful soup is used for scraping which is not powerful enough for large scale of data.
[6]	To propose a general method for sentiment polarity extraction.	• Difficult for review-level categorization based in their specific star-scaled ratings. • Proposed method may not yet work for reviews containing implicit sentiments.
[7]	Extracting useful information from the web using Web Usage Mining and Web Scrapping.	• Scraping program is required to update frequently from time to time due to which maintenance cost becomes high.
[8]	Methods are proposed to improve the efficiency of TF.IDF	• It does not follow the machine learning approach as it concentrate on a suitability of a keyword for a document.
[9]	To add additional components into the application on demand to provide extra features or functionality.	• The paper describes about the powerful and flexible plug-in architecture which builds upon the pluggable factories design pattern. Without using this pattern, it creates both compilation and runtime dependencies on the plugins.

Based on the observations mentioned in Table I, the proposed system is discussed in next section.

IV. PROPOSED SYSTEM

In this section, the outline of the proposed system is presented. The proposed system allows customers to compare multiple SaaS applications and will be able to buy subscription for usage tracking and spend tracking through blockchain based payment gateway. The main goal of the proposed system is to provide a comfortable user experience including a secured payment processing.

The proposed system comprises of following stages: (A) Web Scrapping Stage, (B) Sentiment Analysis Stage, (C) Product Analytics Stage, (D) Plugins Development Stage and (E) Payment Gateway Stage.

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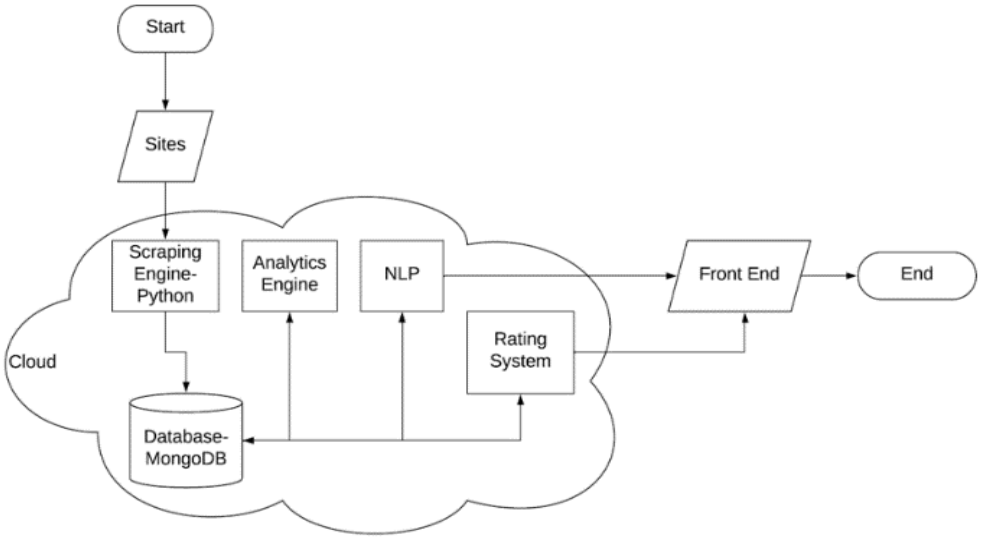

Fig. 1: System flow for concise review and analytical data generation

A. Web Scraping Stage

The first stage is to scrap data from websites and store in the cloud database through API. Input for the web scraper will be review sites such as GetApp, G2Reviews, etc. First crawl those links from which the data is scrapped (i.e the webpages containing the reviews) and then extract the needed information i.e. reviews with the help of data selectors from the crawled links. Send the scraped reviews to the API. Call the API to store reviews to MongoDB database. API will check if the review is already present in the database and if not, it stores the review.

B. Sentiment Analysis Stage

This stage is to perform sentiment analysis on the scraped reviews using machine learning. Pass the reviews to the sentiment analyser, then Sentiment Analyser will differentiate the reviews as positive or negative along with its sentiment score (polarity score). Then parts of reviews are extracted which contains the keyword that describes different aspects of the product. A single concise review for a SaaS application along with its overall sentiment score will be the output of this stage.

C. Product Analytics Stage

This stage is to extract analytical data of individual product and display the analytics on the front-end build using React.js. Pass the input to the analytical algorithms which will generate results (E.g. – ranking system, trends, etc.). Store the results to database through API. Extract the data through API and display it through React Elements/Components. Output from this stage will be the analytical information of SaaS products in the form of Pie charts, Graphs, etc.

The proposed system will also provide front-end search and filter operations for SaaS products where input will be App Name or Category Name. To perform faster search queries, ElasticSearch will be used. The next step is to Setup and Configure ElasticSearch which will create indexes on various fields of the information. Search will be carried out according to the text entered by the user

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and related information will be extracted from the database. Output of this will be the required/searched apps and their details.

D. Plugins Development Stage

Two plugins(browser extensions) will be developed namely SaaS Usage Tracker and SaaS Spend Tracker. Both these plugins will be helpful to track and reduce the organization's spending on the SaaS products.

SaaS Usage Tracker will track how much time the user spends on the site and which links are frequently visited. Admin of the organization will be able to track the SaaS application usage by it's users (employees).

For SaaS Spend Tracker, user should mention the details about subscription taken of a product along with the required details and plugin will give all the necessary analytics (i.e. graphical representation of expenditure of the user).

E. Payment Gateway Stage

Using blockchain as payment gateway will ensure secured payment processing along with higher speed with its' strong infrastructure, it helps in making a lot faster transactions between peers and international payments. Since it is secured and transparent, transactions take a lot shorter time due to the quickness of approval processes.

V. RESULT AND DISCUSSION

Experimental results are discussed below:

A. User Interface:

An e-commerce website is developed using react.js. It shows all the details of the SaaS products using various react elements. For e.g.- product rating, overall score, positiveness, top keywords and top sentences related to those keywords, a single concise review (summarized review), etc.

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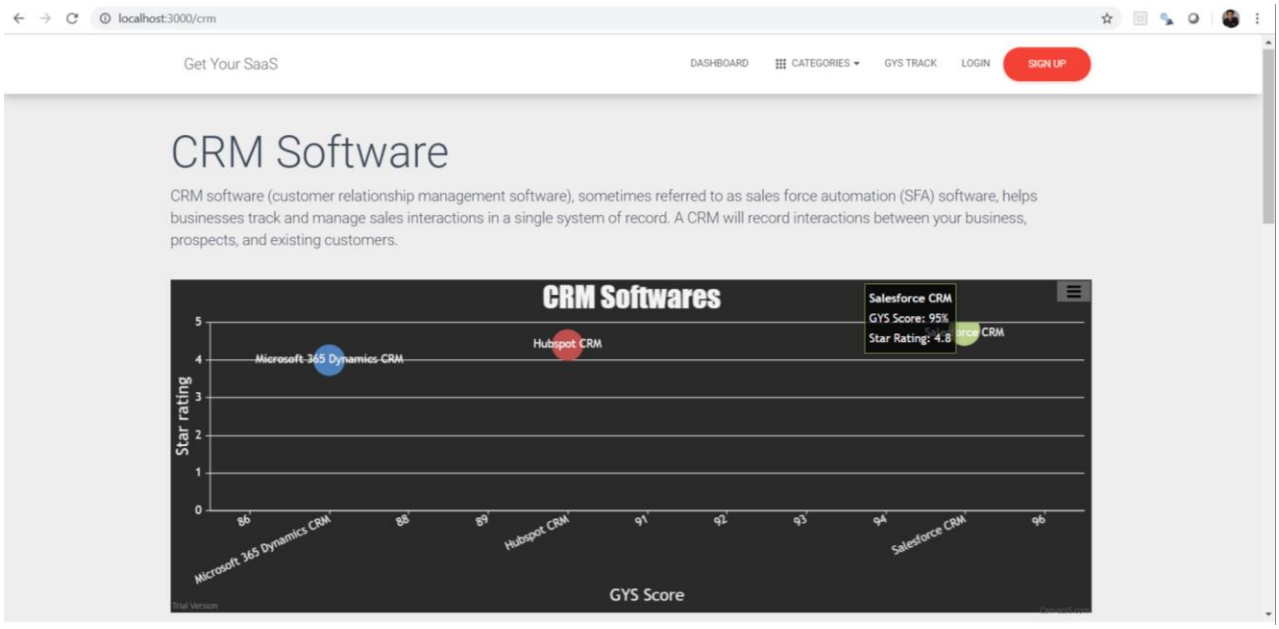

Fig. 2: User Interface showing details of SaaS products graphically

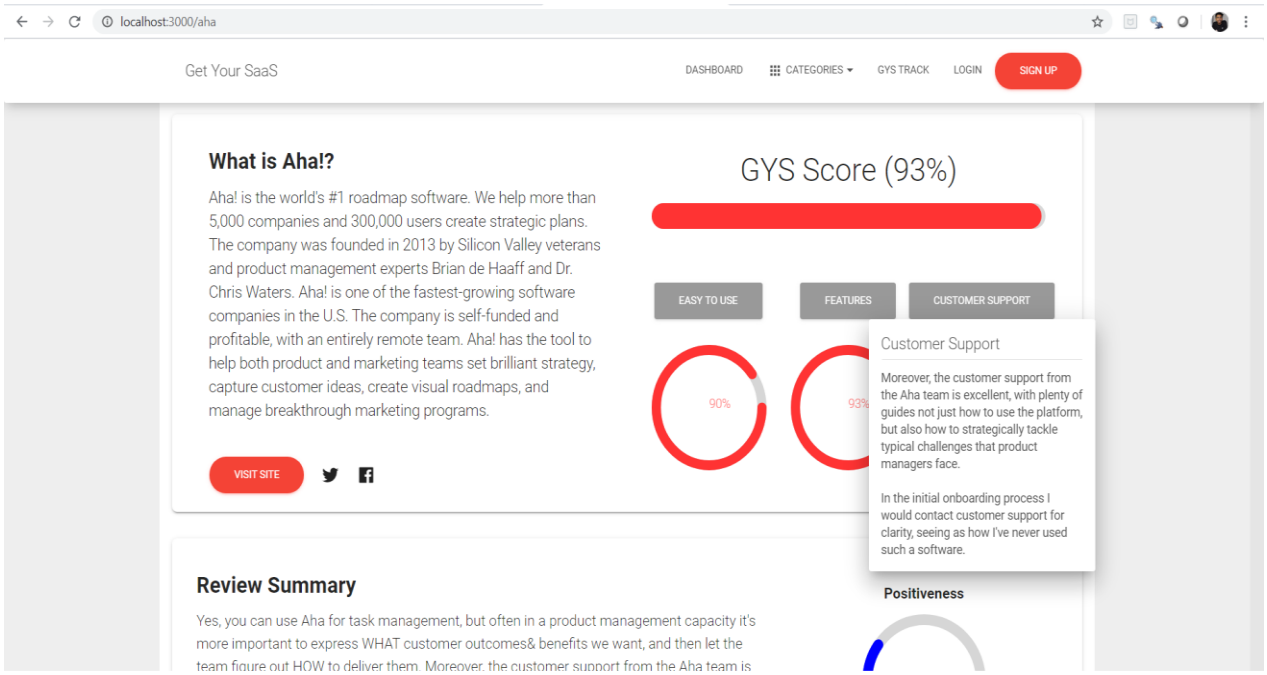

Fig. 3: Keywords along with respective sentences related to the SaaS product

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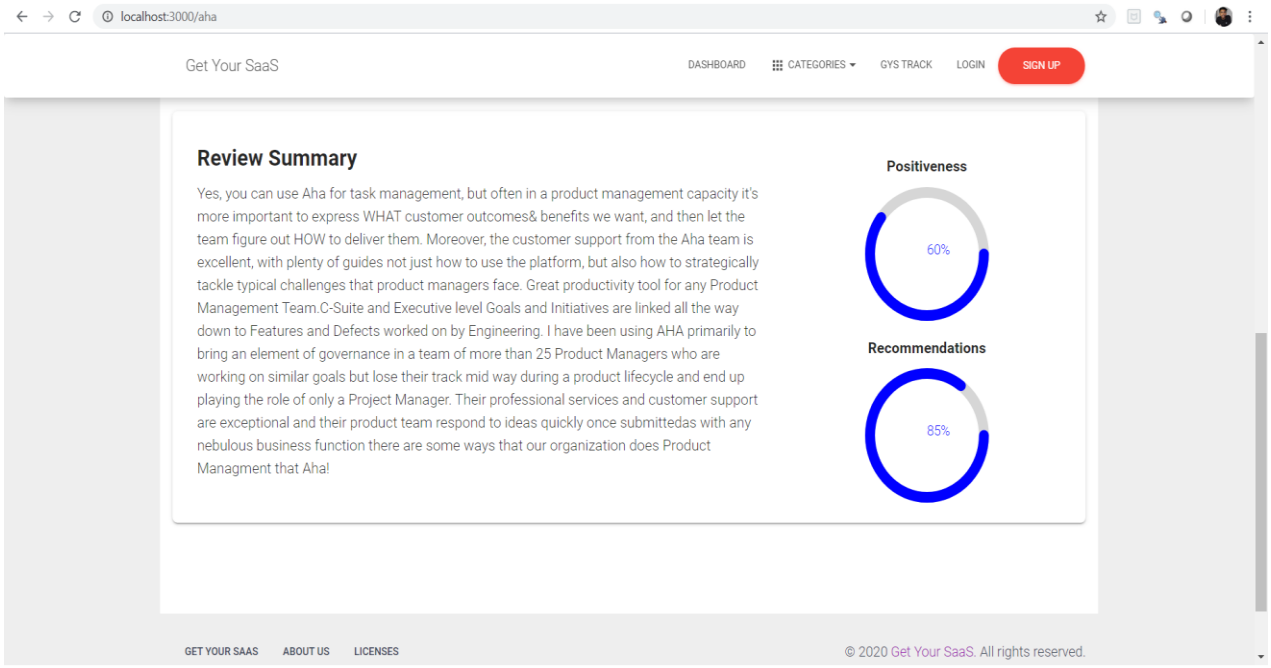

Fig. 4: A concise review i.e. summarized review of the SaaS product

B. SaaS Spend Tracker Extension:

This extension provides spending behavior of any organization or individual in the form of graphical representation. The input is the amount spent on particular month with number of users actively using the SaaS and output shows this data in bar graph. The figure below shows the output the extension for annual spending.

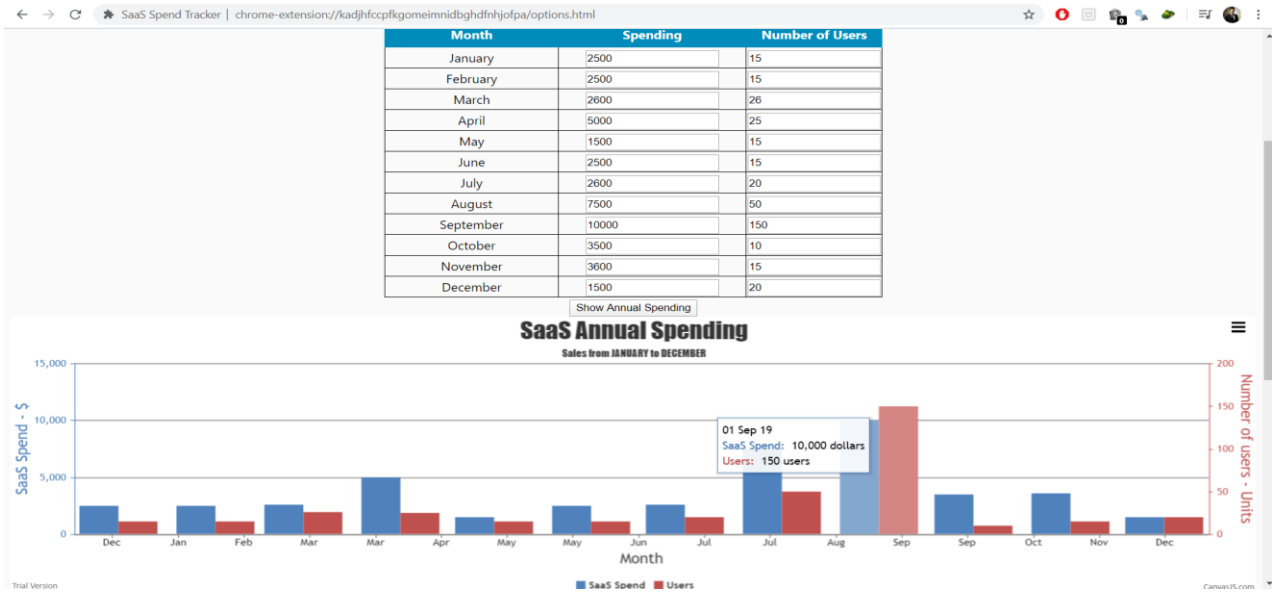

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Fig. 5: Annual SaaS spend representation

This extension also gives dynamic graph as a output for SaaS spending for specific app. The user can dynamically add new SaaS app and that app will be represented in graph dynamically. If user deletes a specific app from the table then that app is also removed from the graph dynamically.

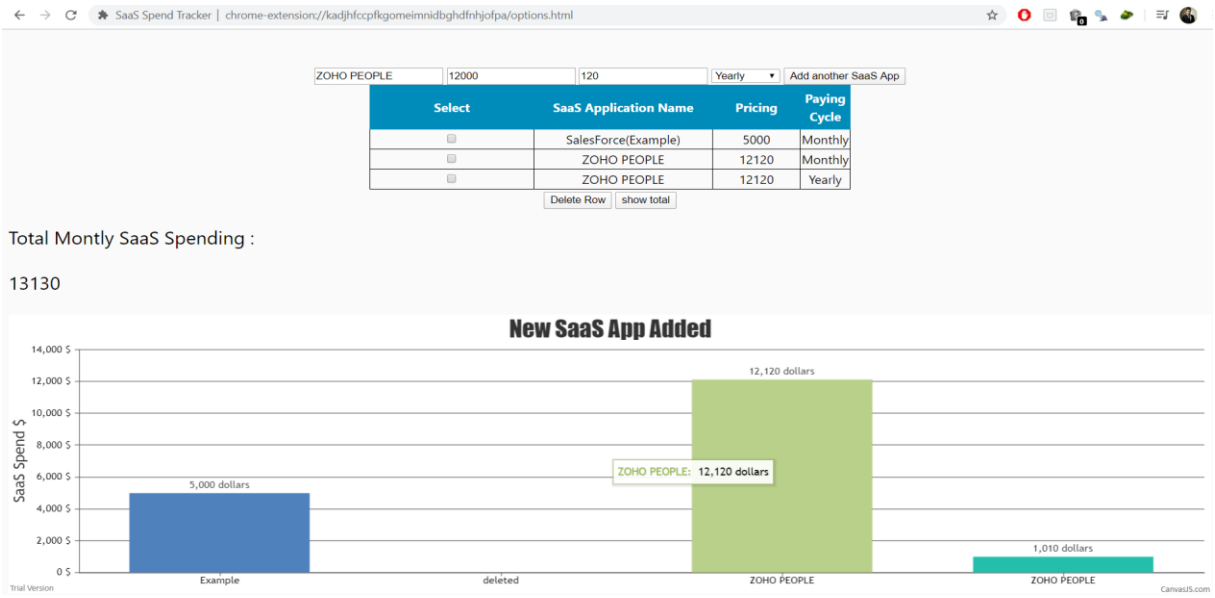

Fig. 6: Monthly SaaS spending on App representation

C. SaaS Usage Tracker Extension:

This extension provides usage detail of users to the organization. Time spent of specified URL is stored and can be viewed by users.

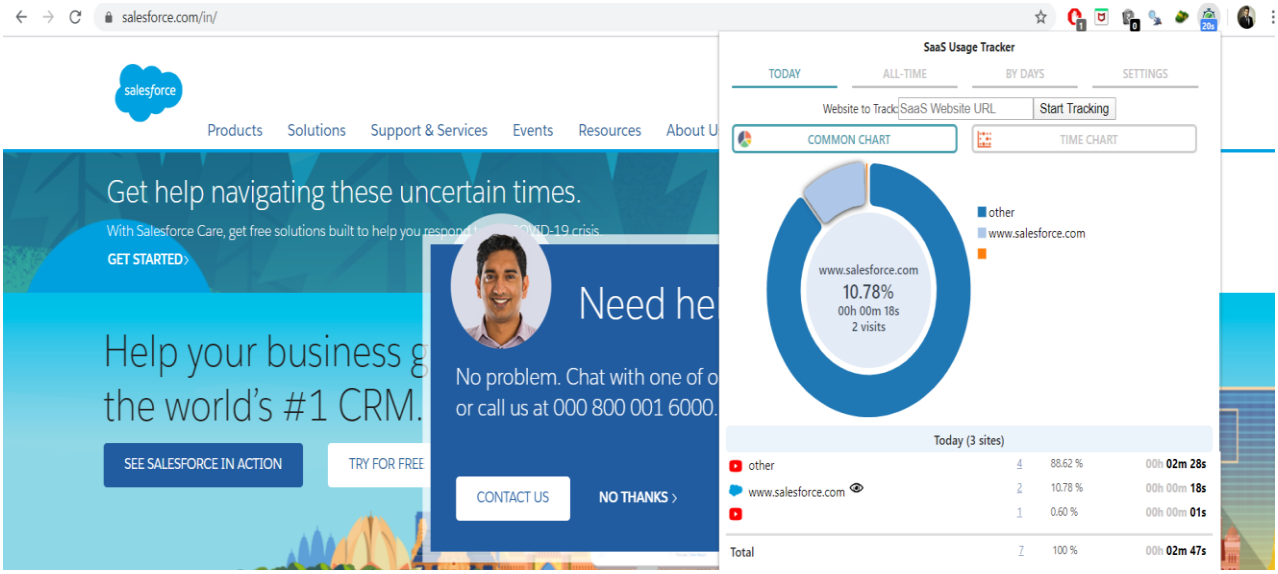

Fig. 7: SaaS usage Tracker

D. Payments User Interface:

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This payments module provides a checkout page (Fig. 8) for users to buy the above mentioned services along with the ability to see all the transactions made by the user. It also provides a pricing details page which tells the user about the prices of the services offered. When a user selects Pay Option from Checkout Page (Fig. 8), a new tab of CoinPayments transaction page (Fig. 9) opens which allows user to scan the QR code from their payments app to complete the transaction. CoinPayments Transaction Page (Fig. 9) also lists all the details regarding the transaction.

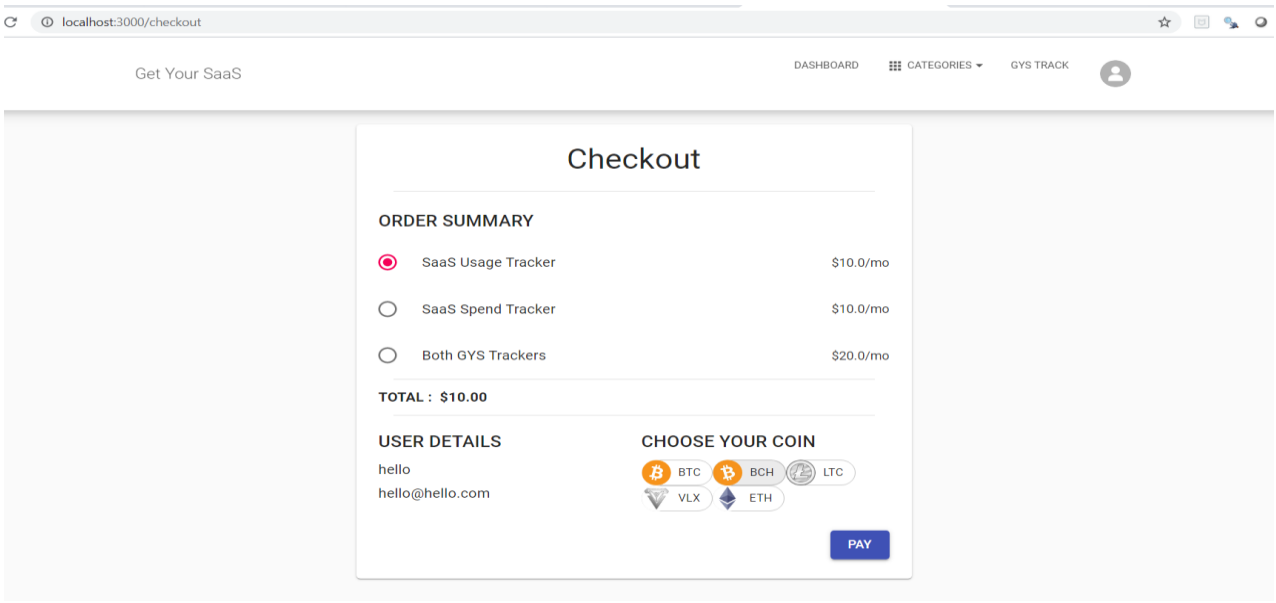

Fig.8: Checkout Page

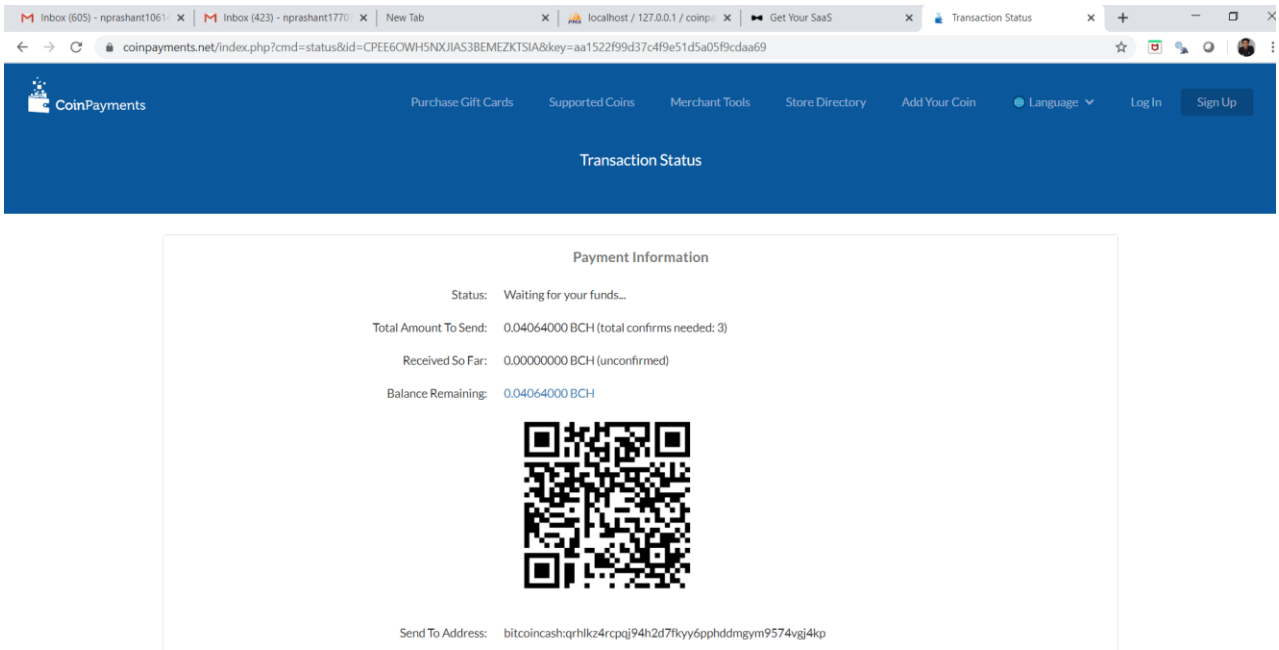

Fig. 9: CoinPayments Transaction Page

VI. FUTURE SCOPE

This paper provides a gist of the existing work carried out by other researchers in this domain. The

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proposed system will include consideration of only SaaS products. In future research, we recommend to extend this system to take advantage of other applications such as PaaS, IaaS or any other products that are suitable and make the system generalized for businesses. The proposed system will provide a comfortable user experience including a secured payment processing along with the best pricing available.

The same web platform design can be applied in other domains such as ecommerce sites and any other domain where reviews are available for the users. Plugins developed can also be used by normal users to track their day to day personal activities as well.

VII. CONCLUSIONS

The purpose of the SaaS Applications management system is to help the customer to choose the best SaaS product among the various available products. Main aim behind the proposed system is to provide all the information needed to know about the product that will be displayed at one place which will decrease decision making time and also help to compare among various available products. The proposed system will also provide services such as usage tracking and spend tracking which will improve efficiency of the client's organization which will be paid according to subscription model.

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