# Smart Monitoring and Controlling of Government Policies Using Social Media and Cloud Computing

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**Abstract.** Lack of public participation in various policy making decision has always been a major cause of concern for government all around the world while formulating as well as evaluating such policies. With availability of latest IT infrastructure and the migration of government think-tank towards realizing more efficient cloud based e-government, this problem has been partially answered, but this predicament still persists. However, the exponential rise in usage of social media platforms by general public has given the government a wider insight to overcome this long pending dilemma. This paper presents a pragmatic approach that combines the capabilities of cloud computing and social media analytics towards efficient monitoring and controlling of public policies. The proposed arrangement has provided us some encouraging results, when tested for the policy of the century i.e. GST implementation by Indian government and established that proposed system can be successfully implemented for efficient policy making and implementation.

**Keywords:** Cloud Computing, E-Government, GST, Sentiment Analysis, Social Media Analytics, Twitter.

## 1 Introduction

Traditionally, the public policy making decisions have always involved only the government agencies and bureaucrats, with general public been never allowed to become a party to it [1]. This led to a sharp decline in conviction as well as reliance of public towards the government [2-3]. The gap between the government & the public dramatically increased and currently both are struggling to maintain harmony with their relationship [4]. E-Government is one such powerful tool that holds all the essentials to improve the relationship between the general public and the government [5] as it strongly put emphasis on maintaining transparency, enhancing public participation and upgrading the quality of service [6]. However, the required ICT (Information and Communication Technology) infrastructure, implementation and operational cost have become a major bottleneck towards the implementation of e-government. Cloud computing is one such popular as well as reliable technology that

can provide solution of this delinquent issue [7]. With several inbuilt advantages such as on-demand scalability and pay-as-use have motivated many countries to adapt cloud computing based e-government [8]. However, the important point of public participation in policy making still remains a distant dream. To overcome this severe problem, governments all around world have started making use of social media to acquire appropriate feedback from the various realms of society regarding various public policies [9].

This paper proposes an innovative and smart approach which unitizes the capabilities of cloud computing and social media analytics for efficient monitoring and controlling of public policies. The main objective of this research is to increase public participation in policy making decisions. We have applied our proposed system to GST (Goods and Services Tax) implemented by Indian Government which was an attempt to unify all the taxes in the country [10]. The results have been observed to be quite encouraging, showing that the proposed approach can be instrumental in efficient policy making decisions.

## 2 Review of Literature

The literature review is classified into two sections. The first section highlights the use of cloud computing in e-government. While the second section highlights the use of social media for policy making.

### 2.1 Use of Cloud Computing in E-Government

E-Government is the use of ICT and other web technologies to provide more effective, efficient and transparent service to its citizens& employees [11]. Although ICT provides lot of advantages, yet the required technical infrastructure, implementation cost and requirement of skilled staff becomes major obstacles towards e-government implantation [12]. With the emergence of cloud computing, these challenges can be addressed upto the fair degree of satisfaction for all the stake holders [7]. Cloud computing consists of large shared pool of computer resources which provide features like on-demand scalability and pay-as-use [13]. These advantages have played a decisive factor in motivating the governments of many countries to migrate from traditional costly e-government model to more cost efficient and scalable cloud based e-government model [8]. Not only this, but cloud based e-government model is also building a strong foundation for smart cities [14].

### 2.2 Use of Social Media for Policy Making

Nowadays, social media have become an integral part of everyday life, irrespective of the status of any individual [15]. This virtual world provides a perfect platform for people from all around the world to discuss topics of common interest such as sports, entertainment and even politics. Talking about politics, at least 33% of social media users comments, discusses or post about politics on these platforms [16]. Even

government have realized the potential of social media and because of this various government agencies are extensively started using these social media to connect with general public [17]. Since social media is increasing the interaction between public and government, hence this indeed is providing a solution to problem of public participation [18]. Generally, people post something regarding government, politics or policies which might be intentional or unintentional [16] and government can utilize this content for providing better services to its citizens [19].

Both the above sections show that considerable work has been done in field of cloud computing based e-government and use of social media for policy making having their own advantages and benefits. But till date no effort has been made to combine both these services. This paper aims to unitize the capabilities of cloud computing and social media analytics for efficient monitoring and controlling of public policies.

## 3 Research Methodology

The primary objective of this paper is to unitize the capabilities of cloud computing and social media analytics for efficient monitoring and controlling of public policies. For this cloud based system is proposed. Figure 1 shows the architecture of the proposed system. The proposed system has three main components: (a) Data acquisition component (b) monitoring component and (c) Controlling component.

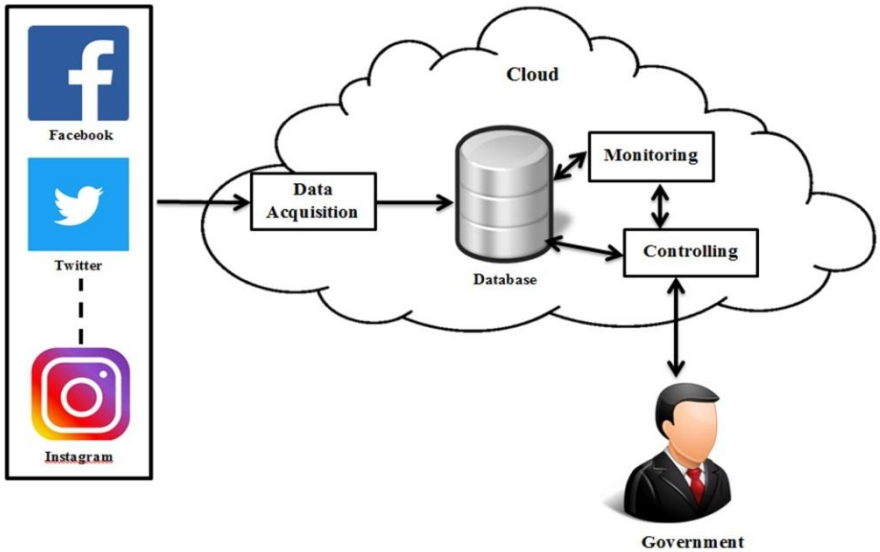


**Figure 1**. Architecture of Proposed Model

**(a) Data acquisition component**: Data acquisition component is responsible for data collection from various social media platforms like Facebook, Twitter, Instagram

etc. This data collection task is performed on continuous basis in a time specific manner. After collection this data from various sources this user content is stored in cloud database so that the computations can be effectively made.

**(b) Monitoring Component:** This component is responsible for performing the monitoring activities. These monitoring activities are performed using various social media analytics techniques, where different operations are performed on the user content for extracting important decision making information [20]. Table 1 shows the various social media analytics techniques. The results of these different analytics are again stored in cloud database.

**Table 1.** Various Social Media Analytics Techniques

| Descriptive Analysis | Content Analysis | Network Analysis | Space-time Analysis |
|---|---|---|---|
| Tweet Statistics [21] | Sentiment Analysis [25] | Friend Follower Networks [28] | Time Series Analysis [31] |
| #Hashtags Analysis [22] | Topic Modeling [26] | Network Layout [29] | Geo-Location Analysis [32] |
| @Mentions Analysis [23] | Lexical Diversity [27] | Cluster Analysis [30] | |
| Word Cloud [24] | | Centrality Analysis [22] | |

**(c) Controlling Component:** This component is responsible for providing alerts and sends calculated information to the government so that appropriate control measures can be taken based upon these results generated by the monitoring component.

## 4 Implementation and Results

For implementation on cloud we have used Amazon EC2 [33]. For computation we have used RStudio server. Data for experimentation has been collected from Twitter. Data was fetched based upon specific #hashtag (#GST). In total 41,823 tweets were collected from June 23, 2017 to July 16, 2017. For better interpretation of the results tweet collection period was broken into 3-phases (Pre-GST, In-GST and Post-GST). The detail of tweet collection is shown in Figure 2.

### 4.1 Tweet Statistics and Data Preprocessing

In total 41,823 tweets were collected from 35,400 different users from India. In total 2,873 users were detected who tweeted more than one tweet, accounting a total of 6,423 tweets. The details of tweet statistics are given in Table 2.

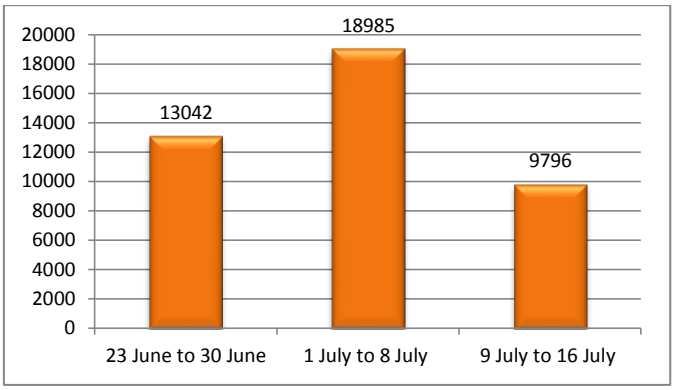


**Figure 2.** Tweet Collection Details

**Table 2. Tweet Statistics**

| | Phase-1 | Phase-2 | Phase-3 |
|---|---|---|---|
| **Total Tweets** | 13042 | 18985 | 9796 |
| **Max Tweets in a Day** | 3026 | 4622 | 1552 |
| **Min Tweets in a Day** | 526 | 440 | 671 |
| **Total Unique Senders** | 11711 | 15187 | 8502 |
| **Average Tweets per Sender** | 1.11 | 1.25 | 1.15 |
| **Average Tweet per Phase** | 1630.25 | 2373.12 | 1224.5 |

Data preprocessing is an important task, which aims to prepare data for various data mining task [34]. Since Twitter data contained lot of noise and unwanted stuff, task of data preprocessing was performed [35]. First and foremost thing we did in preprocessing was to remove multiple tweets from same user. A total of 6,423 such multiple tweets from same users were removed using same technique as used by Singh et al, [36]. These tweets were removed in order to maintain normality; otherwise this would have led to biased results. On remaining 35,400 tweets various preprocessing tasks were performed such as conversion to lower case, removing punctuations, removing special characters and finally removing web links.

### 4.2 Sentiment Analysis

Sentiment analysis is often regarded as most effective tool to map public response towards an entity [19]. Sentiment analysis is defined as a text analytic technique which deals with extraction of sentiment from given piece of text. Sentiment analysis consists of two sub-operations: (a) E-Motion Analysis [37] and (b) Polarity Analysis [38].

(a) **Polarity Analysis:** Polarity analysis deals with polarity identification i.e. positive or negative. The result of polarity analysis is shown in Figure3, while the treemap of positive and negative words is shown in Figure 4. For interpretation of the results we use a threshold value ($\mu$) as given in Equation 1.

$$\mu = \frac{\sum Negative\ Tweets}{\sum Tweets} \quad (1)$$

For our calculations we have taken μ=50% (Threshold Value) i.e. whenever μ> 50%, this will be alarming signal for the government that citizens are not happy with the policy and some appropriate measure are required to overcome this unrest.

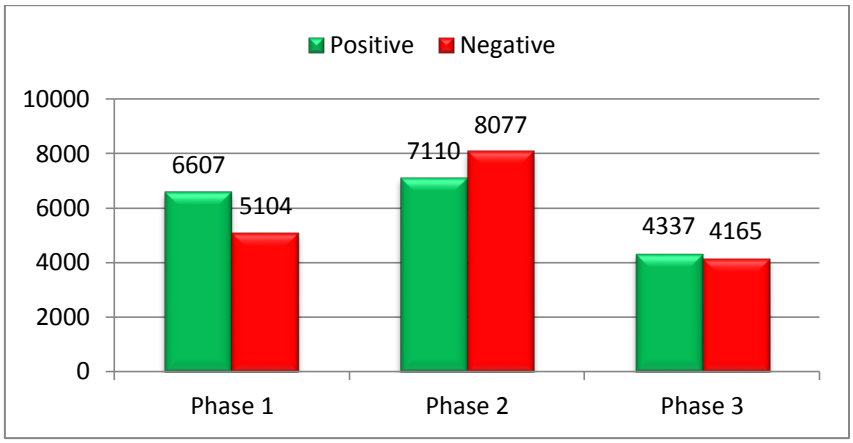


**Figure 3.** Results of Polarity Analysis


**Figure 4.**Treemap of Positive and Negative Words

***Inference:*** During phase-1 (Pre-GST Period) the overall threshold value $\mu < 50\%$, this shows that citizens were in favor of GST as it ended multi tax system and hence giving a hope that prices of fast moving consumer goods (FMCG) [39] will go down. However, as soon as GST was actually implemented on July 1, 2017 (In-GST Period) the threshold value $\mu > 50\%$, showing unrest among citizens. This unrest was due to various problems encountered by public as soon as GST was implemented. From consumer's perspective negative sentiment was due to the fact that traders were charging GST over and above maximum retail price (MRP). Similarly, the traders were unhappy because of the confusion about GST rates on various goods plus they needed to update their current inventory system which led to increased expenses. Since we discussed that as soon as threshold value $\mu > 50\%$, it is an alarming signal for the government to take appropriate steps. So acting upon this, government soon issued warnings to traders that they cannot charge over MRP for any good [40-41].In addition to this government also introduced various courses to train traders and make them familiar with GST filling and other related processes [42].As a result of these measures by the government the threshold value again became $\mu < 50\%$ during phase-3 (Post-GST). This provided a concrete proof that the actions taken by government after phase-2 did helped to win the trust of citizens.

(b) **E-Motion Analysis:** It is a sentiment analysis operation, in which given data is classified according to emotion lexicon comprising of words having association with eight emotions (Trust, Surprise, Sadness, Joy, Fear, Disgust, Anticipation and Anger). The result of e-motion analysis is shown in Figure 3.

***Inference:*** Phase-1 (Pre-GST Period) dominates emotions such as trust, anticipation and joy indicating support of people for GST. These results totally got reversed during phase-2 (In-GST Period) as emotions like fear & sadness dominated, showing unrest among citizens and alerting government to take appropriate steps. As soon as appropriate steps have been taken by government results of phase-3(Post-GST Period) started to fall in line with phase-1 (Pre-GST Period), indicating support for GST once again.

### 4.3 Geo-Location Analysis

Location based analysis is a very crucial tool for gathering information, while mapping public response towards an entity [43]. Although all tweets do not contain location from where they were tweeted, yet we can't ignore them as they provide important information about the actual location, hence helping policy makers to target the audience while finding solution to their problem. Since in the previous section we detected that during phase-2 (In-GST Period) the overall sentiment was on negative side, it is essential to see which states and cities are worst affected so that appropriate solution can be found. Figure 6 shows location wise analysis of two markets of Mumbai city from where negative tweets were sent.

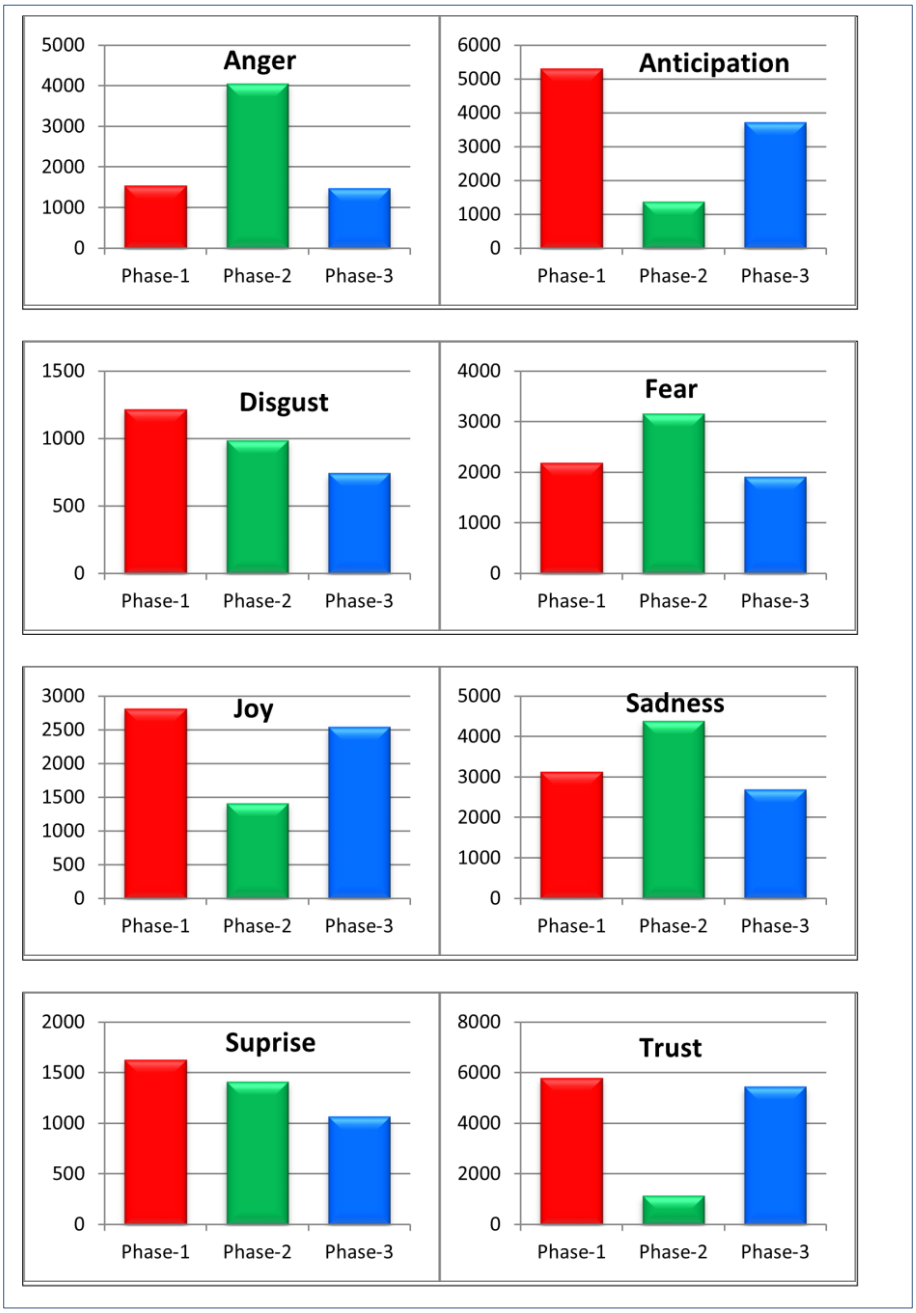


**Figure 2.** Results of E-Motion Analysis

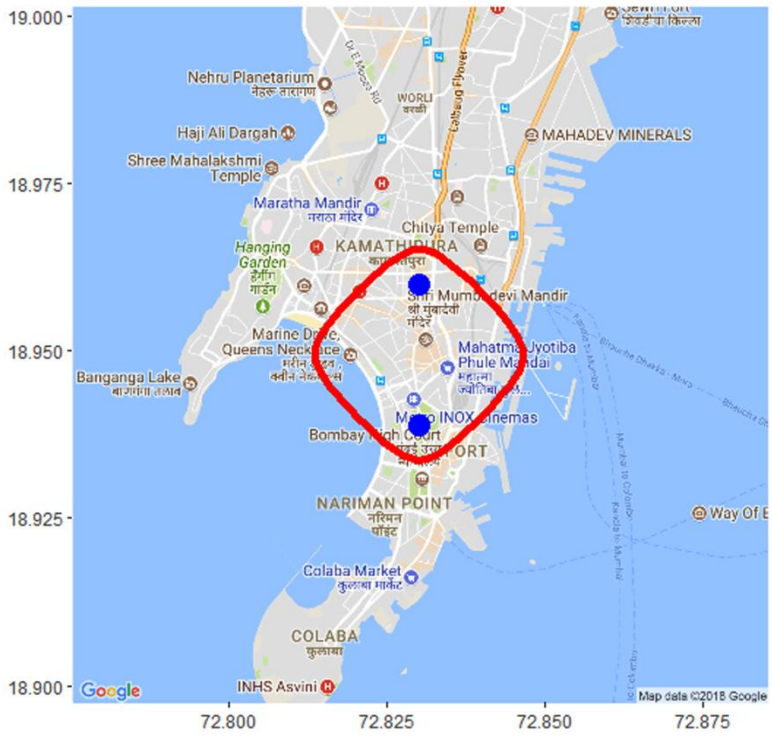


**Figure 6.** Results of Location Based Analysis

***Inference:*** This location based analysis is extremely important; as it gives us the targeted audience which is unhappy with the policy and hence government can take appropriate steps keeping in mind the demands or problems of this targeted group. Since these two points indicates markets of Mumbai city, hence it shows that traders of these markets are not happy and government needs to take appropriate steps accordingly.

## 4 Conclusions

Technology is changing at tremendous pace and all the national governments are continuously adopting newer technologies for providing enhanced services to its citizens. Multiple efforts are being done to bridge down the gap between the policy makers and the general public, for whom these policies are designed & implemented. Cloud computing and social media platforms have emerged as two significantly powerful tools for the central governments all around the world to communicate and provide quality services to its citizens. However, all the studies done till date to the best of our knowledge have utilized the advantages of these tools independently and no fruitful effort has ever been made towards combined implementation of these powerful tools. We started our research work to combine the selective capabilities of

cloud computing and social media analytics towards efficient monitoring and controlling of public policies. We propose a new cloud based approach, which captures the response of public through data gathered from various social media platforms about any policy. For monitoring various social media analytics techniques are applied on this captured data. Based upon the results of these social media analytics techniques, the appropriate controlling operation is performed. We tested our proposed system with data collected towards "the policy of the Independent India" GST implementation by Indian government.

The initial results indicate a strong support for GST, however as soon as the GST became reality , traders and consumers faced hardship and the overall sentiment dipped towards negative side giving an alarming signal to the government to take appropriate actions. After this government took various controlling measures which again resulted in increase of positive sentiment among citizens. A prominent contribution made in this research was to do location based analysis which can help the government to select the targeted audience which are affected with the policy and can take control measures accordingly. These implementation results were quite encouraging, insisting that the proposed system can be used for efficient monitoring and controlling of public policies.

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