DIPONEGORO UNIVERSITY

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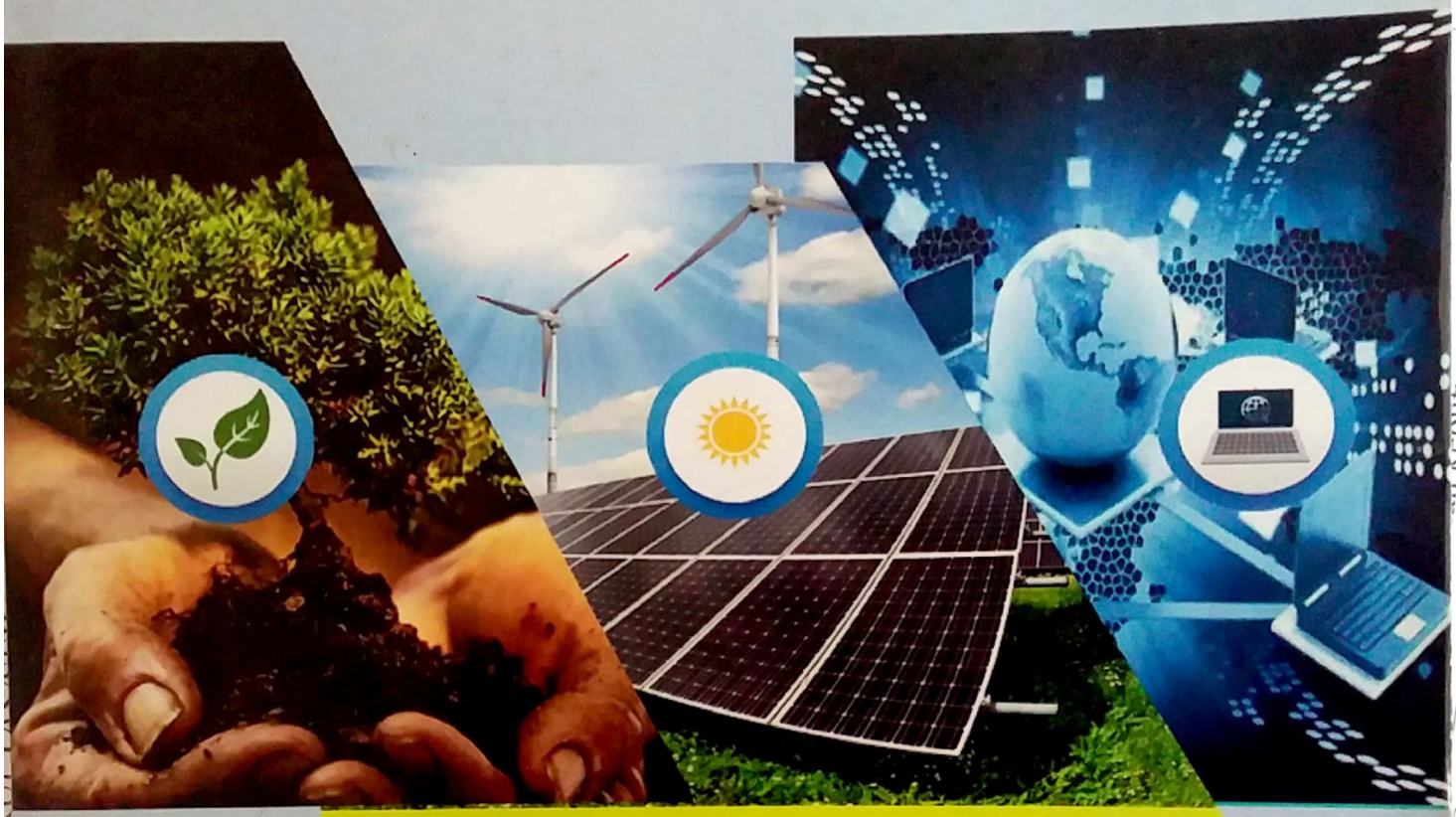
ICENIS 2017
International Conference on Energy, Environment and Information System



ON ENERGY, ENVIRONMENT, AND INFORMATION SYSTEM

AUGUST, 15th - 16th 2017
SANTIKA PREMIERE HOTEL
SEMARANG, INDONESIA

PROGRAMME AND ABSTRACT BOOK

WELCOMING SPEECH AND OPENING
RECTOR OF DIPONEGORO UNIVERSITY

Honorable Guests, Ladies, and Gentlemen,

It is my great honor to welcome you to the International Conference on Energy, Environmental and Information System (the 2nd ICENIS) 2017. This is the second international conference organized by the School of Postgraduate Studies Diponegoro University following the success of the first ICENIS in 2016. With its remarkable accomplishment, this event is expected to be performed annually. We are pleased to support this conference.

Diponegoro University (Undip) is a prominent university located in Semarang, the capital of Central Java. Undip has a strong tradition to carry out Education, Outstanding Research and Community Service throughEleven Faculties, School of Postgraduate Studies, School of Vocation, 49 Undergraduate Programs, 35 Master Programs, and thirteen Doctoral Programs.

Undip is one of the most well-known state universities in Indonesia with an international reputation for its teaching and research activities. In 2017 Undip ranked 6th in Indonesia according to World Universities Rankings. A year before Undip was number 701 in World Class University Rankings with 1294 total scientific publications indexed by Scopus, standing on the 8th position in Indonesia.

Population growth has a significant role in the sustainability of th natural resources and also energy resources. Lifestyle, consumpti patterns, and land-use along with population growth affect direc the resources quality and availability. Some problems arise from hi level of consumption and industrialization, inequality of wealth a land distribution, inappropriate government policies, pover inefficient technology, also uncontrolled exploitation. Depletion natural and energy resources, environmental degradation, and maj health problems are bound to happen due to the lack of control a management in status quo.

It is our responsibility to develop better effort to ensure a sustainab environmental management. Indeed, it is a global challenge th everyone should take their role. I hope this conference will be excellent platform to strengthen our concern and effort in confirmi sustainable development for future human security.

Through this conference I hope experts and researchers from all ov the world could meet and share their experiences and knowledge have explicit understanding regarding the complexity of t problems. I also hope this conference will present a memorab learning experience to all contributors and participants. It is expect that papers presented in this conference are documented for c future reference and encourage further research in relevant areas.

Prof. Dr. Yos Johan Utama, SH, M.Hum

Rector

WELCOMING SPEECH
DEAN OF SCHOOL OF POSTGRADUATE STUDIES

Distinguished Guests, Ladies, and Gentlemen,

It is my pleasure to welcome everyone to the 2nd International Conference on Energy, Environmental and Information System (the 2nd ICENIS) 2017 organized by the School of Postgraduate Studies Diponegoro University.

This international conference is a part of conference, seminars, and workshop activities provided by the School of Postgraduate Studies Diponegoro University. ICENIS 2017 brings out the ideas and researches in the fields of energy, environment, and information system towards sustainable development. This conference promotes new approaches and innovations in the aforementioned fields. All is in support of creating sustainable energy and technology without depleting natural resources.

The objectives of the ICENIS 2017 are:

- creating an international forum for the researchers, students, industries, and governments to

communicate their research results on the fundamentals and applications of energy, environment, and information system,

- sharing and exchanging ideas, thoughts, and discussion on all aspects of energy, environment, and information system,
- facilitating the formation of network among participants to enhance the quality and benefit of research and development.

Furthermore, this conference also constitutes a great opportunity for escalating collaboration among institutions in term of various academic necessities.

I would like to thank the Keynote Speakers for allowing us a chance to experience a valuable sharing. It is essential to gather experts in the field of science and technology to improve the quality of postgraduate education.

Prof. Dr. Ir. Purwanto, DEA

Dean of School of Postgraduate Studies

Diponegoro University

WELCOMING SPEECH
CHAIRMAN OF the ICENIS 2017

On behalf of the ICENIS 2017 Organizing committee, I am honored and delighted to welcome you to the 2nd International Conference on Energy, Environmental and Information System (ICENIS) 2017, with a theme is "Enhancing Sustainability for Energy, Environment and Information system management". This conference is expected to designate an interactive international forum to provide a platform for sharing and exchanging information on the latest research on energy, environment, and information system.

Our technical program is rich and varied with 9 keynote speech around 200 technical papers split between 8 parallel oral sessions a each day. The participants come from various countries and from all over Indonesia consisting of researchers, lecturers, practitioners, post and undergraduate students belonged to various institutions. A large number of papers submitted to this conference indicate that the interest in the field of energy, environment, and information system gains a continuous rise in this country and worldwide.

We are also proud to present the plenary speakers who are qualified to share their valuable information and knowledge

in this conference. On behalf of the ICENIS 2017 Committee, we wish all participants to have a good attainment.

We would like to acknowledge our high appreciation to the Rector of Diponegoro University, the Dean School of Postgraduate Studies Diponegoro University, and the keynote speakers.

I would also like to take this opportunity to thank the organising team from School of Postgraduate Studies, Diponegoro University for all their hard work and dedication in preparing this conference. As we have tried our best in conducting this event, we humbly realize that we may still be lacking in some parts. Accordingly we would like to apologize for any inconvenience.

'With great pride we present ICENIS 2017, and we wish you an inspring time."

Dr. Ing, Sudarno, ST, MSc

Chair of Organizing Committee

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Dr. Suryono (UNDIP – Indonesia)
Dr. Tri Retnaningsih Soeprobowati, MApp.Sc

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Karlsruhe Institute of Technology KIT, Institute of Biology for Engineers and Biotechnology of Wastewater Treatment, Germany
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Dr. Bambang Setiadi
Chairman of National Research Council – Dewan Riset Nasional

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Center for International Forestry Research (CIFOR)
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University of Applied Science Emden Leer, Faculty of Technology, Division Microbiology Biotechnology, Germany
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- School of Postgraduate Studies, Universitas Diponegoro

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"Find The Future From The Past: Palaeolimnology In Indonesia"

Prof. Dato' Ir. DR. Wan Ramli Wan Daud FASc

-Founding Director and Principal Research Fellow

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-Department of Chemical & Process Engineering

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"Microbial Fuel Cells: Simultaneous Power Generation And Wastewater Treatment"

Prof. Dr. Ir. Widodo Wahyu Purwanto, DEA

Sustainable Energy Systems and Policy Research Cluster

Department of Chemical Engineering, Faculty of Engineering, Universitas Indonesia

"Assessing Energy Status and Sustainable Energy System Design in an Archipelagic State"

Prof. Dr. Teddy Mantoro, SMIEEE

Sampoerna University, Faculty Engineering and Technology

"Towards Smart Information Systems: Exploitation on Intelligent Speech News and Tracking User Location Indoor"

PROGRAM

1ST DAY, TUESDAY, 15 AUGUST 2017 – PLENARY SESSION	
Time	**Program**
07.00 – 08.15	Registration
08.15 – 08.45	Opening Ceremony
08.45 – 09.00	Coffee Break 1
09.00 – 11.00	**Plenary Lecture & Discussion (1)** • Prof. Josef Winter (KIT – Germany) • Dr. Bambang Setiadi (Dewan Riset Nasional) • Himlal Baral, PhD (CIFOR, Nepal) Moderator : Prof. Sudharto P. Hadi, MES, PhD (UNDIP)
11.00 – 12.45	**Plenary Lecture & Discussion (2)** • Prof. Claudia Gallert (University of applied science – Emden/Leer – Germany) • Prof. Peter Gell (Federation University Australia) • Dr. Tri Retnaningsih Soeprobowati, MAppSc (UNDIP) Moderator : Dr. Hadiyanto, MSc (UNDIP)
12.45 – 13.45	Lunch

1ST DAY, TUESDAY, 15 AUGUST 2017 – PARALLEL SESSION								
Time	**Room 1**	**Room 2**	**Room 3**	**Room 4**	**Room 5**	**Room 6**	**Room 7**	**Room 8**
13.45 – 14.00	EMP-01	EC-05	EC-19	EPPE-30	PC-03	EC-01	DSS-02	SIS-01
14.00 – 14.15	EMP-02	EC-12	EC-28	EHT-01	PC-05	EC-16	DSS-03	SIS-02
14.15 – 14.30	EMP-03	EC-14	EPPE-02	EHT-03	PC-06	EC-26	DSS-06	SIS-03
14.30 – 14.45	ECE-02	EC-17	EPPE-11	EHT-05	PC-07	EC-27	DSS-07	SIS-04
14.45 – 15.00	ECT-05	EC-21	EPPE-13	EHT-07	PC-10	EC-29	DSS-08	SIS-05
15.00 – 15.15	ECT-06	EC-31	EPPE-16		EC-08	EC-32	DSS-12	SIS-06
15.15 – 15.30	Coffee Break							
15.30 – 15.45	ECE-01	EC-02	EC-03	EE-01	WM-06	PC-09	DSS-04	SIS-07
15.45 – 16.00	ECE-03	EC-04	EC-10	EE-02	ET-01	EC-13	DSS-05	SIS-08
16.00 – 16.15	ECT-01	EC-07	EC-11	EE-03	ET-17	ET-04	DSS-09	SIS-09
16.15 – 16.30	ECT-03	EC-15	EC-20	EE-04	PC-02	EPPE-28	DSS-10	SIS-10
16.30 – 16.45	RE-08	EC-30	PC-11	EE-05	WM-03	PC-08	DSS-11	SIS-11
16.45 – 17.00	RE-13	EPPE-19	PC-12				DSS-01	SIS-12

2ND DAY, WEDNESDAY, 16 AUGUST 2017 – PLENARY SESSION	
Time	**Program**
08.00 – 10.30	**Plenary Lecture & Discussion** • Prof. Dato' Ir. Dr. Wan Ramli Wan Daud (Universiti Kebangsaan Malaysia) • Prof. Widodo W. Purwanto, DEA (University of Indonesia) • Prof. Dr. Teddy Mantoro (Sampoerna University, Indonesia) Moderator : Prof. Dr. Ir. Purwanto, DEA (UNDIP)
10.30 – 10.45	Coffee Break

2ND DAY, WEDNESDAY, 16 AUGUST 2017 – PARALLEL SESSION

Time	Room 1	Room 2	Room 3	Room 4	Room 5	Room 6	Room 7	Room 8
10.45 – 11.00	ECT-02	EPPE-03	EC-06	ET-13	EPPE-14	ET-03	GIR-01	BI-01
11.00 – 11.15	ECT-04	EPPE-05	EC-18	EHT-02	WM-04	ET-05	GIR-03	BI-02
11.15 – 11.30	RE-02	EPPE-08	EC-22	EHT-04	WM-07	ET-07	PC-01	SCIS-01
11.30 – 11.45	RE-03	EPPE-12	EC-25	EHT-06	WM-12	ET-08	GIR-12	SCIS-02
11.45 – 12.00	RE-05	EPPE-25	EPPE-31	EHT-08	WM-13	ET-09	HSEIS-06	IIS-01
12.00 – 12.15	RE-07	EPPE-29	EPPE-32	EHT-09	WM-14	ET-11	GIR-02	IIS-02
12.15 – 12.30	RE-09	EPPE-33	EPPE-35	EHT-10	WM-15	ET-16	GIR-04	IIS-03
12.30 – 12.45	RE-12	EPPE-34	PC-04	EHT-11	GIR-10	ET-19	GIR-05	IIS-04
12.45 – 14.00	Lunch							
14.00 – 14.15	RE-01	EPPE-04	EPPE-01	HSEIS-01	WM-01	ET-02	**Room 7** Green infrastructure and Resilliece (GIR)	
14.15 – 14.30	RE-04	EPPE-06	EPPE-07	HSEIS-02	WM-02	ET-06	" Kick of Meeting Low Carbon Society in Semarang"	
14.30 – 14.45	RE-06	EPPE-15	EPPE-09	HSEIS-03	WM-05	ET-10	City taskforce IGES, JAPAN - MAGISTER OF ENVIRONMENTAL STUDIES SCHOOL OF POSTGRADUATE DIPONEGORO UNIVERSITY	
14.45 – 15.00	RE-10	EPPE-21	EPPE-10	HSEIS-04	WM-08	ET-12		
15.00 – 15.15	RE-11	EPPE-22	EPPE-17	HSEIS-05	WM-09	ET-14		
15.15 – 15.30	RE-14	EPPE-23	EPPE-18	HSEIS-07	WM-10	ET-15		
15.30 – 15.45	RE-15	EPPE-26	EPPE-20	HSEIS-08	WM-11	ET-18		
15.45 – 16.00	RE-16	EPPE-27	EPPE-24	HSEIS-10		ET-20		
16.00 – 16.30	Coffee Break							
16.30 – 17.00	**CLOSING CEREMONY**							

MINISTRY OF RESEARCH, TECHNOLOGY AND HIGHER EDUCATION
DIPONEGORO UNIVERSITY
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ICENIS 2017
International Conference on Energy, Environment and Information System

CERTIFICATE

Number : 1400/UN7.5.12/TU/2017

This is to certify that

Chamdan Mashuri

Has participated as

Presenter

in "The 2nd International Conference on Energy, Environment and Information System (ICENIS) 2017"
Held by School of Postgraduate Studies, Diponegoro University
Semarang, August 15th - 16th, 2017

Dean,

Prof. Dr. Ir. Purwanto, DEA
NIP 196112281986031004

Chair of Organizing Committee

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NIP 197401311999031003

Prediction of Safety Stock Using Fuzzy Time Series (FTS) and Technology of Radio Frequency Identification (RFID) for Stock Control at Vendor Managed Inventory (VMI)

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Abstract. This research was conducted by prediction of safety stock using Fuzzy Time Series (FTS) and technology of Radio Frequency Identification (RFID) for stock control at Vendor Managed Inventory (VMI). Well-controlled stock influenced company revenue and minimized cost. It discussed about information system of safety stock prediction developed through programming language of PHP. Input data consisted of demand got from automatic, online and real time acquisition using technology of RFID, then, sent to server and stored at online database. Furthermore, data of acquisition result was predicted by using algorithm of FTS applying universe of discourse defining and fuzzy sets determination. Fuzzy set result was continued to division process of universe of discourse in order to be to final step. Prediction result was displayed at information system dashboard developed. By using 60 data from demand data, prediction score was 450.331 and safety stock was 135.535. Prediction result was done by error deviation validation using Mean Square Percent Error of 15%. It proved that FTS was good enough in predicting demand and safety stock for stock control. For deeper analysis, researchers used data of demand and universe of discourse U varying at FTS to get various result based on test data used.

Keywords: Stock, Prediction, Safety stock, Fuzzy time series, RFID, VMI.

1 Introduction

Stock management is one of production process planning and controls whose purpose is to decrease total cost of stock material and stock level during lead time and acquisition cost. Management developing stock policy which can minimize operational total cost is the main purpose of planning and control. Stock management is an important factor in production process, one factor influencing stock management is demand prediction; demand fluctuation influences product stock and production activity greatly [1].

An important component of chained supply management is stock management. Stock management can spotlight prediction mistake and decision policy depending on demand having potential to prediction mistake. Prediction having the greatest influence to final user's decision can be used to develop demand prediction concept which can give significant influence to the improvement of a company profit [2].

Demand prediction in control management and production suplly becomes interesting challenge to be researched because most of them work on data of time series as having been done to overcome problem prediction, like prediction in information system management, health care, economy prediction, selling prediction, budgeting analysis, stock exchange fluctuation, and business analysis, etc [3].

Fuzzy time series (FTS) can design problem of prediction having linguistic value with information having been long time. FTS also can use more observation in prediction having been applied to overcome non-linear. Based on theory of fuzzy compilation, FTS model came from Song and Chissom in 1993, FTS was used to predict the registration of Alabama University. Chen presents new model by using simple fuzzy relation and simple arithmetic calculation [4-5].

Fuzzy time series can predict product need for the next period and this prediction can be arranged based on time period needed. By integrating fuzzy time series to an information system to calculate ROP score of each product, the error average of ROP score got after being examined by using method of Average Forecasting Error Rate (AFER) was 7,13%. Fuzzy times series can predict the number of stock needed in stock room, report stock availability, and give goods stock information so high economy efficiency is got [6].

Time series is an ordered time series arranged from quantitative individual characteristics or collective phenomenon taken from time period successively. To understand time series characteristic, many researchers

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have adopted, analyzed, and developed time series method whose final purpose is to find pattern or formula that can be used to predict the future [7].

Radio Frequency Identification (RFID) technology is one technologies used in supply chain management using modern. By using wireless technology, a company can track RFID tags easily without physical contact. RFID technology has been proven to be very useful in planning of production, transportation, and warehousing [8]

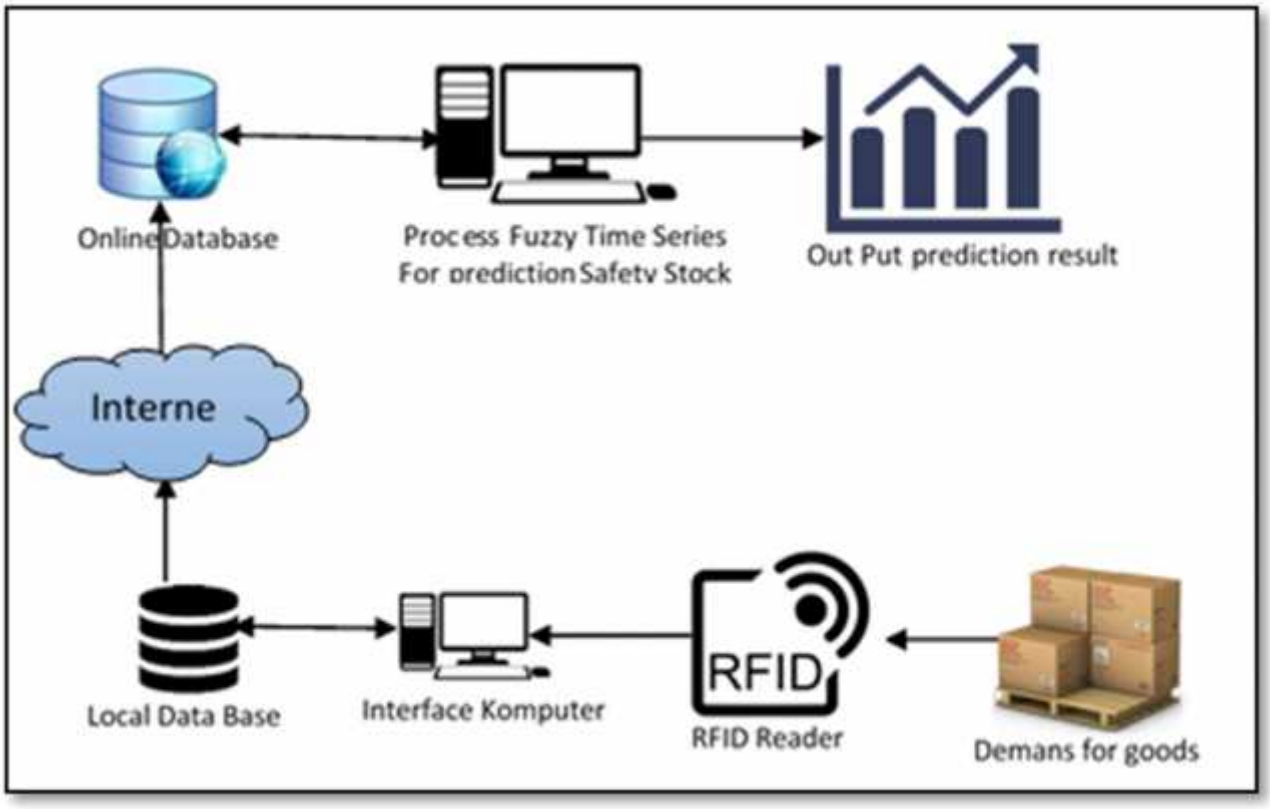
RFID can integrate into company business process so that it is possible for every entity marked can communicate with all organization information infrastructure, so it can enhance information of supply chain. In business technology process, RFID shows that it can operate in small and middle retail industry and can describe effect of RFID in business operation [9]

Vendor Managed Inventory (VMI) has very significant benefit for supply chain and each company. VMI gives competitive profit to retailer related to higher product availibility provided by suppliers with the chance to increase production and marketing efficiency. VMI can increase fulfillment frequency with a small number and decrease stock level for all involved in distribution and supply chain. VMI can optimize supply chain performance in which the producer is in charge to keep distributor's stock level. Producer has access to distributor's stock data and is in charge to order [10-11].

2 Method

2.1 Data Acquisition

This acquisition data process on application of safety stock prediction using Fuzzy Time Series (FTS) and Radio Frequency Identification (RFID) technology for stock control at Vendor Managed Inventory (VMI) applies RFID censor technology which is censor detecting id tags put on the goods using radio waves and analyzed to be data time series stored at local database on microprocessor by using internet network, data of goods demand history is sent to web server and stored at online database then predicted by using fuzzy time series and used to determine safety stock. Data acquisition route is shown in picture 1.



Picture 1. Acquisition process route of goods demand data

2.2 Modelling by using fuzzy time series

Predicting by using fuzzy time series model is method of data prediction using principles of fuzzy whose base is catching formula of long time data then used to project the future data. Modelling of prediction by using fuzzy time series has some steps as follows :

1. Defining universe of discourse U until *f*uzzy set can be determined as U = [x, y].
2. Determining minimal and maximal score of actual history data (Xmin = x, Xmax = y).
3. Dividing universe of discourse U with some series of data u1, u2, …. un and determining linguistic score.

4. Doing fuzzification and fuzzy set from data of actual histories.
5. Calculating score of fuzzy data of actual history by using the following pattern :

$$\mu N \quad [x] = \frac{b - x}{b - a} 203659 \leq x \leq 471585 \qquad (1)$$

6. Choosing basis of model W which is very appropriate and calculating fuzzy using the following pattern:

$$r(M \quad)^{w+1} = \frac{M \quad 1 + M \quad 2 + \cdots + M}{w} \qquad (2)$$

7. Doing defuzzyfication of calculation result from the above step then, calculating prediction result by using the following pattern :

$$y = \frac{(A1 * c1 + A2 * c2)}{A1 + A2} \qquad (3)$$

$$v = r(N \quad) * A1 + r(N \quad) * A2 + \cdots + r(P \quad) * A7 \qquad (4)$$

$$F \quad = y + v \qquad (5)$$

3 Result and Discussion

Data acquisition process on application of safety stock prediction using Fuzzy Time Series (FTS) and Radio Frequency Identification (RFID) technology for stock control at Vendor Managed Inventory (VMI) has some steps as follows:

a. Acquisition process of goods demand data
History data used to predict by using fuzzy time series is data of every month-actual demand data from PT. Quindo food, period of 2012 – 2016, with 60 data as sample taken from scan tag id on goods using censor technology of RFID as in table 1.

Table 1. Data of actual demand

No	Month	Year	Demand Number	Fuzzification
1	January	2012	382635	A5
2	February	2012	355766	A4
3	March	2012	325994	A4
4	April	2012	344349	A4
5	May	2012	362127	A5
6	June	2012	332272	A4
7	July	2012	344733	A4
8	August	2012	262136	A2
9	September	2012	371755	A5
10	October	2012	344931	A4
11	November	2012	360428	A5
12	December	2012	305567	A3
13	January	2013	398608	A6
14	February	2013	401103	A6
15	March	2013	410591	A6
16	April	2013	391991	A5
17	May	2013	373435	A5
18	June	2013	390023	A5
19	July	2013	415428	A6
20	August	2013	294396	A3
21	September	2013	417544	A6
22	October	2013	439641	A7
23	November	2013	422857	A6
24	December	2013	342836	A4
25	January	2014	366797	A5
26	February	2014	423950	A6
27	March	2014	463070	A7
28	April	2014	445420	A7
29	May	2014	452353	A7
30	June	2014	471585	A7
31	July	2014	327364	A4
32	August	2014	388073	A5
33	September	2014	459309	A7
34	October	2014	452508	A7
35	Nopember	2014	425409	A6
36	December	2014	375814	A5
37	January	2015	339850	A4
38	February	2015	376973	A5
39	March	2015	376571	A5
40	April	2015	371001	A5
41	May	2015	304900	A3
42	June	2015	361767	A5
43	July	2015	278754	A2
44	August	2015	430953	A6
45	September	2015	425458	A6
46	October	2015	453944	A7
47	Nopember	2015	394726	A5
48	December	2015	338991	A4
49	January	2016	287776	A3
50	February	2016	362668	A5
51	March	2016	440171	A7
52	April	2016	348626	A4
53	May	2016	339128	A4
54	June	2016	380019	A5
55	July	2016	203659	A1
56	August	2016	388847	A5
57	September	2016	423256	A6
58	October	2016	446611	A7
59	Nopember	2016	450331	A7
60	December	2016	309796	A3

b. Defining universe of discourse U until fuzzy set can be determined. After actual data was calculated, so minimal and maximal score of samploe data was obtained (Xmin = 203659, Xmax = 471585). Based on that score difference, universe of discourse U can be defined as U = [203659,471585].
c. Dividing universe of discourse U with some data series u1, u2, …, un, and calculate linguistic score. Firstly, universe of discourse U was divided into ke 7 intervals which have the same size, using the following way: Xmin + interval length. Interval length= (Xmax – Xmin) / 7, for example, 153 +

((471585 – 203659) / 7) = 38275. u1 = [203659, 241934], u2 = [241934, 280209], u3 = [280209, 318484], u4 = [318484, 356760], u5 = [356760, 395035], u6 = [395035, 433310], u7= [433310, 471585]. Then, we admit them as 7 linguistic scores , such as (Negative Big), (Negative Medium), (Negative Small), (Zero), (Positive Small), (Positive Small), (Positive Big) to describe variance of selling number. Based on that definition, 7 fuzzy sets A1, A2, A3, A4, A5, A6, A7, in which A1= (Negative Big), A2= (Negative Medium), A3= (Negative Small), A4= (Zero), A5= (Positive Small), A6= (Positive Small), A7= (Positive Big). In universe of discourseU with the following scores:
A1=203659, A2=248313, A3=292968, A4=337622, A5=382276, A6=426931, A7=471585.

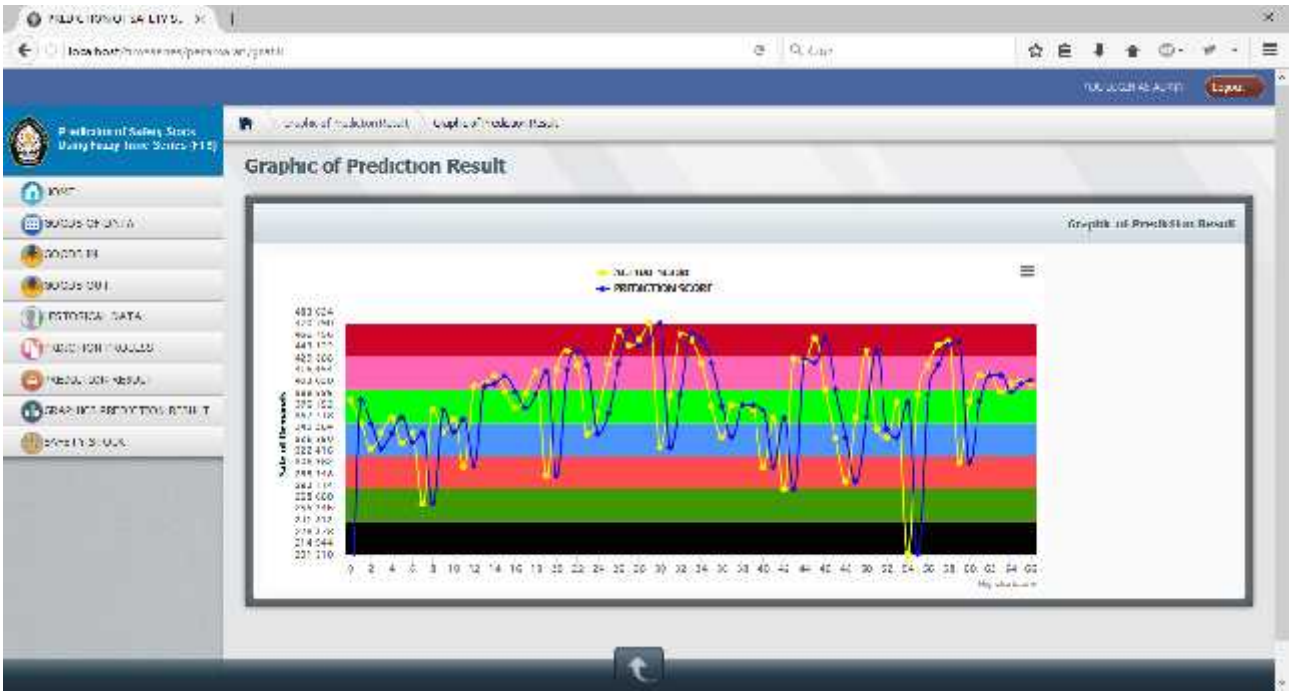
d. Fuzzification of score from history data. In the condition of membershipfunctions (MBF) and fuzzy sets as illustrated in step 3, actual score of selling number can be fuzzified with the norm : "if actual score of selling number is p and score of p on the interval Uj, so p can be translated as Aj". Fuzzifying final score of selling number is based on the norms summarized in table 1.
e. Calculating fuzzy score of selling number history data of product A, in each fuzzy set.
f. Choosing base of model w which is very appropriate and calculating fuzzy operation.
g. Defuzzification of calculation in step 5, and then, calculate prediction result. After the calculation of fuzzy was done, we need to translate fuzzy output, next, final prediction result was got. By using Center of Gravity (COG) method and equality of (3) (4) (5) so it got final calculation result as shown in table 2, and prediction result and graphic on application can be shown in picture 2.

Table 2. Data of prediction result

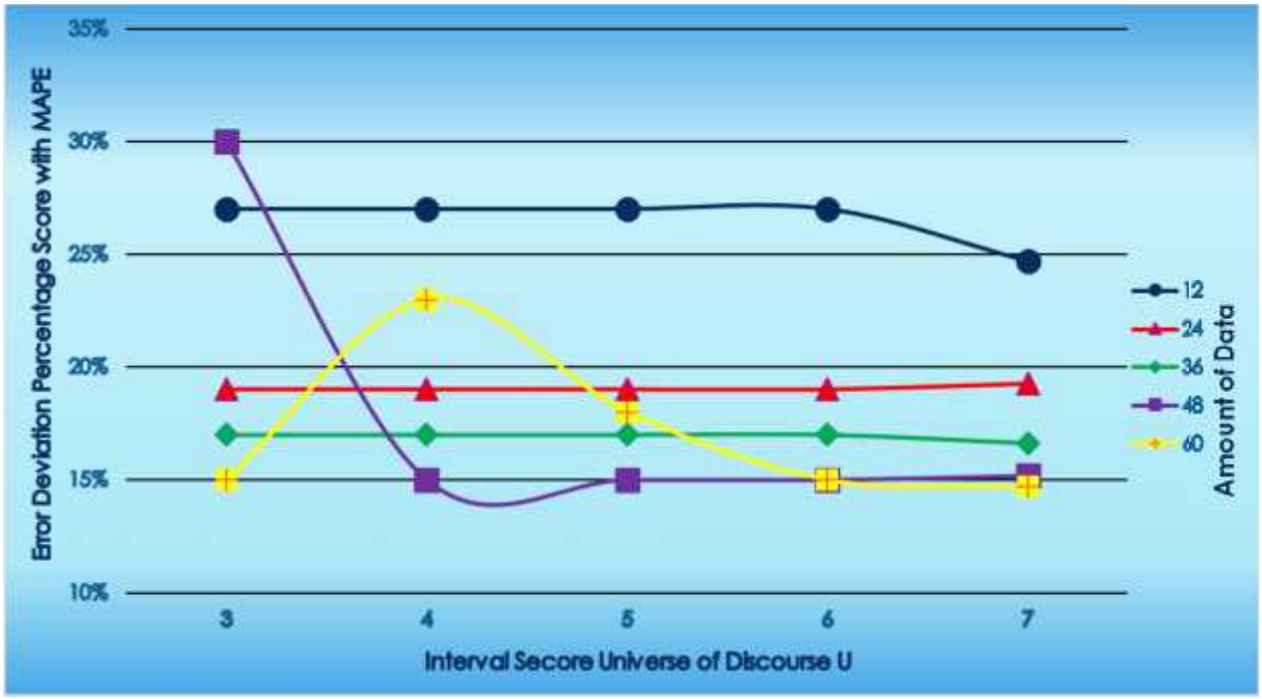
Month	Year	Actual Score	Fi (Prediction Score)
January	2012	382635	0
February	2012	355766	382636
March	2012	325994	355767
April	2012	344349	325995
May	2012	362127	344350
June	2012	332272	362128
July	2012	344733	332273
August	2012	262136	344734
September	2012	371755	262137
October	2012	344931	371756
November	2012	360428	344932
December	2012	305567	360429
January	2013	398608	305568
February	2013	401103	398609
March	2013	410591	401104
April	2013	391991	410592
May	2013	373435	391992
June	2013	390023	373436
July	2013	415428	390024
August	2013	294396	415429
September	2013	417544	294397
October	2013	439641	417545
November	2013	422857	439642
December	2013	342836	422858
January	2014	366797	342837
February	2014	423950	366798
March	2014	463070	423951
April	2014	445420	463071
May	2014	452353	445421
June	2014	471585	452354
July	2014	327364	471586
August	2014	388073	327365
September	2014	459309	388074
October	2014	452508	459310
November	2014	425409	452509
December	2014	375814	425410
January	2015	339850	375815
February	2015	376973	339851
March	2015	376571	376974
April	2015	371001	376572
May	2015	304900	371002
June	2015	361767	304901
July	2015	278754	361768
August	2015	430953	278755
September	2015	425458	430954
October	2015	453944	425459
November	2015	394726	453945
December	2015	338991	394727
January	2016	287776	338992
February	2016	362668	287777
March	2016	440171	362669
April	2016	348626	440172
May	2016	339128	348627
June	2016	380019	339129
July	2016	203659	380020
August	2016	388847	203659
September	2016	423256	388848
October	2016	446611	423257
November	2016	450331	446612
December	2016	……	450332

3.1 Evaluation and validation of calculation result

From evaluation and validation of error deviation toward fuzzy time series above, error deviation also has been tested by using variance of number of universe of discourse starting from 3, 4, 5, 6 and 7 as well as data number starting from 12, 24, 36, 48 and 60 data so that the result got is shown in picture 3.



Picture 2. Graphic of prediction result



Picture 3. Error deviation score with MAPE

4 Conclusion

Prediction by applying algorithm of Fuzzy time series done with variance of interval score toward universe of discourse and variance of data number can be applied to predict safety stock. It can be proven by testing result using data number of 60 and the average error score got was 15% measured by using method of Mean Absolute Percentage Error (MAPE). Prediction result accuracy is influenced by data number fluctuation, the size (small and big) of interval score of universe of discourse and minimal and maximal score of universe of discourse.

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