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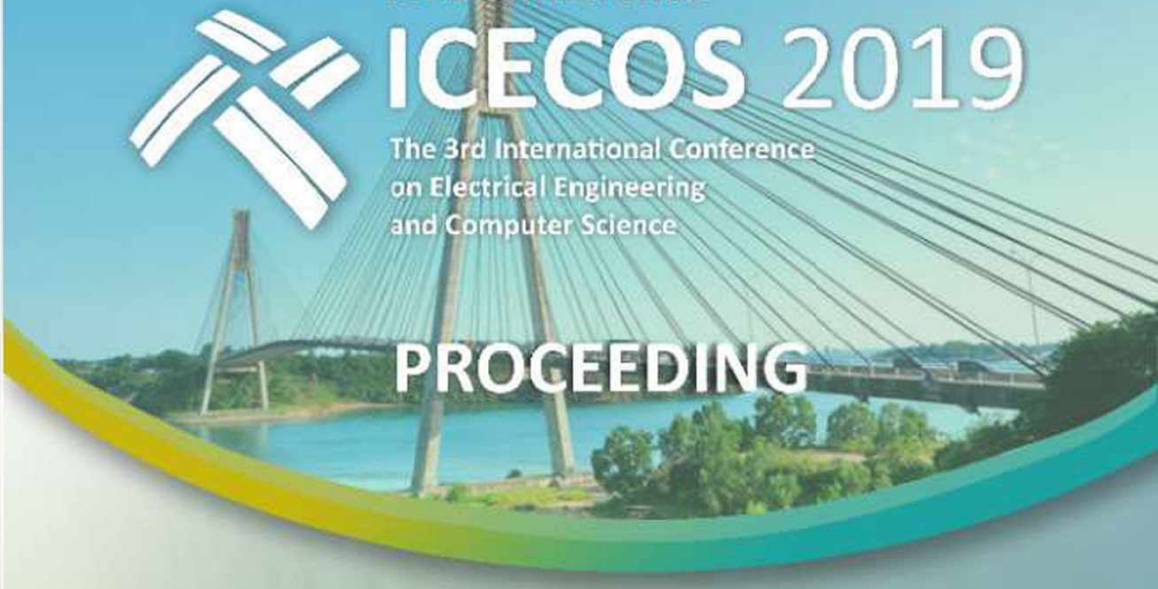

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Network Centralization Analysis Approach in the Spread of Hoax News on Social Media

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***Abstract*— The development of information technology in Indonesia seems to improve from year to year. It has an essential role in disseminating information to the community, including through a social media network is commonly known as Twitter. Some people use Twitter to spread news or information, but some others abuse it to spread fake news or irresponsible information (hoaxes). This study aims to see the patterns of interaction and the actors who play an essential role in the spread of hoax news on Twitter. The crawling of Twitter data uses Python 2.7, and the datasheet is then processed using the Social Network Analysis approach. It is later visualized using Gephi 0.9.2. Determination of the actors who play an essential role in the spread of hoax news is calculated based on centrality consisting of degree centrality, betweenness centrality, and closeness centrality. From several samples that have been tested using social network analysis methods and centrality calculations, have succeeded in identifying influential actors in hoax news dissemination on Twitter.**

Keywords— Twitter, Hoax, Social Network Analysis, Centrality

I. INTRODUCTION

The development of information technology in Indonesia shows improvement from year to year. It has an essential role in disseminating information to the community, including through a social media network. Social media serve as a channel that helps people to easily participate, share and create content, including in blogs, social networks, and forums in the virtual world. Based on "We Are Social" data from January 2017, social media users in Indonesia make up to 40.46% of the total population with 49% active Youtube users, 48% Facebook users and 38% Twitter users. Indonesia ranks high on the list of countries with most social media use, such as Twitter. It is a microblogging site ranking fifth in the world with 29 million users [1]. The activities of Twitter users in Indonesia contribute to this number.

Twitter, being used by some people as a means to convey and receive information, can become a site of misuse of information (defamation, hoaxes, gossip, fraud, pornography, and others). The public has been exposed to this spread of hoaxes. One of the examples of the spread of hoax news on social media is about Ratna Sarumpaet; the hoax news is about her being persecuted. However, after an investigation, it was evident that the news was a lie, and Ratna Sarumpaet held a press conference confirming that she lied about her persecution. It led to her being charged with Article 28 of ITE Law junto Article 45 with a maximum of the 10-year sentence [2].

Therefore, to be able to recognize the characteristics of users of Twitter that have the potential to spread hoax news, a method that can identify and study a person's tendency to spread hoax news is needed. One way of approach to analyze hoax news spreader is the Social Network Analysis (SNA) and Sentiment Analysis. Analysis using the network approach has been widely used in various fields, such as the academic field: conducting network analysis of researchers to find out the strength of a nation's research [3]. Sentiment analysis can also be used to see people's sentiment towards a text message on social media [4]. Approaches to Twitter sentiment analysis tend to focus on identifying individual tweet sentiments (tweet level sentiment detection) [5].

II. LITERATURE REVIEW

A. Hoax

Hoax, is defined as a form of fraud to make humor or bring danger [6]. It means false information or false news. According to the English dictionary, it means "banter, false stories, and deceiving aliases."

Hoax is an attempt to deceive or outsmart readers/listeners to believe something, even though the creator of the news knows that it is false. One of the most common examples of false reporting is to claim an item with a designation that is different from the actual event. Another definition states that hoaxes are tricks used to convince that something wrong is right, and it often does not make sense, through online media [7]–[9].

Sumardi [10] Student social participation becomes more due to the assumption of having a better understanding concept as part and level of learning at the college level. In this study entitled "Sentiment analysis of hoax news towards the 2019 election based on student perspective" hopes to find out the sentiment of UI students' responses to the spread of hoax news ahead of the 2019 ELECTION and anticipate the heat of the political situation in Indonesia ahead of the 2019 ELECTION by educating students to care about social and political problems in Indonesia for the sake of mutual benefit.

Hoax is an attempt to deceive or outsmart readers/listeners to believe something, aiming to spread it as a joke, to take down an opponent, or to promote someone or something through deceptions. Hoax information tends to be trusted if it supports public opinions or attitudes [11]. Hoax includes false news that is deliberately created to disguise the truth [12].

Based on Harley's opinion, hoax information can be identified by the following characteristics: Hoax information is in a chain of messages (1). It does not have realistic responses (2). It has no expiration date (3). No organization or group has been identified or cited as a source of information [13](4).

B. Social Network Analysis

Social Network Analysis (SNA) is a tool to map meaningful knowledge interactions between individuals [14]. SNA is an approach used for social research, including tracking vertical and lateral flows of information, identifying sources and objectives to find limits on resources [15]. It was developed to understand the interactions (ties/edges) of actors (nodes/points) existing in a system with 2 focuses in a particular social context.

SNA is a tool that can help understanding social interactions affecting local development by using several conceptual approaches. Some concepts in the Social Network Analysis, in addition to describing a pattern formed from the interactions between nodes or actors, are more often used to determine the central node on a network by calculating some of the centrality values [16] consisting of:

Degree centrality estimates the number of interactions a node makes.

$$CD(n_i) = d(n)CD(n_i) = d(n) \quad (1)$$

D (n_i) is the number of interactions that node ni makes with other nodes on the network.

Closeness centrality calculates the average gap between nodes on the network.

$$CC(n_i) = \frac{N-1}{\sum D(n_i,n_j)} \quad (2) \qquad (2)$$

Where N is number of nodes on the network. $D(n_i, n_j)$ is the number of shortest paths that connect nodes ni to nj.

Betweenness centrality calculates how often a node is passed by another node to go to a specific node on the network.

$$CB(n_i) = \sum_{j \neq k} \frac{G_{jk}(N_i)}{G_{jk}} \quad (3) \qquad (3)$$

Where G_{jk} (N_i) is the number of shortest paths from node j to node k that passes through node i. G_{jk} is the number of shortest paths between 2 nodes on the network.

III. PURPOSED METHOD

This research uses Social Network Analysis (SNA). The tools used include Python 2.7 computer program for crawling the data and Gephi 0.9.2 for visualizing and analyzing interaction patterns on Twitter's structure of the hoax news spread. The SNA analysis used in this study includes an analysis of overall network density and individual actor analysis. The analysis is done by looking at the value of centrality found in the network, which consists of degree centrality, closeness centrality, and betweenness centrality.

The data used in this study is retrieved from Twitter by crawling the data of sample tweets in the form of interactions (there could be mentions in the way of reply and quote retweet) that contain the words #saveratnasarumpat, #Aksi911, #jokowibloodyhands. The approach of this research generally consists of the following six stages: Start or preparation. At the preparation stage of the research, the authors made observations directly to the object in advance, by looking at the network structure of hoax news spread recorded in the Buster Tools Hoax application: (1). Data Crawling (data retrieval). After understanding the hoax news spread recorded in the Hoax Buster Tools application, the authors then did data crawling using Python 2.7.; (2). Social Network Analysis (SNA). SNA is a method used to translate crawled data represented in graphs; (3). Results and Discussion. At this stage, the authors discussed the results of the testing of crawled data in the form of datasheets and analyzed and implemented them into the patterns of interaction and communication using the Gephi software; (4). Conclusion. At this stage, the authors drew conclusions from the results and discussion stage done previously.

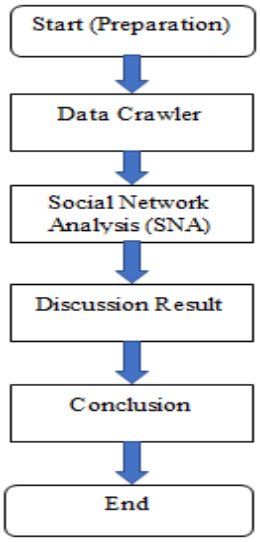

Fig. 1. Flowchart of the research stages

IV. RESULT AND DISCUSSION

The research was conducted by visualizing the network structure of hoax news spread patterns from datasheets obtained through crawling of the data using Python 2.7 into sociogram using Gephi 0.9.2. The dataset used is Twitter's network data in the form of hashtags. In this study, the authors experienced obstacles in the retrieval of Twitter's hashtag data, as its API (Application Programming Interface) limits the retrieval of data based on a certain length of period. Therefore, to get the data from a specific time in the past, the authors did a hashtag retrieval by using web scraping. Before this research moved to further discussion, the authors evaluated the research result. This evaluation was useful as a measure of planned activities to determine the state of the object. The evaluation results in a framework used as the reference in this study, as presented in Fig. 2.

The research result framework explains the following: Problem identification, in which the authors observe the hoax news available on the Hoax Buster application according to the background of the research (1). The hashtag is the research object, including '#aksi 911, #saveratnasarumpaet, #jokowibloodyhands' (2). Data collection is done by crawling data using Python 2.7 (3). Processing of data and measures of the network structure of hoax news spread aims to look at the interaction patterns that represent the undirected type of graph model. Then the result of the visualization is calculated using network attribute values, consisting of the number of nodes, edges, average degree, average path length, and some community (4). After data processing, the next stage is the analysis of measurement of size, mutuality, gap, and final centrality. To identify nodes or actors that influence

the number of network interactions, a measure of centrality is needed. It includes degree centrality, closeness centrality, and betweenness centrality. The result of the measurement of centrality is then ranked to find out the centrality of the actors (5). The process of evaluating the result of the research moves on to the conclusion (6).

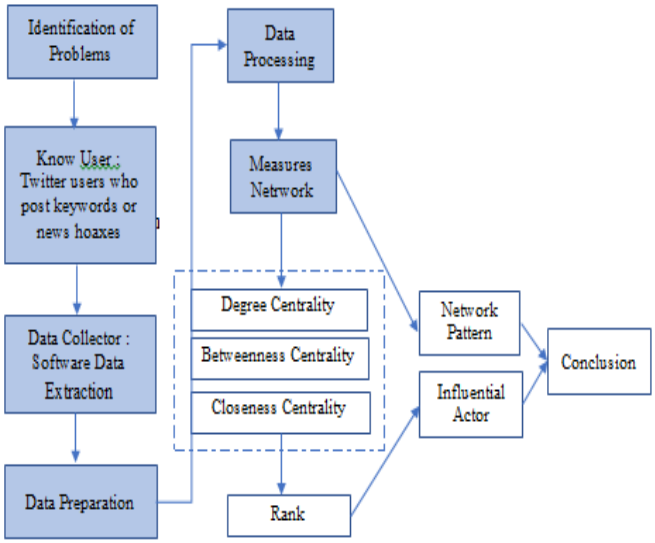

Fig. 2. Research Result Framework

A. Network Structure Analysis of Hoax News Spread

The network structure of hoax news spread was observed in the hoax news recorded in the Hoax Buster Tools application. This study raises the question of the network structure in the spread of hoax news on Twitter. The news on the Hoax Buster Tools application is used as a reference in this study, including:

TABLE I. HOAX NEWS RECORDED IN THE HOAX BUSTER TOOLS APPLICATION

No	News	Clariffication	Hashtag
01	[SALAH] Ada Aksi 911 dengan Geruduk Kedubes Arab Saudi untuk Bela Kalimat Tauhid dan Habib Rizieq 	FPI's Legal Counsel, Munarman, denied and confirmed that his party had not held a 911 protest by occupying the Saudi Embassy to defend the *Kalimat Tauhid* and Habib Rizieq in the case of extremist flag installed at his residence in Saudi Arabia [17].	#Aksi911
02		The newspaper headline was made when President Joko Widodo rejected requests from family convicts, Prime Minister Tony Abbott and other country leaders to stop the execution of two Australian citizens, the Bali Nine duo, Andrew Chan and Myuran Sukumaran, who were arrested on April 17, 2005 in Bali, Indonesia for smuggling 8.2 kg of heroin from Indonesia to Australia. This news was published on April 29, 2015, and had absolutely nothing to do with the 2019 Election [18].	#JokowiBloodyHands
03	 Politik Ratna Sarumpaet Dianiaya Beberapa Orang	The police got the evidence of Ratna's presence at the hospital. According to the police, Ratna was treated in Room B.1, 3rd floor of Bina Estetika Hospital. "Based on CCTV footage, Ratna Sarumpaet left the Bina Estetika Hospital on Monday, September 24, at 9:28 p.m. WIB, with a Blue Bird taxi," [19].	#SaveRatna Sarumpaet

It is necessary to measure the degree of vertex and average degree, density, modularity, gap, diameter, and centrality (closeness and betweenness) in the network structure of hoax news spread [20]. All data visualized in this study were obtained from the crawled dataset by Python 2.7. Social network analysis is known for its undirected graph. To obtain visualization result, the dataset was imported into the adjacency list format available in Gephi 0.9.2.

B. Data Pre-Processing

Doing the Pre-Processing stage is considered very important in data mining techniques, especially on data sourced from social media in the form of a text. In Fig. 3, there are several steps that are used in the process of crawling data as follows :

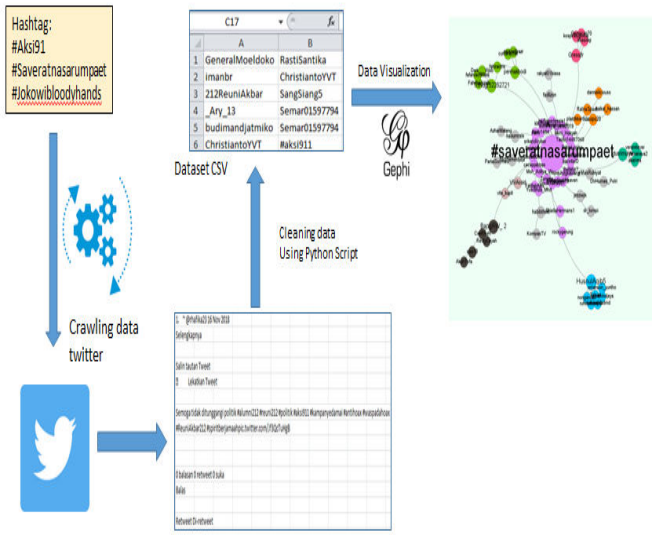

Fig. 3. Data Crawling Process

From the data crawling process above, it can be explained as follows: identify the problem about hoax news so that it has a hashtag that will be used for crawling the hashtag on Twitter and the hashtag data period on # actions911 was first tweeted on 7 November 2018 and finally on 23 November 2018, # saveratnasarumpaet on 23 July 2013 and finally 2 October 2018, for the first #jokowibloodyhands being tweeted on 15 May 2019 and finally 26 May 2019 (1). Then crawling the hashtag on Twitter using python 2.7 (2). After crawling the hashtag using python 2.7, a datasheet is obtained in the form of CSV (3). Datasheet that has been obtained in the form of CSV, then removing mentions and removing emojis that are used to delete tweet mentions or retweets, numbers and symbols. After removing mentions and removing emojis, a datasheet

that contains the names of users who use the hashtag (4) is obtained. Then visualization using Gephi 0.9.2 (5)

C. *Analysis of the Network Structure of Hoax News Spread Result*

The result of the comparison of attribute values on the network in spreading hoax news is presented in Table 2 below:

TABLE II. CENTRALITY VALUE BASED ON HASTHAG

Network Attribute	#Saveratna sarumpaet	#Aksi911	#Jokowibloo dyhands
Total Node	75 Node	16 Node	57 Node
Total Edges	78 Edges	17 Edges	59 Edges
Average Degree	1,09	1,062	1,038
Average Weighted Degree	1,08	1,066	1,035
Network Diameter	5	4	4
Average Path Length	2,8 Node	2,375 Node	2,964 Node
Density	0,028	0,142	0,037

The result of the identification of influential accounts in this study can be used by Twitter users to see the number of user interactions involved in the spread of hoax news on the network. There are 7 network attributes used to know the value of comparison in the spread of hoax news on Twitter.

Table 2 shows that of the 7 network attributes, #Saveratnasarumpaet is superior in four network attributes, including the number of nodes, number of edges, Average Degree, and Network Diameter, while #Aksi911 is superior in density, and #Jokowibloodyhands is superior in average path length. It can be concluded that #Saveratnasarumpaet as a hashtag is the most used by Twitter users in the spread of hoax news in this study.

D. *Result of Network Structure #Saveratnasarumpaet (Undirected Graph)*

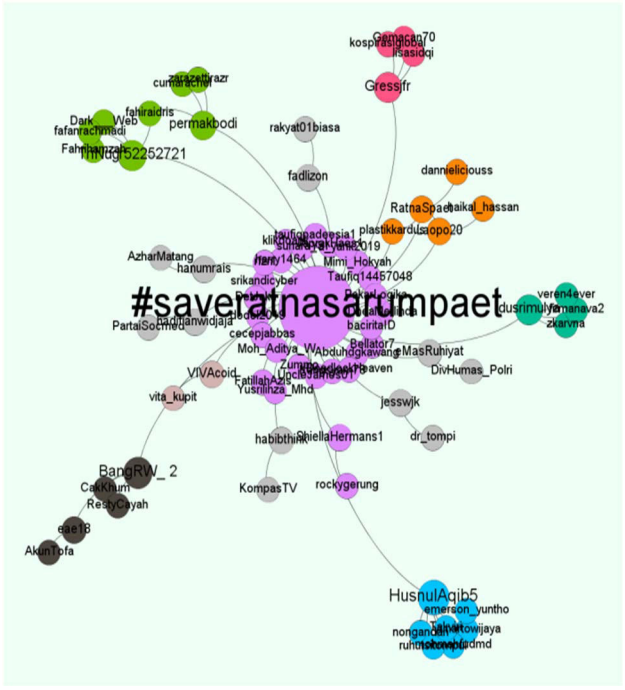

Fig. 4. Visualization of Network Structure #Saveratnasarumpaet

The visualization result obtained from #saveratnasarumpaet in Fig. 4 shows nodes that have a centrality role in the formation of the network structure of hoax news spread. Nodes in network formation are centralized through the measurement of nodes, edges, average degree, modularity, and network diameter.

E. *Result of Network Structure #Aksi911 (Undirected Graph)*

Fig. 5. Visualization of Network Structure #Aksi911

The visualization result obtained from #Aksi911 in Fig. 5 shows nodes that have a centrality role in the formation of the network structure of hoax news spread. Nodes in network formation are centralized through the measurement of nodes, edges, average degree, modularity, and network diameter.

F. *Result of Network Structure #Jokowibloodyhands (undirected graph)*

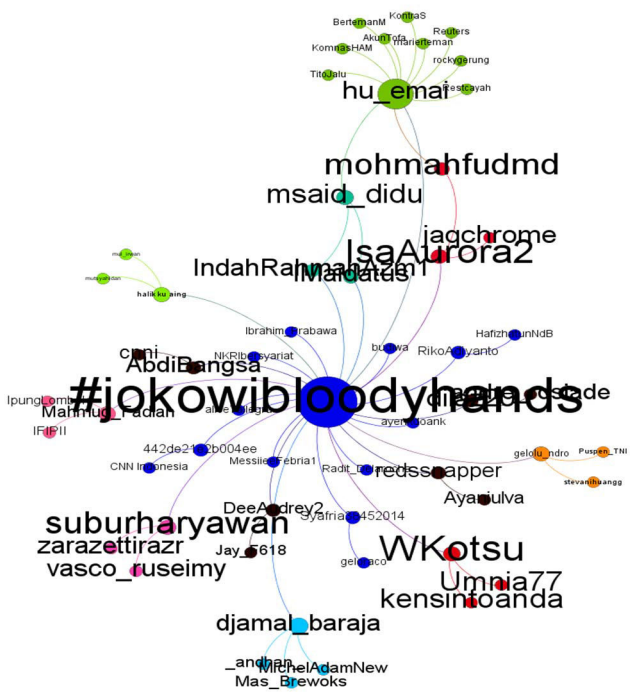

Fig. 6. Visualization of Network Structure #Jokowibloodyhand

The visualization result obtained from #Jokowibloodyhands in Fig. 6 basically shows nodes that have a centrality role in the formation of network structure of hoax news spread. Nodes in network formation are centralized through the measurement of nodes, edges, average degree, modularity, and network diameter.

G. Analysis of Network Result #Saveratnasarumpaet

TABLE III. VALUE OF ACTOR CENTRALITY ON THE NETWORK #SAVERATNASARUMPAET

Node	Degree Centrality	Betweenness Centrality	Closeness Centrality
HusnulAqib5	7	423	0.440476
TriNugr52252721	5	249.5	0.430233
BangRW_ 2	4	285	0.430233

Based on the degree of centrality, betweenness centrality, and closeness centrality calculation result on Gephi 0.9.2 software, the most influential actor for #Saveratnasarumpaet network interaction is HusnulAqib5, as the account is superior in the degree of centrality, betweenness centrality, and closeness centrality.

It can be seen from table 3 that the centrality of the node is the user HusnulAqib5 with a value of degree 7. In addition to degree centrality there is also a connecting node between nodes. The link between nodes is called betweeness centrality. In the #Saveratnasarumpaet network there are HusnulAqib5, TriNugr52252721, BangRW_ 2 as betweeness centrality. The closeness centrality value shows the average distance between one node and another node. The higher the value of the node, the closer the node is to the other node. HusnulAqib5 has a high closness value so it can be assumed that HusnulAqib5 has a value of closeness with other nodes.

HusnulAqib5 account is the most influential actor for the total number of interactions produced, and it becomes the bridge for other actors to interact on the network and is superior about other prominent actors in the network. It also shows proximity to other actors, meaning that the actor can convey information to other actors quickly. Other supporting actors who also have considerable influence in the #Saveratnasarumpaet network interaction are TriNugr52252721 and BangRW_ 2.

H. Analysis of Network Result #Aksi911

TABLE IV. VALUE OF ACTOR CENTRALITY ON THE NETWORK #AKSI911

Node	Degree Centrality	Betweenness Centrality	Closeness Centrality
RastiSantika	3	14	0.483871
Semar01597794	3	27	0.5
rhafika23	2	0	0.46875

Based on the degree of centrality, betweenness centrality, and closeness centrality calculation result on Gephi 0.9.2 software, the most influential actor for #Aksi911 is Semar01597794, as the account is superior in the degree of centrality, betweenness centrality, and closeness centrality.

It can be seen from table 4 that the centrality of the node is the user RastiSantika and Semar01597794 with a degree value 3. In addition to degree centrality there is also a connecting node between nodes. The link between nodes is called betweeness centrality. In network # Aksi911 there are Semar01597794, RastiSantika, rhafika23 as betweeness centrality. The closeness centrality value shows the average distance between one node and another node. The higher the value of the node, the closer the node is to the other node. Semar01597794 has a high closness value so it can be assumed that Semar01597794 has a value of closeness with other nodes

Semar01597794 account is the most influential actor for the total number of interactions produced, and it becomes the bridge for other actors to interact on the network and is superior with other influential actors in the network. It also shows proximity to other actors, meaning that the actor can convey information to other actors quickly. Other supporting actors who also have considerable influence in the #Aksi911 network interaction are RastiSantika and rhafika23.

I. Analysis of Network Result #Jokowibloodyhands

TABLE V. VALUE OF ACTOR CENTRALITY ON THE NETWORK #JOKOWIBLOODYHANDS

Node	Degree Centrality	Betweenness Centrality	Closeness Centrality
hu_emai	12	496.5	0.46281
djamal_baraja	4	162	0.408759
halik ku aing	3	109	0.402878

Based on the degree of centrality, betweenness centrality, and closeness centrality calculation result on Gephi 0.9.2 software, the most influential actor for #Jokowibloodyhands is hu_emai, as the account is superior in the degree of centrality, betweenness centrality, and closeness centrality.

It can be seen from table 5 that the centrality of the node is the user hu_emai with a value of degree 12. In addition to degree centrality there is also a connecting node between the nodes. The link between nodes is called betweeness centrality. In the #Jokowibloodyhands network, there are hu_emai, djamal_baraja, and my halik as betweeness centrality. The closeness centrality value shows the average distance between one node and another node. The higher the value of the node, the closer the node is to the other node. hu_emai has a high closness value so it can be assumed that hu_emai has a value of closeness with other nodes.

hu_emai account is the most influential actor for the total number of interactions produced, and it becomes the bridge for other actors to interact on the network and is superior with other prominent actors in the network. It also shows proximity to other actors, meaning that the actor can convey information to other actors quickly. Other supporting actors who also have considerable influence in the #Jokowibloodyhands are djamal_baraja and halik ku aing.

V. CONCLUSION AND SUGGESTIONS

Based on the overall result of this study, the SNA method shows a significance in measuring the centrality of nodes (actors). The #Saveratnasarumpaet hashtag shows the highest value of communication pattern of nodes (actors) in the spread of hoax news on Twitter, as it is superior in the number of nodes, edges, Average Degree, and Network Diameter. After considering the degree of centrality measurement based on the number of nodes of each network structure, HusnulAqib5 is named the most influential actor in the spread of hoax news for #Saveratnasarumpaet hashtag.

Based on the degree of centrality measurement on the number of nodes of each network structure, Semar01597794 account is named the most influential actor in the spread of hoax news for #Aksi911 hashtag. While hu_emai account is the most influential actor in the spread of hoax news for #Jokowibloodyhands hashtag based on the degree of centrality measurements on the number of nodes of each network structure.

For further research, centrality measurements can not only be limited to individual actors, but also to measuring the centrality of the nodes in the form of institutions that become the coalition of actors. And from the measurement results of the political network structure centrality is still not optimal and for maximum results can be developed again by measuring Sentiment Analysis, Eigenvector centrality, K-Shell centrality and Subgraph centrality and the application of clustering and text mining methods are highly recommended for comprehensive results in social network analysis.

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Network Centralization Analysis Approach in the Spread of Hoax News on Social Media

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Abstract: The development of information technology in Indonesia seems to improve from year to year. It has an essential role in disseminating information to the community, includi...
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Abstract:
The development of information technology in Indonesia seems to improve from year to year. It has an essential role in disseminating information to the community, including through a social media network is commonly known as Twitter. Some people use Twitter to spread news or information, but some others abuse it to spread fake news or irresponsible information (hoaxes). This study aims to see the patterns of interaction and the actors who play an essential role in the spread of hoax news on Twitter. The crawling of Twitter data uses Python 2.7, and the datasheet is then processed using the Social Network Analysis approach. It is later visualized using Gephi 0.9.2. Determination of the actors who play an essential role in the spread of hoax news is calculated based on centrality consisting of degree centrality, betweenness centrality, and closeness centrality. From several samples that have been tested using social network analysis methods and centrality calculations, have succeeded in identifying influential actors in hoax news dissemination on Twitter.

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share and create content, including in blogs, social networks, and forums in the virtual world. Based on "We Are Social" data from January 2017, social media users in Indonesia make up to 40.46% of the total population with 49% active Youtube users, 48% Facebook users and 38% Twitter users. Indonesia ranks high on the list of countries with most social media use, such as Twitter. It is a microblogging site ranking fifth in the world with 29 million users [1]. The activities of Twitter users in Indonesia contribute to this number.

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