

Mini Market: Information Technology Based Support Tool for Small and Medium Scale Enterprises in Sri Lanka

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Abstract

Small and medium enterprises (SMEs) play a crucial role in developing countries such as Sri Lanka in growth of an economy. Recently online platforms are being extensively used by SMEs for both marketing and selling items. In a context of keen competition among the online selling platforms, sellers are increasingly feeling the pressure for improving their sales and marketing strategies. When investigating existing problems of SMEs, we were able to find they do not have proper guidance to improve their own business. Simply, the SMEs cannot identify their own marketing level among the other competitors, they haven't any suitable guidelines to identify how they can improve their own market and they have to use manual reports to get their own sales details for visualizing their marketing level where they waste their valuable time and money for visualizing sales market outcomes. In consideration of this, we propose a web system, that examines the effects of three categories in this system, i.e. Seller trustworthiness, analyze customer's emotions, feelings, thoughts, and opinions through Social media (Facebook) and sales prediction component. This system facilitates a multiple seller platform, where they can dynamically manage virtual shop inside this platform. It increases their stability and it will provide directions to overcome economic and unemployment barriers in our country. The results support our research hypotheses partially. The findings of this study are expected to provide some suggestions for sellers on promote and improve of their sales.

Keywords: Sentiment Analysis, ROC-AUS Matrix, Small and Medium Scale Entrepreneurs.

Introduction

SMEs (Small and Medium Enterprises) play an important role in global economy due to many reasons such as providing employment opportunities to many and contributing to the growth of economy. In developing countries where the governments are under the huge pressure of creating employment opportunities, SMEs have especially caught much attention. Following the global trend SMEs have been much popular in Sri Lanka in past decades. In fact, it has become the backbone of the Sri Lankan economy.

Information and communication technologies (ICT) have created much opportunities for SMEs in the recent past. Currently online platforms are used by SMEs for the purpose of marketing and creating platforms for selling and there is a massive competition among the online sellers. Under such circumstances it's very important for sellers to be informed of how they are performing in the current market and how their business could be further improved for their survival. Especially for budding SMEs it will be beneficial to be constantly monitored of their progress.

Much research conducted in the past have paid attention in assisting buyers in shopping using online platforms. For example, research has investigated of understanding buying patterns, suggesting items to buy and identifying the lowest prices for a certain item. However, limited research has developed with related to online sellers. Especially, a smaller number of researches has been conducted on assisting sellers to improve their business.

This research focus on developing a support system namely E-Mini Market for assisting online sellers to improve their business. E-Mini Market is a multiple seller platform where shopkeepers can register their shop in a platform. The sellers are provided with an admin panel where they can dynamically manage virtual shop inside the platform. The system collects data for evaluating the progress of their performance via social media. Registered sellers evaluate how the sellers are performing in three dimensions namely market value, buyer opinions on seller's trustworthiness and

buyer emotional responses for items sold by sellers. A number of methods including machine learning, natural language processing and social network analysis is used for the implementation of the system.

Using E-Mini market will be beneficial for sellers due to several reasons. Firstly, will help the sellers to obtain accurate and timely information from E-mini market on their progress and thus saving their money spend on consultancy and time spent on paper on. Secondly, the system will provide the sellers with information on which areas the sellers are performing well and which areas they are not performing well. Thirdly, the system will enable the sellers to take corrective actions based on the provided information and thus, ensuring survival of their businesses.

Background

Social media is widespread used at present for capturing voices of community. User opinions published in social media are often downloaded and analyzed to obtain insights on human behavior and social happenings. Such analysis reveals important aspects such as human emotions and sentiments. In the context of online businesses analysis of social media content is useful to identify user preferences of goods.

There are number of existing systems and research conducted on analyzing user preferences in relation to online businesses. For example, fanpage Karma (GmbH, n.d.) is a web-based application which analyses fan pages for business and provide various insights. In particular, the application is focused on proposing best times of business owners to publish posts, what type of posts to be published and how often the posts should be published. The application is capable of providing such information to business owners in reports of various nature by analyzing its own page as well as those of competitors. The above system is useful for online sellers mainly, however, for the purpose of marketing. The system does not provide information on other aspects that would be help the businesses to improve their performance.

Likealyzer (“Meltwater - Likealyzer,” n.d.) is a similar application to fanpage Karma. Likealyzer provides users’ the ability to analyze content published on Facebook and obtain detailed reports on user likings. The application is capable of performing comparisons of Facebook pages among competitors and also recommending similar pages which are popular among users. In addition, it also provides the business owners with the facility to promote new products. However, similar to fanpage Karma the application does not provide the users insights on how the businesses are performing considering other aspects such as users’ trust of business.

Erdogomus and Cicek (Murtiningsih and Murad, n.d.) have investigated which aspect of the online content published is most desired by customers. Analyzing responses from users who have followed popular brands on social media platforms using statistical techniques the research has revealed that customers most prefer the brand when social media is used to offers advantageous campaigns, offers relevant content, offers popular contents and appears on various platforms. In a similar research conducted in fashion industry Kim and Ko (Pourazad and Pare, 2015) investigated how investigated the effects of marketing through social media on customer relationships (involving intimacy and trust) and purchase intention using data collected through questionnaires. The research revealed that effectiveness of marketing using social media positively influences both customer relationships and purchase intention and proposes a strategy to enhance the brands’ performance by defining specific factors influencing both.

In a research conducted in pizza industry He, Zha and Li (He et al., 2013) states that competitive advantages for sellers could be obtained by analyzing customer-generated content on their own social media sites, but also the content on their competitors’ social media sites. Using content published using Facebook and Twitter the above research has investigated customer responses provided in five dimensions which are customer perspective of ordering and delivering, quality of pizza, customer responses to casual socializing tweets, feedback on customers purchase decision and customer response to marketing tweets using text mining technique to analyze how three pizza chains have performed.

Abrahams, Jiao, Wang and Fan (“Vehicle defect discovery from social media | Request PDF,” n.d.) have conducted a research on discovering defects of vehicles with the aim of ensuring the quality of vehicles. For the above purpose a series of techniques including text mining and sentiment analysis are used on data published by customers on online forums.

Nevertheless, our effort to overcome obstacles and to develop excavating tools, the authors “Social media analytics and intelligence,” (Zeng et al., 2010) promote rule-based tactic which has been evoked to analyze the linguistics of social media sites.

Methodology

The purpose of this research is to develop an application capable of providing insights on how sellers could improve themselves in terms of market share, trust worthiness and user preference. The architecture of proposed system, namely E-Mini Market is shown in Fig. 1.

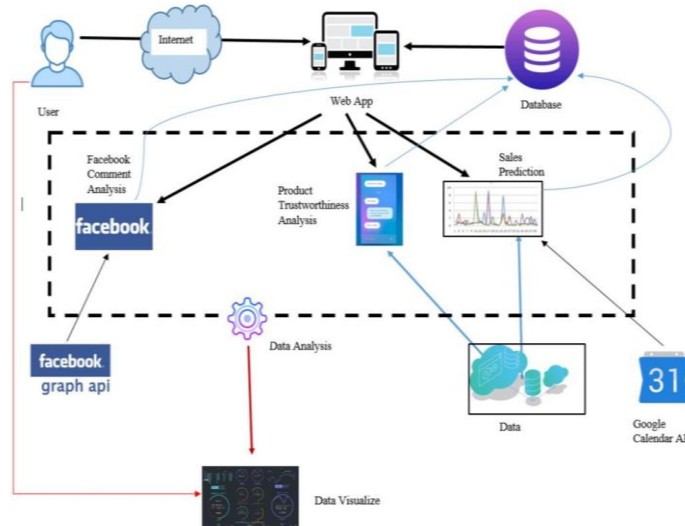


Figure 1: High level overview of the E-Mini Market system.

As the figure shows, the system consists of three main components namely sales predictor, Facebook comment analyzer and product trustworthiness analyzer. As shown in the system architecture, the data required for the system is obtained through Facebook.

Sales Predictor

Sellers using E-Mini Market is facilitated to predict sales for a given period based on past data via the Sales Predictor component. The sellers can get an overall overview about the behavior of present and historical data related to their businesses using this component. An overview of the component is shown in Fig. 2.

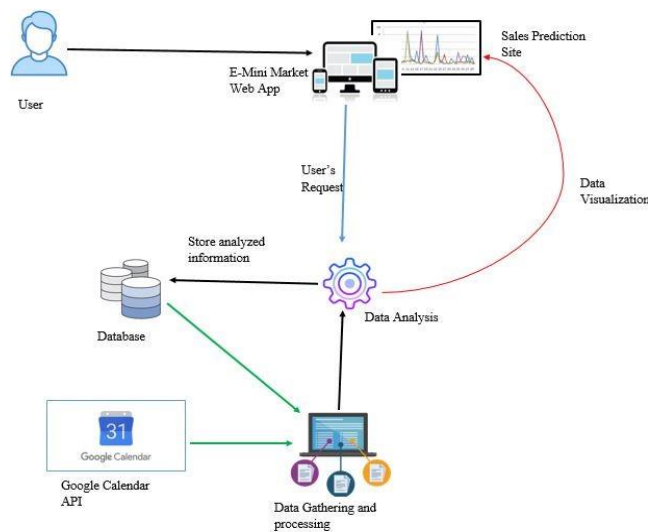


Figure 2: Sales Predictor components

Step 1: E-Mini Market Web App with Sales Prediction Site: First user login to the E-Mini Market web app and then move to the sales prediction site.

Step 2: Data Gathering Processing System: Using Google calendar API, Seller can pick a date. Once the date picked relevant festival list for the month will be displayed and once the user selects the festival all the information related to the user request will be retrieved from the database. According to the selected festival, historical pre-product list will be displayed and then seller can request sales prediction details for a selected sold product.

Step 3: Data Analyzing: In this phase, research team have used most-effective approaches for prediction such as predictive analytics. Then seller can predict (K-Mean Algorithm, Linear Regression Algorithm) quantity, price and target group (teenagers, adults, kids) and locations through the system for selected product.

Step 4: Visual Analytics: It is used to show the transformed data in a graphical way (using bar charts, pie charts, table etc.). User can get overall overview about the behavior of present and historical data related to their businesses.

Trustworthiness Analyzer

The purpose of the trustworthiness analyzer is to provide sellers on information as to how the buyers trust them. An overview of the component is shown in Fig. 3.

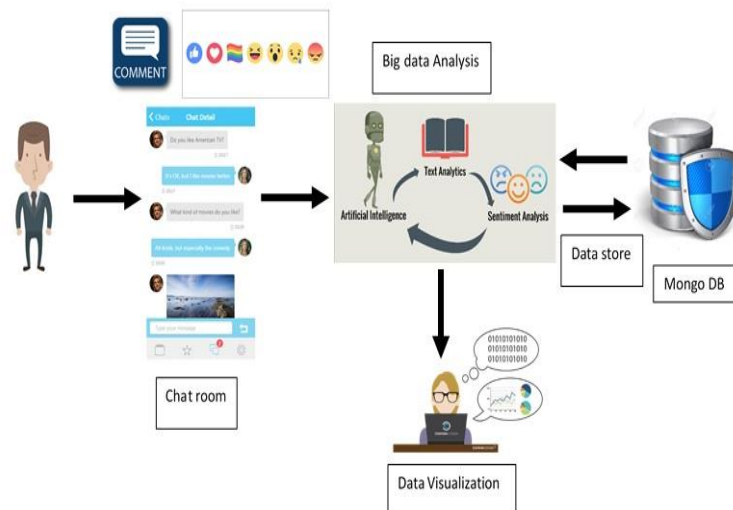


Figure 3: Trustworthiness Analyzer components

Step 1: - E-Mini Market Web App with trustworthiness chat Site: First user login to the E-Mini Market web app and then move to the trustworthiness chat app site.

Step 2: - Data Gathering Processing System: Using chat site and firstly register the seller and opening a new virtual shop in our site. Then he can chat sellers. Once a buyer will comment good or bad comment then seller automatically down or up their trustworthiness value. We will store our data for Mongo DB. Every time the seller can request show the analysis details for a selected trusted product.

Step 3: - Data Analyzing: In this phase, the research team has used most-effective approaches for analysis such as trustworthiness analytics. Then seller can analysis their product trustworthiness and seller trustworthiness in this technique (sentiment analysis).

Step 4: - Visual Analytics: It is used to show the transformed data in a graphical way (using percentage values, database attributes value, table etc.). The user can get an overall overview of the behavior of present and historical data related to their businesses.

Social Media Feedback Analyzer

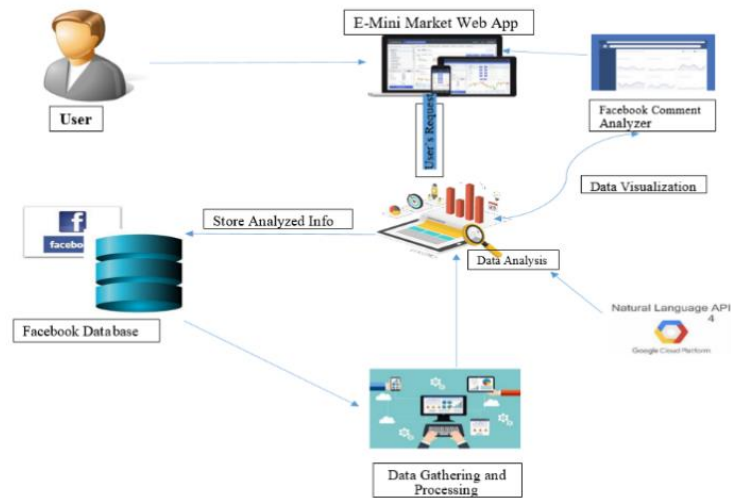


Figure 4: Facebook comment analyzer components.

Find out historical data from Facebook page (comments) from leading companies (Top ten companies) in Sri Lanka. Identify Positive and Negative feedback from Comments. Find out Synonym words From Comments and Analyze that Comments.

In this section, the individual contributions to the system, and how they were implemented shall be explained. The components/features that shall be discussed within this report are:

Extract Facebook comments from official FB pages, Identify Positive and Negative feedback from Comments, find out Synonym Words from Analyzed Comments.

Results

The results section of the research paper is where we report the findings of the project based upon the information gathered as a result of the methodology [or methodologies] we applied.

The final result of the E-Mini Market system based upon the outcome results of three different components. Moreover, the overall System was benchmarked using Sales Predictions, Facebook Comment Analysis and Product Trustworthiness Analysis. When we consider sales prediction component, seller can predict sales details through the system for selected product.

Using Google calendar API, Seller can pick a date. Once the date picked relevant festival list for the month will be displayed and once the user selects the festival all the information (sold product list) related to the user request will be retrieved from the database. According to the selected festival, historical sold product list will be displayed and then seller can request sales predication details for a selected sold product.

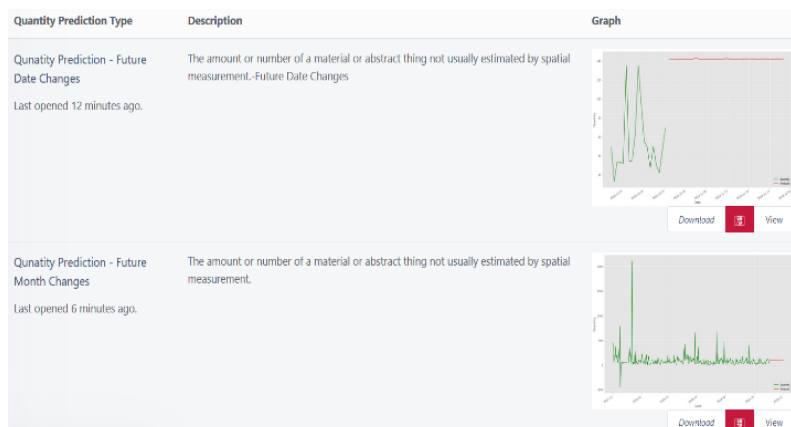


Figure 5: Quantity Prediction Graphs

After seller can predict quantity, price and target group (teenagers, adults, kids) and locations through the system for selected product. K-Mean and Linear Regression Algorithms are used for the predictive analysis implementation. This will show future sales details according to the seller request. In this research, sales prediction component was tested by using ROC-AUS Matrix.

ROC-AUS Matrix

The receiver operating characteristic (ROC) is a metric used to check the quality of classifiers. AUC is an abbreviation for area under the curve. It is used in classification analysis in order to determine which of the used models predicts the classes best. An example of its application are ROC curves. Here, the true positive rates are plotted against false positive rates (“Receiver operating characteristic,” 2018).

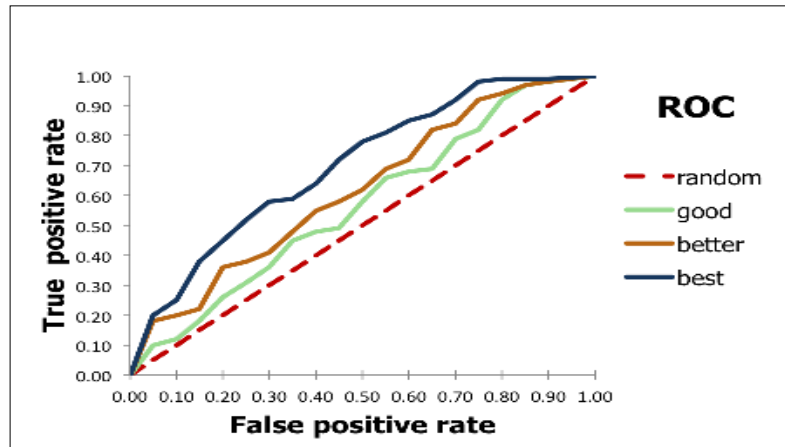


Figure 6: ROC Graph.

Research team were able to find Sales probability of each product in the given data set. Figure6 shows probability that is calculated using algorithm.

Table 1: Sales Probability calculated using different model.

Seller Id	StockCode	Probability_Pri	Probability_Qu	Probability_CP	Probability_CG
SE_0100	637846A	0.5	0.4	0.4	0.4
SE_0153	376436	0.2	0.1	0.2	0.1
SE_0144	368746P	0.4	0.3	0.5	0.4
SE_0200	736437D	0.4	0.3	0.4	0.4

Probability Price= probability calculated by Linear Regression (Price → result)

Probability Quantity= probability calculated by Linear Regression (Quantity → result)

Probability Location= probability calculated by Linear Regression (Country Prediction → result)

Probability Target Group= probability calculated by K-Mean (Customer Group → result)

In order to benchmark the model so far developed, ROC-AUC Values as the performance matrix is used.

Table 2: ROC-AUC values for sales prediction model

PREDICTION MODEL	ROC-AUC Values
Linear Regression	0.721 =72%
K-Mean	0.630 =63%

$$ROC(t) = \Phi(\alpha_0 + \alpha_1 \Phi^{-1}(t))$$

Product Trustworthiness component has a unique feature compared with other existing systems. Basic sentiment analysis algorithms use natural language processing (NLP) to classify documents as positive, neutral or negative. Most sentiment analysis algorithms are about 80% accurate.

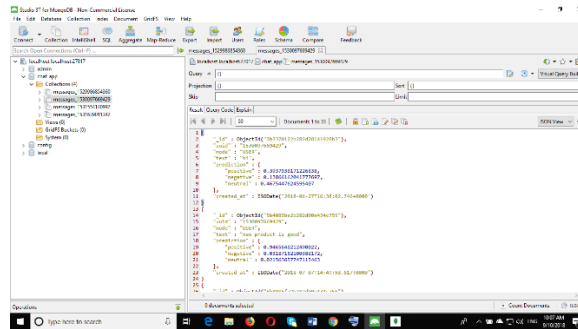


Figure 7: Product Trustworthiness calculated using different model.

Identify Positive and Negative feedback from Comments. Find out Synonym Words from Comments and analyze Comments.

Seller Id	Facebook page Id	Post Id	Probability_Negative Comment	Probability_Positive Comment
SE_0100	FB_001	PO_003	0.6	0.7
SE_0100	FB_002	PO_004	0.6	0.7
SE_0101	FB_033	PO_005	0.7	0.67

Figure 8: Facebook comment Analysis calculated using different model.

E-Mini Market possess the unique features in comparison to the existing BI tool which is customer profiling. Figure 6 talks about Customer profiling which is one of the best features of our tool. For the benefit of their business,



Figure 9: Benefit of Their Business

E-Mini Market - When it comes to company, customer is one of their biggest assets. They cannot afford to lose them. Research shows that it is always highly expensive to gain new customer rather than retaining existing customer.

Conclusion and Future Work

This paper provides possible approaches that are best suitable to develop decision support tool based on statistical model, data mining and machine learning approaches. Our system will help small and medium scale entrepreneurs to make decisions for their business. E-Mini Market system has a unique feature compared to other existing systems. Reasons for this system to be unique is three main factors. They are: Sales Prediction, Facebook Comment Analysis and Product Trustworthiness Analysis. At present, there are no any decision support tool which focus on above key features for Sri Lankan small and medium scale entrepreneurs.

In next stage, research team will be focusing on increasing the accuracy of these model, maintain the customer profiling mechanism and increase the performance of prediction process by introducing more effective data cleansing and transformation techniques. Facebook comment analysis and product trustworthiness process will be uplift by introducing more effective data cleansing and transformation techniques. We hoped that for any researcher who expects to build a similar system or any other real-time system, results of this research will be an aid and will provide insight on the performance, accuracy and reliability level that can be expected with the combination of tools, technologies, programming approach considered in this paper.

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