ISBN : 978 - 602 - 0860 - 14 - 5

Integrated Sci-Tech

The Interdisciplinary Research Approach

Volume 2

IC - STAR 2016

The 2nd International Conference on Science, Technology and Interdisciplinary Research 2016

Bandar Lampung, 22 - 25 August 2016

Integrated Sci-Tech : Interdisciplinary Research Approach
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Publisher :

Research Institute and Community Services
University of Lampung

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Cover and layout :
IC-STAR Team

Publisher :
Research Institute and Community Services
University of Lampung

ADDENDUM

Addendum to the book chapter Integrated Sci-Tech: The Interdisciplinary Research Approach Volume 2 (ISBN: 978-602- 0860-14- 5) was provided due to the missing an accepted and presented paper in this book. Paper entitled “Overtaking Situation Identification In Connected Vehicles Environment”, writted by Noor Cholis Basjaruddin from Department of Electrical Engineering, Bandung State Polytechnic, Bandung, Indonesia, and Kuspriyanto, Yoga Priyana, Emir Mauludi Husni, from School of Electrical Engineering and Informatics, Bandung Institute of Technology, Bandung, Indonesia, has been included in the section 1 (engineering) page 37-46. Accordingly, the table of contents of this book was updated as well.

Preface

The 2nd Volume of Integrated Sci-Tech: Interdisciplinary Research Approach book is published by the Research Institute and Community Services, University of Lampung. It integrates engineering, life sciences and biomedical engineering, and agriculture engineering and food sciences. The aim was to provide a cross section roadmap from basic research, technological and developments, processes development, and their applications and integrity in the real-world usage. The motivation for this Volume-2 book was to provide a suitable reference text for those who interested in the interdisciplinary studies and research. The book was also planned to provide advanced orientation and understanding for related industries and governments to looking across industrial partnerships, business strategic, and policy and regulations, with expected for a wider range of readers.

This book consists of several chapters divided into three sections i.e., engineering, life science and biomedical engineering, and agriculture engineering and food science. Each chapter is a completely self-directed contribution in chained discussion which aims to bring academia, researcher, practitioners and students rise to speed with the novel developments within the particular area. In order to enhance the reader experience, each book chapter contains its own abstract, instruction, main body, as well as conclusion sections. Moreover, bibliography resources are available at the end of each chapter.

We are pleased and thankful for all distinguish authors and reviewers for their contribution that have made this book possible. We do hope that you will enjoy this book and find it as a useful guide and reference.

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SECTION 1 :

ENGINEERING

Water-Oil-Air Three-Phase Flow in Porous Media: Land Contamination by Oil

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Abstract. *In order to simulate contamination of ground by leakage of oil, a rational three-phase characteristic curve model defining the capillary pressure–degree of saturation relationship of water, NAPL and air phase was proposed and transport phenomena of NAPLs in unsaturated ground was simulated in this study. Existing models will be briefly reviewed and their limitations will be pointed out. To overcome issues of these models, a new variable representing the relative magnitude of NAPL pressure to water pressure and air pressure was employed as a parameter that plays a central role in the modeling, and a novel water–NAPL–air three-phase model was formulated. It is revealed through the simulations that the proposed model can consider the transition phenomena between water–NAPL–air three-phase and arbitrary two-phase system through the parameter. The numerical method for water–NAPL–air three phase system was also developed based on the proposed model.The validity of the proposed model was checked by comparing the results calculated by the proposed model with those calculated by an ordinary model and past experimental results. The proposed model is capable of considering the interactions among the water–NAPL–air three-phase, and predicting the actual retention behavior of NAPL in unsaturated ground.*

Keywords*: oil contamination, napl*

Integration of a Big Data Emerging on Nanotechnology Theory, Model, Simulation and Its Application using Green Computing Platform

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Abstract. *A small data solution dealing with a simple analysis, reporting, course-grained visualization with giga-bytes or a few tera-byte data sizes. A single processor and small size of the local memory platform are well be enough to support small scale simulation. Contradictory, a big data integrated solution was not just limited to analyzing and reporting, but high potential for predicting, insights with complex, advance and fine-grained resolution. Multi-structured data type size becomes a significant consideration of peta-, exa- and zetta-bytes data size. Thus, small data size is not well suited for predicting and solving nanotechnology application accurately. A big data associated with nanoscale computing can be generated by sensor data, device data, image processing resolution and grid generation simulation. These emerging opportunities to combine big data integration with nanotechnology theory, multi-scale model and large scale simulation. Furthermore, the nanotechnology theory includes the fundamental nanoscale structures, features and mechanical properties of the nanomaterial. The multi-scale model involving the integration of ordinary differential equation (ODE) and partial differential equation (PDE) with multi-type system and multi-scale features. The discretization techniques for solving the multi-scale mathematical model emphasized on mesh generation strategy of finite difference method (FEM) and finite element method (FEM). Green computing of high performance platform has been used to support the big data environment and large sparse simulation. Green computing includes the implementation of energy-efficient of sustainable IT facilities such as CPUs, GPU, servers and peripherals as well as reducing resource consumption and proper recycle of low cost computer equipments. Additionally, this paper proposes some conceptual frameworks for big data integration on five nanotechnology applications. First application is the nanoparticle assisted drug delivery process through a blood flow. Second application is the fabrication of silicon nanowire by chemical vapor deposition (CVD) process. Third applicationis the prediction of some depend parameters on multilayer nanoscale device in semiconductor manufacturing. Fourth applicationis molecular abnormal cell growth and the fifth is an image processing for tumor cell classification. Parallel algorithm for the numerical solution emphases on SIMD taxonomy instructions. In order to improve the performance on green computing system, this paper investigates the distributed-shared memory architecture containing multi-core Intel Xeon processors and CPU-GPU platforms. Numerical analysis and parallel performance evaluation (PPE) are the indicators to validate the nanotechnology complex theory, multi-scale model and large scale simulation of the grand challenge applications. Comparison table, graph illustration and 2D visualization are the tools for result presentation.*

Keywords*: big data, fem, green computing*

Ergonomic Chair Design using Bamboo Lamination Technic

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Abstract. *The use of bamboo for furniture in Indonesia like chairs, uses bamboo that is still in its natural cylindrical form, which are then put together into the form of a chair. This results in a design that is masiff and square, uncomfortable and unergonomic.Furniture products design must be designed with an ergonomic aproach so that it may be comfortable for the end users, one of the alternative to this is by using lamination technic in the process. This technic can be applied in the manufacturing of a more ergonomic and anatomically correct for the end user. It can also result in a more aestheticaly pleasing and more inovative design.*

Keywords*: Bamboo, Furniture, Ergonomic, Design*

1. Introduction

The use of bamboo as a main material to produce furniture is common in Indonesia, especially in Western Java. The characteristic of bamboo that it is easy to grow and has no speciall needs and relatively short maturing time (4-5 years) makes it easy to use for many uses. Bamboo is also used for building construction, house walls, and also home furnishings.

One of the furniture products that is made in West Java that is made from bamboo mainly uses convensional and traditional manufacturing system. The bamboo chair is made by local artisans, and it is mainly made from bamboo still in its cylindrical form, or from pieces that has been cut down. And all the parts is held together ny using natural weave or rattan strips.

If looked at from the main aspect of being used a chair, the bamboo chair fits, but if looked from an anthropometrical point of view, it is still lacking, especially when conforming to the needs of the human body ergonomically. This is because the way the bamboo chair is made with just the raw form of the bamboo material. The measurements of the chair made using tradisional methods does not comply to good ergonomics standards, generally these chairs has a seat depth of 50 cm, width of 63 cm and the back rest height is 45 cm. Also there is no slope, the back rest is at a straight 90° [3].

One such way to improve this is by using a lamination technic for bamboo. The bamboo that is shaped and formed using this technic can be molded into a shape that is more flexible and dynamic and can fit the human anthropometry more suitably. The laminating system that is used for this is the Cold Press System, where pieces of bamboo slates are pressed with a matrix, in this case PVAC glue.

The use of this technic is besides improving the ergonomic and anthropometric aspects, this technic would also allow a more creative, inovative and more aethetically pleasing way to produce and improve the value of the furniture products that can be made by the local home industries or artisans in Indonesia.

2. Research Method

The research methode is experimental, where the process of making the laminated bamboo using moulds that has the correct curves that is suitable with the human posture and anthropometry [2]. The bamboo that will be used has a moisture content of 12-15% [4].

The mould that will be made is the back rest, seat, and arm rest of the bamboo for the bamboo chair. The mould will be made using multiplex wood and wood blocks. The bamboo used for the laminate will be from the Betung variety, because this variety of bamboo is available abundantly in Indonesia, and is usually used for furniture too.
Figure 1 is the steps that will be done for the experiment process and the making of the chair from the bamboo laminate:

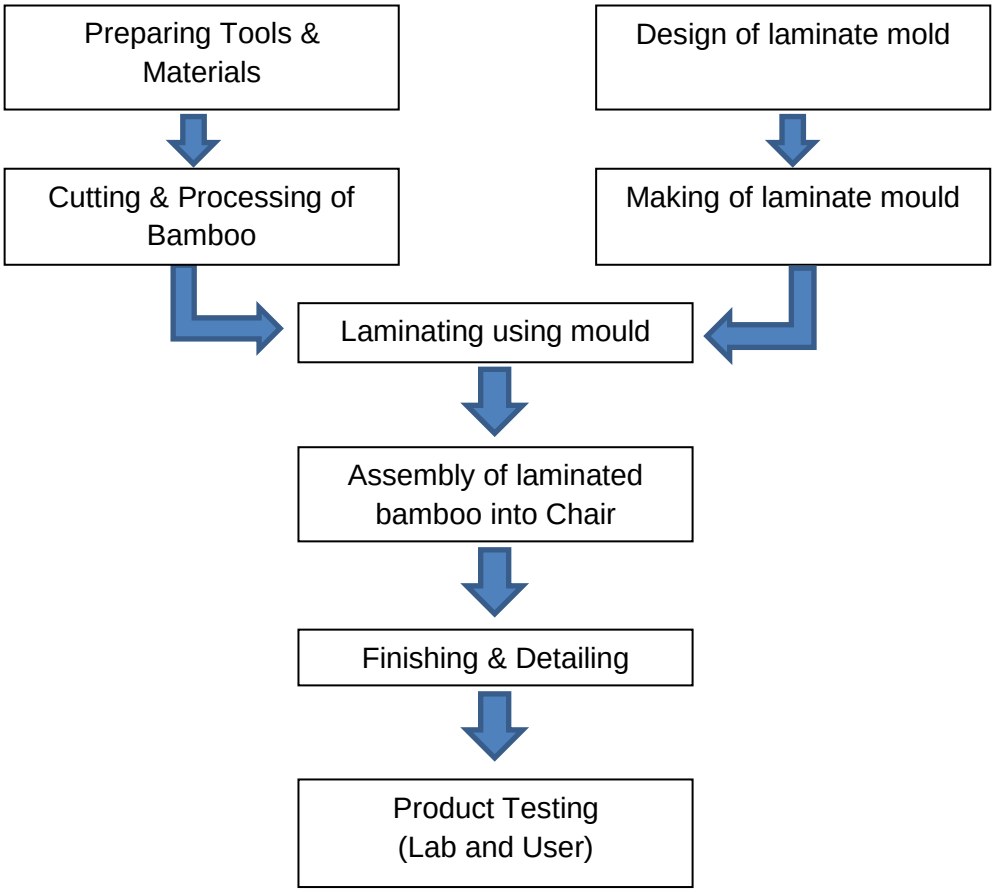

Figure 1. Research Method

3. Results and Analysis

From the previous research overview as a guide, the design process for the ergonomic bamboo chair will be focused on using the Cold Press Lamination System which will use a Thermosetting Urea Formaldehyde as the bonding agent [1].The laminates produced will be used as the basic material in the making of the chair which will use the applied ergonomic and anthropometric standards for the end users [3]. The bamboo laminate material will be used for the frame, back rest, and seat. The joining system will be using dowels and a knock down system with no other supporting materials. The laminating Press sytem used will be two-way laminating so that it can produce a material that can be shaped for the backrest and seat which have a maximal ergonomic form.

To produce the form of the seat and backseat which is comfortable and conforms to the ergonomic principles which is a design that is organic in nature and has certain curves and radii, a mold is needed that can form the bamboo material from two different pressing areas.

For the start of the experiment, the mold used to make the prototype parts of the seat will be using plywood with a thicknessof 15 mm, while to make the frame of the chair a mould made from a solid piece of block of wood will be used, and the pressing process will be used is a manual clamping process

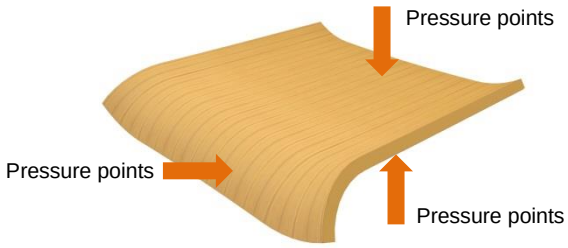

Figure. 2. Illustration of pressure points to shape the laminated bamboo material

Figure. 3. Illustration of bottom (a) and upper (b) press mold part used to shape the laminated bamboo material using the Two-way Press system

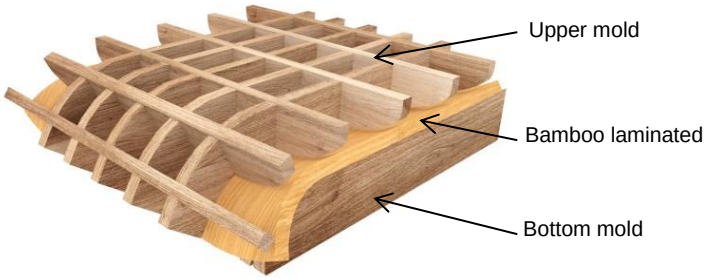

Figure. 4. Pressing Process of the laminated bamboo material using bottom and upper press mold

From the experimental process of making the mold and producing the laminated bamboo material, the outcome can be used to make the design of the chair. The following components will be made which is the frame of the chair, the seat and the back rest. The frame components will be made using laminated bamboo which is formed into blocks with depth measuring 6 cm x 6 cm and for the seat will be using laminated bamboo made into boards with a depth of 1,5 cm.

a b

Figure. 5. Experimental process of press mold for seat component of bamboo chair

a b

Figure. 6. (a) wooden molds for bending the seat frame structure (b) bending process frame structure of bamboo chair

In designing the ergonomic chair, the standard dimensions refers to BIFMA standards for anthropometry and ergonomics of Indonesian users. The dimensions chosen and used is the standards for making office chairs [5].

Table 1. Anthrpopometric Data For The Design Of The Laminated Bamboo Chair

COMPONENT	NAME OF COMPONENT	DIMENSIONS (CM)
A	Height of chair from	95
B	Height of seat from floor	40
C	Height of backrest	40
D	Width of backrest	50
E	Length of seat	47
F	Width of seat	50
G	Angle of seat	5-7◦

Figure 7. Design and measurements of bamboo laminated chair which conforms to anthropometric standards

The following figure is the design and break down of the components of the laminated bamboo chair which has conform to the anthropometric standards:

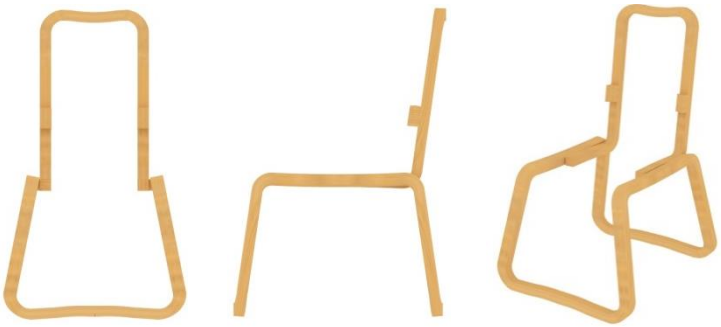

Figure 8. Design of frame structure of laminated bamboo chair. (a) Front view, (b) side view, (c) perspective view

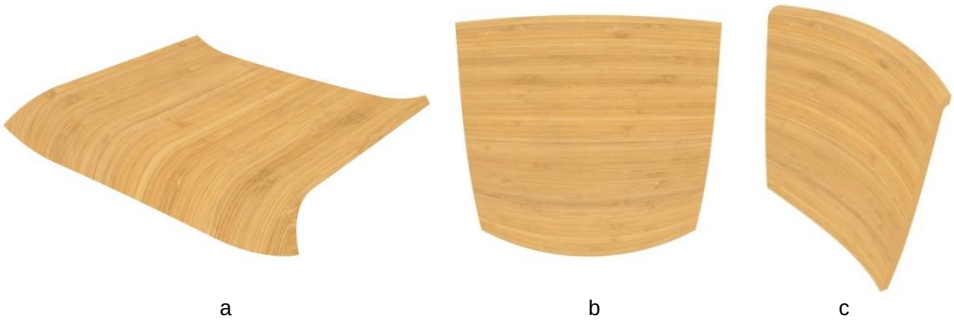

Figure 9. (a) Perspective view design of the seat component of laminated bamboo chair, Design of the back rest of the laminated bamboo chair. (b) Front view, (c) Perspective view

4. Conclusion

From the design and manufacturing of the bamboo chair prototype using laminated bamboo materials using the Two-way Press System, the following results has been collected :

1. Refinement of the making of the press mold which can press more and minimizing the gap of the surface of the laminated bamboo material.
2. The mold made using plywood and wood can not be used to produe a more complex shape from the laminated bamboo materials
3. The use of other bonding agents besides PVAC.
4. Testing using laboratry equipment is needed to find out the load bearing properties of the material and chair made using laminated bamboo.

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Designing Ergonomic Participatory based on Critical Safety Performance Index in Batik Creative Industries

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Abstract. *Batik Creative Industries have potentialy significant economic contribution to Indonesia. Unfortunately, the key parameters of its contribution are currently just focus on the financial aspect. One of the workers element productivity such as safety behavior is neglected. This research aimed to design the ergonomic participatory in which both of workers and owners of small and medium sized enterprise of Batik are involved. The indicators of design obtained from safety performance index (SPI) which have been evaluated in four different areas using a critical behavior checklist of behavior based safety method. The results show that Bangkalan has the lowest score of SPI than three others area, then, the safety programs of participatory involvement were executed especially at which indicated by SPI less than 50%. The programs are reciprocal control between worker and owner, personal protective equipment in proper use, waste water treatment, knowledge and experience for preventive action, attitude and perception of better quality of life.*

Keywords*: ergonomic participatory, safety performance, behavior based, creative industry*

1. Introduction

United Nations Educational, Scientific and Cultural Organization (UNESCO) at October 2nd, 2009 stated that batik as a craft was the Indonesian heritage for masterpieces of the oral and intangible heritage of humanity [1]. Producing batik needs creativity, skill and individual talent that why batik categorized as handycraft or design as well as fashion [2], [3]. A batik is made by some workers which requires a kinds of innovation to draw into the motif of the produk. Meanwhile, research by Wang [4] found that to create that innovation and a competitive product advantage for Small Medium Enterprises (SMEs) in the market, they should reinforce the human resources which are triggered by knowledge absorptive capacity.

Based on the road map of Indonesian creative development [5], creative industries are urgently developed. They are beneficiary in terms of significant economical contributions, creating a positive business climate, building images and a nation identitiy, using renewable resources, pursuing innovation and creation as national best parctise and giving positive social impact.

Research by Oughton [6], Xiongjun and Wan [7] stated that the characteristics of health and safety in SME are commonly like lack of management. They are less of knowledge management, highly worker return, low competence, safety system function controlled by people not system it self, low awareness of safety and inadequate safety apparatus. Hence, Hasle and Limborg [8] regarding to the review of Occupational Health and Safety (OHS) in SME as well as Walters and Lamm [9], Makin and Winder [10] informed that the implementation of OHS can be established by managing the hazard of workplace through safety management system approach in SME as the alternative solution.

Based on the safety management characteristic in SME, the most weaknesses process for work safety implementation is human factor. One of the element is unsafe behavior which accumulated effect to be work accident. Behavior based safety (BBS) is an effective method which function to improve level of safety management as well as to prevent work accident due to unsafe behavior [11]. BBS concerns with behavior observation in relation with safe behavior as the comparation. Accoring to Gene [12] as tool of management, BBS capables to encourage worker, improving safe behavior, correcting unsafe behavior to promote safe atmosphere and enhance safety performance. Moreover, Ramdan [13] added that OHS problems in batik industry are generally regarding to the worker awareness, no health insurance, the corporate business that not registered as legal business, no compensation of work accident and health problems, no skill and knowledge relating to the hazard in workplace.

OHS performance will induce work productivity, research by Antonsen et al [14] informed that to identify the hazard, it requires safety management system, Cockburn [15] stated that the implementation of OHS management system can improve work condition, improving productivity, quality and moral as well as profitability as the final result. Therefore, the aim of this research is to design ergonomic participatory through BBS model by involving the autonomous participatory between the worker and the owner in order to establish the awareness of safety behavior in workplace.

2. Research Method

The outcome of this research is the ergonomic participatory model of occupational safety management system in the creative industry. It implemented by quantitative-descriptive approach based on performance measurement indicated by safety performance index. However, determining the key performance of safety performance parameter will adequately searched by identifying the significant factors. The data obtained by combining either secondary and primary datas in SMEs in batik creative industry.

Design of critical behavior checklist (CBC) questionnaire refers to Al-Hemoud & Al-Asfoor [16], whether the target behavior is work activities and the use of personal protective equipment. Target behavior and a list of personal protective equipment adapted to the conditions of the batik industry. Questionnaire CBC performed on two stages, namely pre-intervention and post-intervention phase, it followed by non parametric statistical analysis in order to analyse the level of differences between pre and post. Therefore, during the period pre and post intervention, the ergonomic interventions are implemented simultaneously in accordance with the elements of total ergonomic such as systemic, holistic, interdicipliner and participatory.

This questionnaire is used to measure safety performance index. CBC questionnaires are conducted in a questionnaire -making routines workers, then, given to all workers who become the object of research. Finally, the result of pre and post gap, together with the data analysis, the model can be determined based on the best practice chosen that significantly increase the safety performance index as the parameter of safety performance used.

Table 1 shows the mapping of four regions in Madura following by the number of industry, factors and the method of identification. As clearly be seen that the biggest number of respondent involved is in Bangkalan which has 100 respondents, while Pamekasan and Sumenep have same number of respondent. The criteria of SME which appointed to be the object of observation are the complete process of production namely drawing process, dying process and cleaning process.

Tabel 1. Result of Mapping for Factor Identifications

District	Number of SME	Number of Factors	Number of Respondent	Method of Identification
Bangkalan	11	7	100	Principal Componennt Analysis
Sampang	7	4	105	Principal Componennt Analysis
Pamekasan	9	4	80	Hazard Identificaton
Sumenep	6	2	80	Multivariate Linier Regresion
Sum	33		340	

The principle of BBS management is field observation, analysis and communication based on unsafe behavior to help the workers in order to be aware of the risk of unsafe behavior as the consequencies and enhance the objectives of either preventive or reduced unsafe bahaviour [17]. The process of BBS management implementation following DO IT method (figure 1) which consist of definition stage, intervension stage and evaluation stage. In addition that Geller [18] points out that this method is able to improve sustainable intervention process.

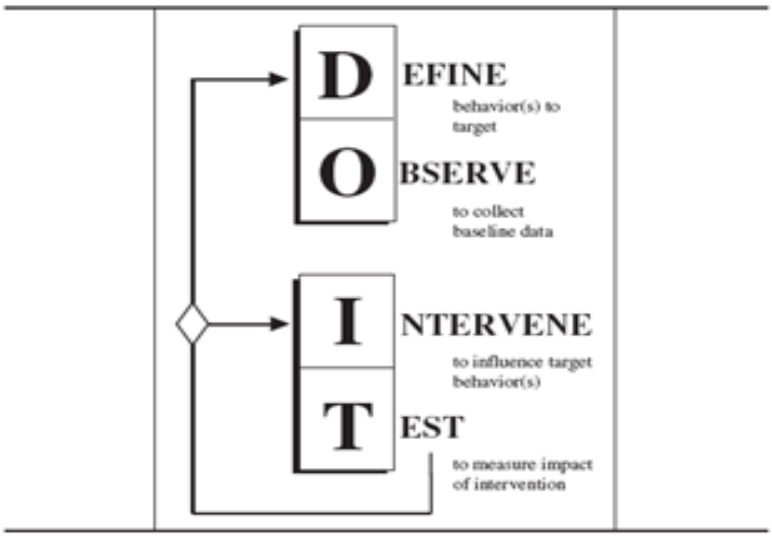

Figure 1. Stage of BBS Management

3. Results and Analysis

The significant factors that influence the safety behavior in different place gained from four different regions (Bangkalan, Sampang, Pamekasan and Sumenep). Table 2 shows the different region obtained for mapping the factors. It shows that Batik creative industry in Bangkalan is the most popular region which has the biggest significant factors than the less four other regions. Obtaining different factors probably caused by workers characteristic either worker and owner where as culture and model of leadership can contribute its mapping.

Table 2. Factor's Identification of Safe Behavior

Region/Factor	Behavior Based								
	A	B	C	D	E	F	G	H	I
Bangkalan *)	v	v	v	v	v	V	V	v	
Sampang			v		v		V		v
Pamekasan **)			v	v			V		v
Sumenep ***)			v				v		

A ; Waste Management	F ; Level of Ergonomic	*) Ansori et al. [19]
B ; Work Condition	G ; Knowledge	**) Ansori et al. [20]
C ; PPE	H ; Experience	***) Ansori et al. [21]
D ; Work Facility	I ; Attitude and Perception	
E ; Control		

Figure 2 illustrates SPI for each process which consist of drawing, dying and cleaning. As can be seen that Bangkalan entirely has lower level accounting for 0.39 and 0.48 for the process drawing and dying respectively. However level score zero in Bangkalan because there was no evaluation.

Meanwhile, the condition is not same in Sampang and Pamekasan. They have index for SPI more than the average (50%). This condition indicate that the safety behavior of the worker are relatively safe. In contrast, Sumenep eventhough the two indicators of dying and cleaning have 0.45 and 0.41 (below 0.5). However, it has the biggest safety performance indicator in drawing accounting for 0. 71 (70%). Those descriptions indicate the heterogenities of SPI's achievement that reflecting even they have similar process, facilities and technologies but the safety behavior is not equal. Therefore, it needs a target to make the standarisation of OHS management system in Indonesian Batik Creative Industry in order to obtain similar level of safety performance.

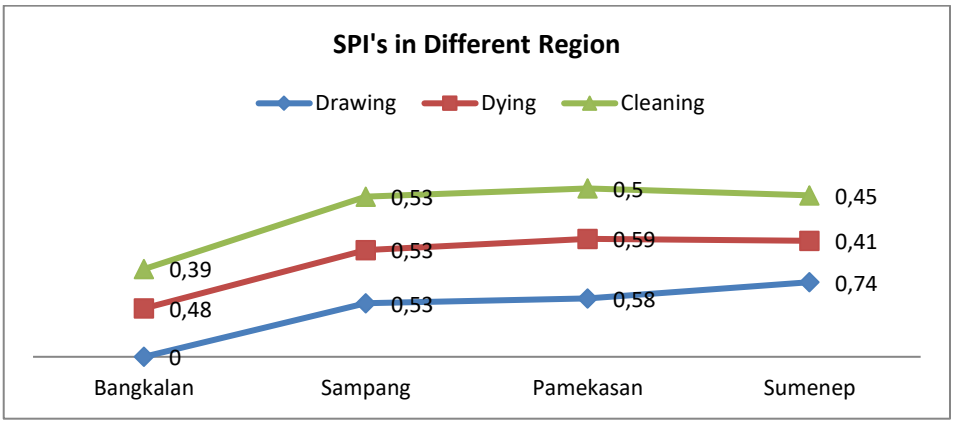

Figure 2. SPI Comparison in Batik Creative Madura
Reference : Ansori et al [20], Ansori et al [21], Ansori et al. [22]

In BBS, an alternative solution can be adopted to improve safety performance by integrating ergonomic participatory as the entired model of total ergonomic. It has four elements namely SHIP (Sistematic, Holistic, Interdicipline and Participatory). Those elements are used since small and medium size enterprises commonly characterized due to low skill and knowledge, less management also facilities and financial support.

Based on the situation analysis of overall considering work conditions, SPI which has score below average (50%) will be identified to observe the factors that requires the improvement of SPI performance by implementing ergonomic intervention. Table 3 performs the result of each SPI's factor which valued below average. From the table also shows the different achievement in several regions (Bangkalan, Sampang, Pamekasan and Sumenep) which consist of drawing process, dyeing and cleaning.

The main concern of factor should be carry out are [i] Controlling [ii] PPE. Meanwhile the dyeing process are [i] Waste management [ii] PPE [iii] Knowledge and Experience [iv] Controlling. I addition, cleaning factors are gained [i] waste management [ii] Work condition [iii] PPE [iv] Controlling [v] Kowledge and experience and [vi] Attitute and perception as performed in table 3.

The improvement of SPI can be done by acquisiting total ergonomic principle as SHIP. The framework of intervension as per table 4 that informs the programs and participations which will be executed to reduce the unsafe behavior.

The follow up of SPI's analysis focused on the score below 50% which indicate key parameter for implementating ergonomic intervention via ergonomic participatory. It established by participatory program that shows the real activities should be done by both of worker and owners. Table 4 performs the breakdown of the comparison previous behavior activities and the model of participation model included the media of intervension

Table 3. SPI's Analysis, SPI < 50%

Process	Bangkalan's SME	Sampang's SME	Pamekasan's SME	Sumenep's SME	Performance Parameters
Drawing		Controlling [0.39] PPE [0.24]		PPE [0.36]	Controlling ; - Giving advice while working - Must report when any accident - Controlling the operator in order to dicipline Personal Protective Equipment ; - Availability of PPE - Motivation in wearing PPE - PPE's ergonomic
Dyeing	Waste Treatment [0.32] PPE [0.37] Knowledge and Experience [0.45]	Controlling [0.36] PPE [0.25]		PPE [0.28]	Waste Management ; - Not escaping the garbage any palce - Understand the dager of waste toward the invironment - Knowing the action of waste management PPE ; - The use's consistence for PPE by ergonomic perspectives - PPE's avaibality and conformities - Giving the notice when not wear PPE by motivating Knowledge and Experience ; - Knowing first aid for accident - Availability of PPE - Guidance and work procedure Controlling ; - Giving notice while working - Obligation to report - Opetaror's controlling
Cleaning	Waste Management [0.31] Work Condition [0.40] PPE [0.25] Conrolling [0.31] Knowledge and Experience [0.45]	Controlling [0.36] PPE [0.25]	Attitute and perception [0.38]	PPE [0.28]	Waste Management ; - Not escaping the garbage any palce - Understand the dager of waste toward the invironment - Knowing the action of waste management Work Condition ; - Understand additive material in use - Undersand PPE's function - Work place not hot - Work place not dark PPE ; - The use's consistence for PPE by ergonomic perspectives - PPE's avaibality and conformities - Giving the notice when not wear PPE by motivating Controlling ; - Conforming work facilities - Give notice when PPE not wore - Obligation to report - Controlling by owner Kowledge and Experience ; - Knowing first aid for accident - Availability of PPE - Guidance and work procedure Attitude and perception ; - Affectivity and Awareness to work atmosphere

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Table 4. Participatory Programs and Intervension Media

Program	Previous Behavior Activities		Participation Model		Intervension Media
	Worker	Owner	Worker	Owner	
Controlling	Trivial working	Uncare to worker	Works in accordance with standard operating procedure include using appropriate work facilities Conssistent to the safety rule	Establishing work awareness in accordance with work procedure	Making standard operating procedure
	Not discipline while working therefore many activities are not safe such as cheating, unsufficient work method, not used PPE Do not care if there is accident	No warning at all to worker	Active participatory by reporting any accident to the owner	Giving advice while work indiciple appearance	Releasing work discipline, PPE's usage standard operating procedure
		Do not care any accident while happen		Follow up work accident for preventive action	Socialization ice mountain effect regarding the accident cost to establish the awareness of occupational health and safety Creating guidance for maintain work accident
Personal Protective Equipment	Not discipline in the use of PPE while the reason of quantity, not ergonomic in use due to expired	Not willing to control the availability and PPE's standard such as mask, glove, safety boot, apron	Using PPE is the basic need of safety and no force doing its	Control and provide PPE in appropriate quantity and quality	Designing posters for work processes and appropriate PPE, posters for investigating unsafe PPE in order to ergonomic in use
	Less motivation to use PPE because the lack of awareness to health performance by using PPE, habit for using PPE, and any perception that while PPE used can disturb the work productivity	No efford to motivate the use of PPE	Awareness campign for using PPE	Intervension by religious aspects, engaging social leader like moeslim leader in order to self taker by using PPE. Owner giIntervensi religius aspek, owner gives advice while workers not use PPE	Designing posters for awareness campign by protecting the workers by PPE religiously.
Waste Management	Do not care to the waste due to lack of knowledge Expelling waste not in appropriate place	No respect and there is no knowledge to the danger of the waste There is no storage of liquid waste	Understanding hazard and waste management Putting the waste into the waste storage	Understanding hazard and waste management Installing waste storage	SOP waste management, 5S posters
Knowledge and Experience	Let any accident while working No understanding relating to the important of PPE, work procedure, and the asumption that all works procedures for externall inspection only	No attention to worker's accident Knowledge/experience of PPE and work procedure not adequately implemented	Campin for care of work accident Campign for today should be better than yesterday	Follow up accident by first aid Safety culture by morning talk	Checksheet work hazard identification Pocket Note PPE guidance and work procedure
Work Condition	Works by minimum requirement	Work orientation just for result	Work in ergonomic condition	Reengineering work condition such as hot temperature, light and free of chemical effect	Evaluation information for physical work environment such as illumination, temperature, labelling and storage management for additive material (chemical materials)
Attitute and Perception	Less attention to work environment	Not sensitive toward the work environment	Intention of work not due to income however sustainability of work	Awareness of work environment that safety and ergonomic are entirely responsibilities	Open minded for advice by life box

As mentioned in table 4, the compromise solution for improving safety behavior can be executed by making standard operating procedure namely work activities, PPE or preventing work accident. In addition, the campign for the awareness of safety behavior through safety talk (sosialization of safety), safety work culture (5S) and waste management can be implemented as well. Figure 3 confirms that safety behavior can be established by intimacy talking each other (a), poster for visualization (b) and safety propaganda by involving the workers (c).

(a) **(b)** **(c)**

Figure 3. (a) Safety Apparatus Campign, (b) Occupational Health and Safety Poster, (c) Workers Participatory

4. Conclusion

The result of factors identification for safety behavior in Batik's Madura Small and Medium Size Enterprise are [i] waste management, [ii] work condition, [iii] personal protective equipment, [iv] work facilities, [v] controlling, [vi] ergonomic, [vii] knowledge and experience, [viii] attitude and perception. The lowest safety performance index is Bangkalan (score 0.39, 0.48, 0 are below 0.5 for drawing, dying and cleaning respectively), however, the three others are hingher than average (0.5). Participatory safety program can be implemented to improve safety performance index such as autonomous safety behavior, standarisation of procedure, safety work culture and waste management.

Acknowledgement

This research is funded by The Ministry of Resaerch, Higher Education for funding at scheme of PHB in second year.

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Process of Dispute Resolution in Construction Projects through Arbitration: A Literature Study

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Abstract. *The construction industry has a level of complexity and competitive in which participants with different views in talent and knowledge level of the cooperation process of construction. In the construction industry, due to differences in perception between the project participants, conflict is inevitable. If the conflict is not managed properly, they quickly turn into a dispute. Dispute resolution can be done by appointing an arbitrator of the arbitration board. Evaluation process of dispute resolution in construction projects through a risk-based arbitration is performed to improve the performance of the Indonesian National Arbitration Board.*

Keywords*: Project, construction, risk, performance, process, and arbitration*

1. Introduction

Claim construction have a major influence in the implementation of projects such as the cost and time. An effective claim management system is needed [1]. The heavy influence of the claims can cause impact of not complete the project or other projects. Application of proper claims management system will greatly assist in the claims process. The process of settlement of disputes through the courts or commonly referred to as a litigation settlement with conservative manner.

Lack of understanding of the claims made against the stakeholders of the construction industry are afraid, the claim should not be avoided and can be managed properly . Because in principle claim is a demand for someone to regain their rights. The unavailability of relevant documents , and negotiating conflicts that arise between the owner and contractor makes a claim that is turned into a dispute is resolved through the courts or arbitration[2].

In development, emerging dispute resolution process by working out of court. Agreement dispute settlement established through a contract in which the parties to the dispute appoint the arbitrator of the arbitration board to settle disputes. The final decision of the arbitration is binding. Arbitration is an alternative that is faster and cheaper to resolve claims and thus more desirable than through the courts [3]. However, in practice it is not always the case, it is important to evaluate the process of dispute resolution in construction projects through the Badan Arbitrase Nasional Indonesia (BANI).

2. Claim Resolution

Construction claims management can be interpreted as a process of seeking approval (dealing) for controlling and searching for consideration or changes by one of the parties involved in the construction process [4]. Construction Claims Management is a process to control claims. Along with the increasing number of substantial construction claims at this time, the implementation of effective management and construction claims are absolutely necessary [1].

The researcher [5] identified that the results confirmed that the most important source of the dispute is a contract management 74.04%, the second is a contract document 71.49%, the third is financial problems 67.80%, the fourth is the problem associated with the project 63.92%, and lowest are other sources (eg force majeure) 61.58% .

In Law No.30/1999 of mediation and alternative dispute resolution, provides that the completion of the mediation conducted before through arbitration. Parties who wish to use a third party as a mediator or arbitrator may appoint a third party by yourself or follow the process of a special institution that organizes the settlement of disputes through Alternative Dispute Resolution. UU No.30/1999 regulate dispute resolution outside the court approved by the parties to the dispute as set forth in a written agreement. Before admission into the arbitration process, the parties tried to organize other alternative dispute resolution, such as negotiation, mediation, and conciliation. Arbitration is the preferred alternative dispute resolution method in international construction contracts because it saves time and money and prevents litigation under foreign laws [6].

3. Claim Resoluion Process

Claims resolution process can be resolved by negotiation, mediation, arbitration and litigation. According to [6], there are several methods in settling claims, consist of :

a. Negotiation

Negotiations are communication/meetings between disputing parties (usually the owner and contractor representatives) that can help achieve early resolution of the dispute. Project owners tend to spend a lot of time in studying the claims and corrective actions . If no resolution is reached, the settlement claims must get out of this method and proceed to mediation or arbitration. .

b. Mediation

When negotiation fails, the parties can resolve their claims by appointing a mediator. The mediator's role is to bring the parties together in an effort to reach an agreement to resolve the dispute. The mediator may clarify or elaborate on dissent. This helps each side understand the other side's positions. The mediator can advise and propose the final solution. As a mediator, however, does not have the power to issue a final decision. The parties to the dispute, therefore, not required to accept the mediator‘s decision.

c. Arbitration

If the disputing parties can not resolve claims and use negotiation or mediation, the disputing parties may conduct the arbitration process as a solution. Although, they are reluctant to use arbitration as a solution to resolve the dispute. With the appointment of arbitrators, each party tries to convince the arbiter of the truth of his position and to each have a full opportunity to propose case. After the hearing, the arbitrator makes a final decision.

d. Litigation

If the disputing parties do not agree on the arbitrator or the arbitrators is not agreed to performing their duties, or if no impediment to proceed with the case there is no agreement between the parties in this case, the parties can file a claim to the court case. Because this is a last resort and the decision final and binding on both parties.

4. Arbitration Process

Arbitration is a process of resolution like a trial without a jury. In general, arbitration is a private and confidential hearing. The parties tell their sides of the story to the arbitrator in a setting that is less formal than a court hearing. In an evaluative ADR, the arbitrator is like a judge who serves as fact-finder and decision-maker, providing the parties with an assessment of the merits of some or all aspects of the case. The purpose is to assess and decide the dispute. Arbitrators may be attorneys or business executives and professionals who are experts in the subject matter of their disputes. Many Commercial Contract Containing chapters that using arbitration as a Claims Resolution. Many Construction Contracts using arbitration clauses to avoid litigation in foreign courts. Securities arbitration is an area that growing stable. Since the decision of the United States Supreme Court, in 1987, arbitration become the most widely used means of resolving disputes in the securities industry [8]. According to Bennet [9], some reasons for the success of arbitration are:

- Arbitration takes less time and better productivity, The arbitrator is an expert with the problem in construction law (contractual and managerial approach).
- The Parties have the same opportunity to agree on who will decide their case. dispute can be heard much more quickly in arbitration than if placed on a court.
- Arbitration is more cheaper than on a court. Arbitration provides quick, inexpensive decisions and allows the prevailing party to recover costs.
- The decisions are final and this is one of arbitration’s primary benefits.
- Arbitration awards are final, binding, legally enforceable, and can be made public record.

The arbitration process consist of :

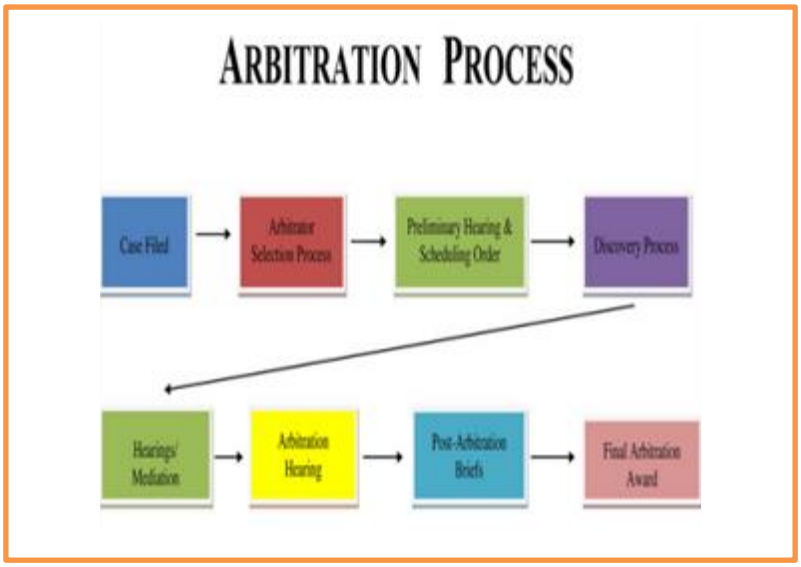

Figure.1 Arbitration Process
Source : Judicial Workplace Arbitrase. Inc

The Arbitration Process include :

- File a Claim
  A claimant initiates an arbitration by filing a statement of claim that specifies the relevant facts and remedies requested
- Answer a Claim
  A respondent responds to an arbitration claim by filing an answer that specifies the relevant facts and available defenses to the statement of claim.
- Arbitrator Selection
  Arbitrator selection is the process in which the parties receive lists of potential arbitrators and select the panel to hear their case
- Prehearing Conferences
  Prior to the hearing, the arbitrators and parties meet telephonically to schedule hearing dates and resolve preliminary issues
- Discovery
  Discovery is the exchange of documents and information in preparation for the hearing
- Hearings
  The parties and arbitrators meet in person to conduct the hearing in which the parties present arguments and evidence in support of their respective cases
- Decision and Awards
  After the conclusion of the hearing, the arbitrators deliberate the facts of the case and render a written decision called an award

5. Documentation in Arbitration

In the settlement of disputes through arbitration, the evidence presented is primarily document-based. Depending on the arbiter-based document information to help them reconstruct review Dispute Condition. Arbitrators rely on this document-based information to help them reconstruct the "story" under which the dispute occurred. This enables the arbitrator to evaluate the merits of each case presented and to determine which party, if any, deserves an award. Thus, without adequate documentation, will be hard for proving the standing of his or her case to a panel of arbitrators [11]. Base on research that a significant percentage of credibility and impartiality, describe how expert testimony supports document-based evidence, were the most important characteristics of a "good" expert witness. If truly qualified, the expert's testimony can add strong support to document-based evidence. The overall results of this survey clearly support the notion that the party who keeps the most comprehensive and detailed records will have the decided advantage in any dispute resolution proceeding.

The easiest way to reduce review covers the cost of handling regarding case, normally the arbitrator asks for a review set of documents relating the case including the following :

- Electronic mail
- Meeting minutes;
- Handwritten notes
- Daily reports or jobsite diaries;
- Change orders;
- Requests for information (RFIs);
- Job cost reports

Organize the copies of documents in chronological order (main chronology) with separate binders containing: meeting minutes, submittals/transmittals, daily, field/foreman reports, schedules, and cost records.

6. Risk Management in Arbitration

Arbitrage can resolve disputes more quickly than the courts. This is because their statements in legislation thus only deadline for the settlement of disputes in arbitration. Therefore arbitration often used by construction services practitioners are involved in a dispute to seek justice. At the time of MEA, there will be a lot of contractual relationships involving the parties come from different legal backgrounds, which allows the existence of differences in the understanding on a contract or agreement. Therefore, the legal aspects can significantly affect the performance of the process carried out by arbitration. In the process, wherever possible arbitration always have to minimization both material and moral damages.

According [10], Many opportunities in the international construction and contractors are faced with many challenges and difficulties when moving to international markets. Many

external risks associated with risk contained in the contract clause. And the research suggest to use of a particular method of dispute resolution depends on the expected risk in the project and help international contractors in the selection of appropriate methods of dispute resolution. There are two steps to improve the arbitration process which is based on a risk managent.

a. Plan Risk Response

Risk is the possibility that the impact and interaction events may turn out differently than anticipated. Each process involves some kind of risk. The most common approach to plan risk analysis following these steps : risk identification, risk assessment and risk response. The general method that most often used in considering the risk factors are classified according to the source by using a hierarchical structure [9].

Risk response plan is a process created to make the choice of action to improve the opportunities and minimize resistance at project target (PMBOK, 2013). Risk response plan carried out in accordance with the priority risks. In this study conducted at the risk response activities and processes that affect the performance of dispute resolution into a plan for improving the performance of arbitration. Risk response should be approved expert and responsible for such risk. Risk response is divided into two : positive and negative. For the negative risks, the thing to do is to avoidance, transfer, mitigation, and acceptance. As for the positive risk, the following is done that exploit, share, enhance, and acceptance.

b. Control Risk

Controll risk is the process of implementation of the risk response, oversees the process minimize risk and identify new emerging risks, and evaluate the risk management process on the project. In controlling these risks can be done with reassessment of risk, audit risk, performance measurement, analysis and meetings reserve. (PMBOK , 2013).

7. Strategis to Maximaze Benefit of Arbitration

Arbitration is evolving from a swift, cost-effective alternative dispute resolution mechanism to a slow, laborious process akin to litigation in terms of procedure and costs without the safeguards of litigation. By use of several unique techniques to reduce the time and costs, the original virtues of arbitration can be restored, while maintaining the integrity of the process and its inherent procedural fairness. several suggestions on how, with some forethought and planning, cost and time reductions can be enacted without sacrificing the main tenet of the arbitration process, namely, a fair, swift, and cost-effective dispute resolution process [13]. Identified, there are several strategies to maximize arbitration [14]:

- Establishing the Arbitration Framework, ex: Administered or not, which arbitration service, extent of arbitration service involvement
- Selection of arbitrator, ex: check candidates, consider objections for cause.
- Control the arbitration process, ex : scheduling
- Establishing procedure and rules ex: qualifications and experience arbitrator
- Presenting the case effectively and efficiently at the hearing

Identified that to establish and Monitor the Arbitration Budget Get an estimate of the legal fees for each of the tasks including research, preparation for arbitration, and hearing time. The tasks involved may include [13]:

- Gathering and organizing client documents;
- Inspection of opposition documents;
- Interviewing client personnel;
- Depositions;
- Motions (sometimes requested by the parties and granted by the panel);
- Pre-hearing presentations;
- Post-hearing briefs;
- Preparation of exhibits and PowerPoint presentations for the hearing itself;
- Use of expert witnesses;

8. Conclusion

The heavy influence of the claims can impact on the completion of the project or other projects. Application of proper claims management system will greatly assist in the claims process. This study aimed to review the process of dispute resolution in construction projects. Arbitration has much offered in the resolution of disputes. Arbitrase can be more expeditious and less costly than court actions. It is private and confidential and it may permit the parties to achieve mutually beneficial resolutions that could not be ordered by a court.

The heavy influence of the claims can cause no impact on the completion of the project or other projects. Application of proper claims management system will greatly assist in the claims process. This study aimed to review the process of dispute resolution in construction projects.

Arbitration has much to offer in the resolution of disputes. It can be more expeditious andless costly than court actions. It is private and confidential and it may permit the parties toachieve mutually beneficial resolutions that could not be ordered by a court.

The Practical differences between arbitration and Litigation are : (i) Opportunity for Faster Pace (ii) Control of Scheduling (iii) Control of Process (iv) Expert Fact Finder (v) Peer Fact Finder (vi) Alternatives in Evidence Presentation

In general, based on literature shows that arbitration is the most preferred alternative claim resolution when dealing with almost all of the risks listed can identified and minimally. Although in practice there are still many difficulties in the process of arbitration, by evaluating the arbitration process-based risk management, the difficulties can be reduced or avoided. So that a claim will be more easily resolved.

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Undang-Undang Dasar Negara Republik Indonesia Tahun 1945

Peraturan Prosedur Badan Arbitrase Indonesia (BANI)

Electrocardiogram Medical Recording Design using Microcontroller- based Fuzzy Clustering Means

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Abstract. : *An Early Cardiac Disease Detection System was developed to be one solution for facilitating detection of good human cardiac condition. The technique is using electrocardiogram (EKG) signal, but EKG system today have been not integrated into database on patient medical recording. Consequently, the data on cardiac patient medical recording are collected in manual manners for the sake of the next consultation, and if patient lose his or her medical recording the physician have not database for medical recording. In addition, the community, in general, is particularly lay on symptoms of cardiac disease, so a system is necessary to assist human to detect their cardiac condition before consultation to physician.*

To respond to the problems, a cardiac disease detection system completed with display and medical recording equipment is developed in this study. The equipment is portable intelligent device (Smartphone and PC desktop) to facilitate users in monitoring their cardiac conditions. Also, since there are some types (stadium) of cardiac disease, the Fuzzy Clustering Means was used in this study for accuracy of cardiac disease stadium diagnoses.

The results are prototypes; that are, instruments with capabilities to display visualization of heartbeat, to classify cardiac disease and medical recording. To facilitate human to detect their cardiac conditions, the instruments were developed by integrating EKG into PC desktop and mobile PC (notebook and netbook) to monitor patient cardiac condition.

Keywords*: Electrocardiogram, Fuzzy Clustering Means, Smartphone, PC desktop*

1. Introduction

The scope of the study entitled "Design of Medical Record System using Fuzzy -Cluster electrocardiogram-based microcontroller Means" is a study of problems related to Heart Disease Early Detection System (Heart Disease) is made to be a solution to this problem by utilizing the signal electrocardiogram (ECG), but the system has not been any ECG patient medical record data if for the next consultation, so that if a patient is missing medical records, then from the doctor is not Adaiah database to record. The system to be developed in the form of portable intelligent devices, making it easier for users to monitor the condition of the heart anytime. This study uses fuzzy Clestering Means. Given these intelligent devices, is expected to help the community or the patient to determine and maintain heart health.

The classification results are then combined with a prototype device that can display a visualization of the heart rate and classification of heart disease. The first integrated module is a combination of an ECG module by telephone or computer, this study focused on patients' medical records database in detecting heart. This application help system and provides an alternative to doing Elektrodiogram medical record patient data, so that the patient's existing medical records contained Elektrodiogram patient's medical record database, making it easier for the doctor to see the medical records of medical patient data.

2. Literature Review

A. ECG Examination Overview (Electrocardiography)

EKG can record the activity of 'electrical' heart. Blockage of coronary heart experiencing 'ischemic' cause nuisance activity 'electric' heart detected by 'electrocardiogram'. ECG also can record the heart's electrical activity of a variety of other disorders. with EKG can note the possibility of abnormalities in the heart with a level of accuracy of 40%. using sound waves to produce images of the heart. During this process, the doctor can determine whether all parts of the heart wall contribute usual in the heart's pumping activity. Weak moving parts may have been damaged during a heart attack or receives too little oxygen. This may indicate coronary artery or a variety of other conditions. EKG can record the activity of 'electrical' heart. Blockage of coronary heart experiencing 'ischemic' cause nuisance activity 'electric' heart detected by 'electrocardiogram'. ECG also can record the heart's electrical activity of a variety of other disorders.

B. Algorithm Fuzzy C-Menas Clustering

Algorithm fuzzy c - means clustering can be summarized as follows :
1. Determine the matrix X to be clustered
2. Determine the initial parameters
3. Generating random numbers degrees of membership with the formula :

$$Q_i = \sum_{k=1}^{c} \mu_{ik} \quad (2.1)$$

$$\mu_{ik} = \frac{\mu_{ik}}{Q_i} \quad (2.2)$$

4. Calculate the center of the cluster using the formula :

$$V_{kj} = \frac{\sum_{i=1}^{n}((\mu_{ik})^{w} * X_{ij})}{\sum_{i=1}^{n}(\mu_{ik})^{w}} \quad (2.3)$$

5. Calculate the objective function using the formula :

$$P_t = \sum_{i=1}^{n}\sum_{k=1}^{c}\left(\sum_{j=1}^{m}(X_{ij} - V_{kj})^2\right)(\mu_{ik})^{w} \quad (2.4)$$

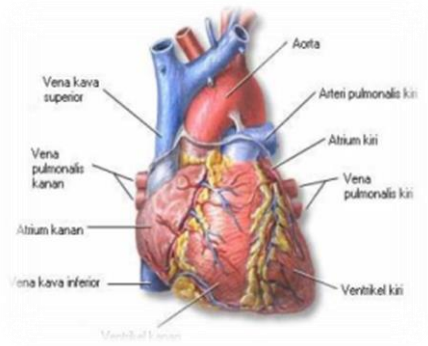
6. Calculating the matrix changes the partition using the formula :

$$\mu_{ik} = \frac{\left[\sum_{j=1}^{m}(X_{ik} - V_{kj})^2\right]^{\frac{-1}{w-1}}}{\sum_{k=1}^{c}\left[\sum_{j=1}^{m}(X_{ik} - V_{kj})^2\right]^{\frac{-1}{w-1}}} \quad (2.5)$$

Check the condition stops

C. Heart

Definition of heart disease and heart attacks are different. If a heart attack is a condition that causes heart was not functioning. This condition usually occurs suddenly, and often referred to heart failure. Causes of heart failure vary, but usually the main cause is the inhibition of blood supply to the heart muscles, because the blood vessels that normally drain blood to the heart muscle are blocked or hardened, either because of fat and cholesterol, or because the substances chemicals or substances such as excessive use of drugs containing Phenol Propano Alanine (PPA) which is commonly found in drugs such as Decolgen, and nicotine. (source: wikipedia). However, heart disease is a dangerous disease and cause of death to many sufferers. Not infrequently, the patient is too late that he was suffering from heart disease so late to diatasai. For that, knowing the symptoms of heart disease you need to know in order to be done immediately follow the treatment as soon as possible



.

Figure 1. Heart

D. Human Heart Rate

Due to the labor - ter heart ventricles and atria main then the resulting heartbeat . With a resulting ter - called heart rate and then gave birth to the heart rate (heart rate) . When the left ventricle contracts , blood pressure is pumped throughout the body is divided into arteries and veins throughout the small arteries (arterioles) , including arteries in the fingers . In that short time later O2 rich blood into the cells and capillaries each pull of the CO2 -rich blood cells. Blood - CO2 -rich blood is then entered into the right atrium of the heart.Period work of the heart when me - pumped and the blood draw is one heart -beat ver . When in a state of ver - rest, the average heart rate of adult men about 70 times per minute and an adult woman about 75 times per minute . At each contraction of the heart will move the blood into the aorta as much as 60-70 CC . Medium - right while doing a lot of per - movement or activity , heart rate of an adult would reach 150 times per minute . Variations in heart rate throughout a significantly is influenced by several factors , such as age , genetics , and the activities conducted.

E. Early detection system Heart Disease (Heart Disease)

Early detection system Heart Disease (Heart Disease) is made to be a solution to this problem by utilizing the signal electrocardiogram (ECG) . The system developed in the form of the medical records of patients , this study using the Fuzzy Clustering Means , with this smart device , diharapkn can help people or patients to determine the funds maintain heart

health . The classification results are then combined with a prototype device that can display a visualization of the heart rate and classification of heart disease . The first integrated module is a combination of an ECG module by telephone or computer, this study focused on patients' medical records database in detecting heart . Here is integrated between the ECG to a PC desktop or mobile PCs (notebooks and netbooks) to monitor the patient's heart condition in Figure 2.

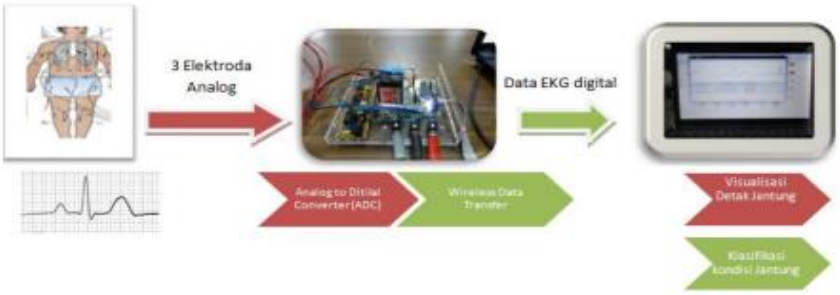


Figure 2. The device integrates an electrocardiogram (ECG) with a desktop PC .

III . Research Methodology

This study was designed gradually to two-year study period. Broadly speaking, the research will include: (a). Design of Electrocardiogram Medical Record System using Fuzzy-Cluster-Means Microcomputer based, (b) Analysis and retest the previous research and do a comparison with the results of current research studies have been conducted with the same object, (c) the results of segmentation analysis of medical records electrocardiogram to determine the database decision support tools for the medical record the electrocardiogram based on the results of research
conducted, and (d) the data analysis and research results overall for the conclusion.
The first year, the study begins with a preparation phase and data collection-dataterkait with electrocardiogram medical records to be used. In this study, which will be used in the form of medical records especially Electrocardiogram Hospital in Banten Province. In addition, a preliminary study in order to strengthen the research literature conducted, mainly related to methods of Fuzzy Cluster Means Microcomputer based.
The second year, is a stage of research that aims to analyze and identify medical records electrocardiogram using Fuzzy - Cluster- means based microcontroller. This research phase also developed a prototype. As the results of the first year of research, the development of prototype systems in the second refers to the results of a preliminary analysis of the first year. And resulted in the medical record database electrocardiogram either smart device that where visualization and clarification and analysis of heart rate data in the form of smartpone, making it easier for the patient can more easily know the state of the heart at any time. Where the process of reading sensor and data acquisition Heartbeats manusus into Analog to Digital processing and sending data to the Smart Device Clarification samapai heartbeat pattern in the form of clarification and visualization as well as the results of the data analysis heartbeat

Table 1 Research Data

NO	PATIENT'S NAME	AGE	TIME	HEART RATE
		(In Month)	(In seconds)	
1	NY M	0	60	130
2	NY F	0	60	140
3	NY D	0	60	136
4	NY I	0	60	140
5	NY N	0	60	132
6	INAYATUN	1	60	180
7	ARAFAH	1	60	183
8	SEPTIAN	1	60	190
9	M NAZAR	1	60	189
10	PANI	1	60	189
11	M FAHRI	1	60	181
12	JIHAN	1	60	180
13	ZAHRA	1	60	179
14	DILA	1	60	179
15	JIHAN	1	60	180
16	AJRIL	1	60	175
17	OLIP	1	60	175
18	DADAN	1	60	173
19	ABDI	1	60	179
20	ALIF	1	60	171
21	DIRA	1	60	171
22	ALIFAH	1	60	172
23	SUBNI	1	60	169
24	ANIF	1	60	169
25	MADANI	1	60	169
26	CHYNTIA	2	60	138
27	ALDO	1	60	140
28	KHENZO	4	60	136
29	AMANDA	1	60	134
30	VINO	3	60	138
31	ADARA	6	60	145
32	NADIFA	7	60	130
33	REVAN	8	60	130
34	SABILA	9	60	144
35	NABIL	10	60	145
36	FATUR	11	60	130
37	ADIKA	12	60	133
38	IBNU	6	60	151
39	ADITRA	12	60	151
40	JOHDAYATI	12	60	120
41	ANASTASYA	9	60	101
42	EKA PUTRI LESTARI	10	60	99
43	FITRI AYU	8	60	100
44	OCTARIO HARJANTO	12	60	90
45	ANGGI PERMATA	7	60	110
46	REYAN ADITYA	1	60	90
47	SALSABILA NAFIATUL HUSNA	2	60	83
48	MUHAMMAD AFNA	2	60	110
49	NANDRIAN KUSUMA	2	60	95

50	SUKMA	1	60	90
51	DINDA AULIA	4	60	69
52	ASYIFA DEWI PERTIWI	3	60	106
53	FAJAR JULIANSYAH PUTRA	6	60	93
54	EVA SOPIANSYAH PUTRI	5	60	65
55	INTAN FAHIRA	5	60	45
56	FAISAL AHMAD ALFAI	7	60	106
57	DANI PUTRA SAMUDRA	10	60	112
58	DAFI ARDIANYAH	10	60	106
59	DENIS IKHTISOM	6	60	106
60	ZAHRATUSHIFA	7	60	91
61	SALMA SALBILA	11	60	76
62	LITA HUMAIROH	11	60	64
63	FAJRINA CHANDRA	11	60	72
64	RATU NAJWA	11	60	80
65	VINKAN ZAHRA	12	60	70
66	MELLY AJENG PRATIWI	16	60	70
67	DENI ARDIANSYAH	17	60	63
68	OKTA SATRIA SULAEMAN	18	60	60
69	CITRA AYU PRADIPTA	17	60	74
70	FUJI LESTARI	16	60	63
71	SURYANDIKA	19	60	120
72	YUNI	19	60	84
73	BILFRID JOSHUA	19	60	84
74	AMEL	19	60	60
75	NTIH ROHA	19	60	92

Calculate the amount of each column

$$Q_i = \sum_{k=1}^{c} \mu_{ik} \qquad (2.1)$$

$$\mu_{ik} = \frac{\mu_{ik}}{Q_i} \qquad (2.2)$$

C2 ==> Q2= 33,8

for formula

$$Q_i = \sum_{k=1}^{c} \mu_{ik} \qquad (2.1)$$

$$\mu_{ik} = \frac{\mu_{ik}}{Q_i} \qquad (2.2)$$

$$V_{kj} = \frac{\sum_{i=1}^{n} ((\mu_{ik})^{w} * X_{ij})}{\sum_{i=1}^{n} (\mu_{ik})^{w}} \qquad (2.3)$$

Table 2. Initial partition matrix U formed (random)

C1	C2	Q1 C1^2	Q2 C2^2
0,5	0,5	0,25	0,25
0,7	0,3	0,49	0,09
0,3	0,7	0,09	0,49
0,8	0,2	0,64	0,04
0,6	0,4	0,36	0,16
0,8	0,2	0,64	0,04
0,4	0,6	0,16	0,36
0,6	0,4	0,36	0,16
0,3	0,7	0,09	0,49
0,6	0,4	0,36	0,16
0,7	0,3	0,49	0,09
0,3	0,7	0,09	0,49
0,8	0,2	0,64	0,04
0,6	0,4	0,36	0,16
0,8	0,2	0,64	0,04
0,4	0,6	0,16	0,36
0,6	0,4	0,36	0,16
0,3	0,7	0,09	0,49
0,6	0,4	0,36	0,16
0,7	0,3	0,49	0,09
0,3	0,7	0,09	0,49
0,8	0,2	0,64	0,04
0,6	0,4	0,36	0,16
0,8	0,2	0,64	0,04
0,4	0,6	0,16	0,36
0,6	0,4	0,36	0,16
0,3	0,7	0,09	0,49
0,6	0,4	0,36	0,16
0,7	0,3	0,49	0,09
0,3	0,7	0,09	0,49
0,6	0,4	0,36	0,16
0,6	0,4	0,36	0,16
0,8	0,2	0,64	0,04
0,4	0,6	0,16	0,36
0,6	0,4	0,36	0,16
0,3	0,7	0,09	0,49
0,6	0,4	0,36	0,16
0,7	0,3	0,49	0,09
0,3	0,7	0,09	0,49
0,6	0,4	0,36	0,16
0,6	0,4	0,36	0,16
0,8	0,2	0,64	0,04
0,4	0,6	0,16	0,36
0,6	0,4	0,36	0,16
0,3	0,7	0,09	0,49
0,6	0,4	0,36	0,16
0,7	0,3	0,49	0,09
0,3	0,7	0,09	0,49
0,8	0,2	0,64	0,04
0,6	0,4	0,36	0,16
0,8	0,2	0,64	0,04
0,4	0,6	0,16	0,36
0,6	0,4	0,36	0,16
0,3	0,7	0,09	0,49
0,6	0,4	0,36	0,16
0,7	0,3	0,49	0,09
0,3	0,7	0,09	0,49
0,6	0,4	0,36	0,16
0,6	0,4	0,36	0,16
0,8	0,2	0,64	0,04
0,4	0,6	0,16	0,36
0,6	0,4	0,36	0,16
0,3	0,7	0,09	0,49
0,6	0,4	0,36	0,16
0,2	0,8	0,04	0,64
0,3	0,7	0,09	0,49
0,8	0,2	0,64	0,04
0,6	0,4	0,36	0,16
0,8	0,2	0,64	0,04
0,4	0,6	0,16	0,36
0,6	0,4	0,36	0,16
0,6	0,4	0,36	0,16
0,4	0,6	0,16	0,36
0,6	0,4	0,36	0,16
0,3	0,7	0,09	0,49
41,2	33,8	25	17,6

IV. Working Principle System

Heart rate detector that is designed utilizing the optical system has a higher sensitivity compared to visible light, the infrared rays merah.Kemampuan optical system which meant that detects the presence of blood flow causes the emission of infrared light to blood vessels triggered. When the heart contracts to pump blood throughout the body, the volume of blood in the arteries also increases. When the volume of blood in the arteries increases, the intensity of the reflected infrared light is increasing. If the intensity of the reflection of infrared rays that are received by the photodiode increases will cause photodiode voltage increases. Increasing the photodiode voltage will cause the output voltage of the sensor increases. The output of the sensor in the form of an analog signal which will then be forwarded to a signal conditioner circuit.

When the heart is not contracting, the blood volume in the arterial blood vessels estab- will be reduced. When the volume of the blood vessels resulting in reduced intensity of the reflected infrared light is reduced as well. At that time also will menyebab-kan on the photodiode decreases the voltage value and generates the value of sensor output voltage is low. The low value of the voltage the output of the sensor will be the absence of information about the pulse rate is detected .

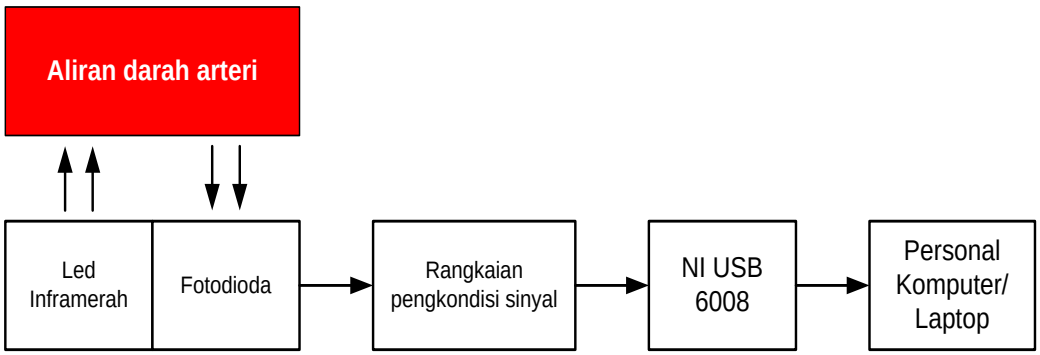


Figure 3 - Block diagram of a heart rate monitoring system

Heartbeat Detector Architecture

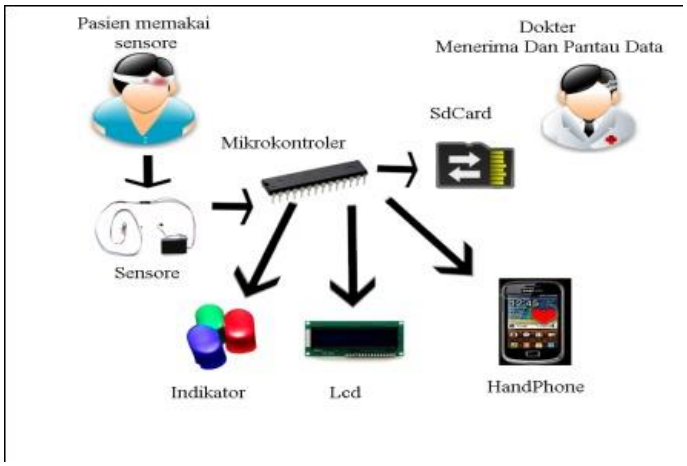


Figure 4. Heartbeat Detector Architecture

The design of Microcontroller Tools

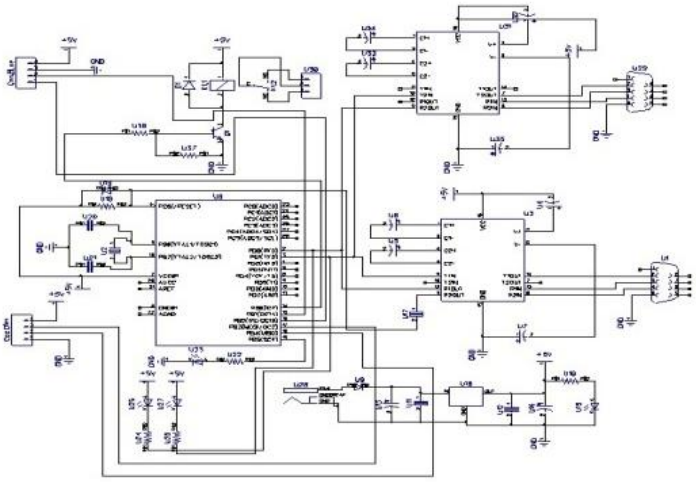


Figure 6 The design of Microcontroller Tools

Work Stages Microcontroller
The way the device is made using a combination of pulse sensore device as a detection rate in patients by attaching the sensore ketubuh patient at the fingertip or the tip of the ear .
• Pulse sensor will transmit analog data in the form of electrical pulses to the microcontroller port as a data processing center .
Analog inputs are processed using a microcontroller contains a program that can provide output in the form of digital data through two channels, namely direct path consisting of three indicator LED lights to indicate the condition based triage category and an LCD
screen as the interface that displays the number of beats per minute , and this tool equipped with sdcard as the data storage process at any time if needed.

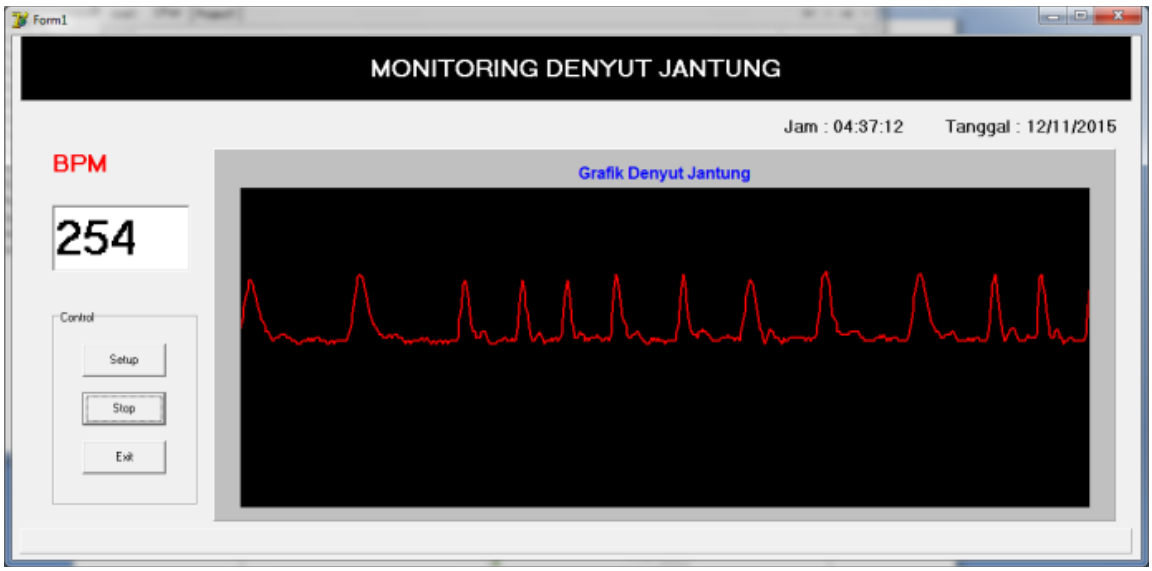


Figure 7. Display Heartbeat Monitoring Applications

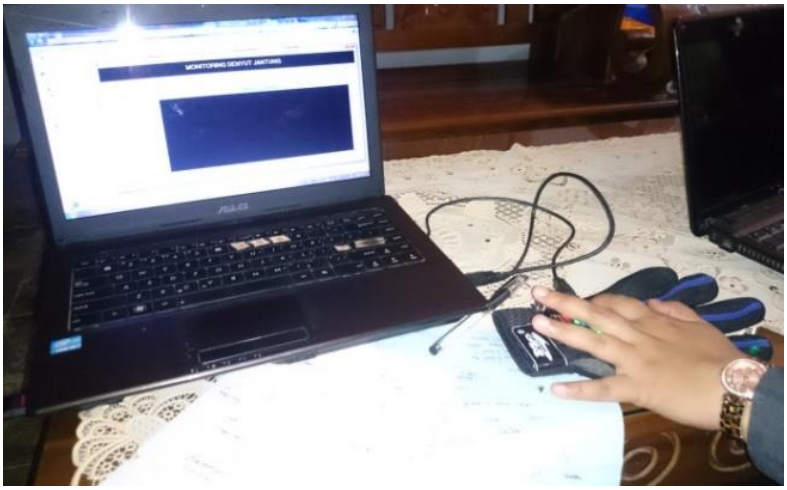


Figure 8. Display Heart Rate Monitoring Applications with Microcontroller Tools

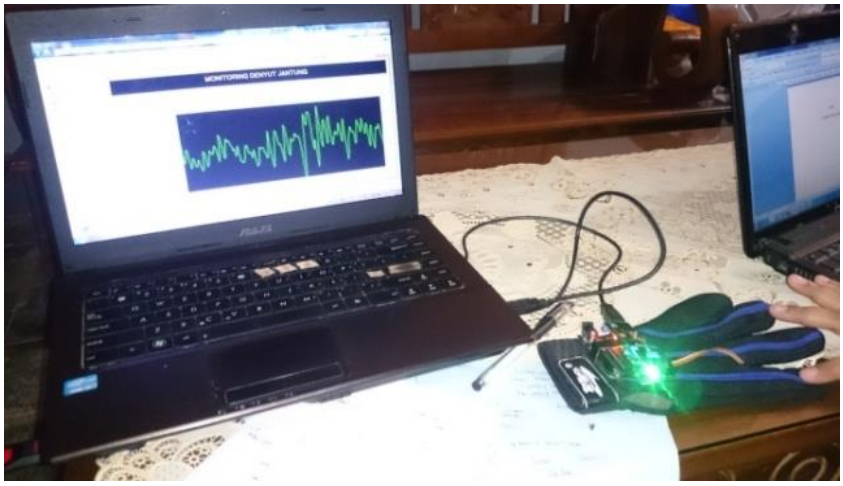


Figure 7. Display Heartbeat Monitoring Applications with Microcontroller Tools

V. Conclusion

From the results of analysis and discussion of this research, several conclusions can be drawn as follows:

can be drawn as follows

1. This application system help and provide an alternative in doing Elektrodiogram medical record patient data , so that the patient's existing medical records contained Elektrodiogram patient's medical record database , making it easier for the doctor to see the medical records of medical patient data .
2. Heart disease Early detection system is made to be a solution to the problem by utilizing the electrocardiogram signal (ECG) with Fuzzy method Means Clustering - based microcontroller .
3. With Intelligent devices are expected to help patients or the public to know and maintain heart health .

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Overtaking Situation Identification In Connected Vehicles Environment

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Abstract. : *Vehicle to vehicle (V2V) communications technology allows the development of Cooperative Overtaking Assistant System (COAS) and Cooperative Automatic Overtaking System (CAOS). The cooperation ability of vehicles can overcome the limitations of the sensors such as camera, lidar, and radar, so that the level of vehicle safety can be improved. The first phase of the operation of COAS and CAOS is determining the situation of overtaking. In the connected vehicles environment the identification of a overtaking situation can be determined based on vehicle data are distributed through the V2V communication devices such as Wireless Access in Vehicular Environment (WAVE). This study discusses the identification of a overtaking situation in connected vehicles environment by utilizing Vehicles in Neighborhood Table (VNT) and Vehicles in Maneuver Table (VMT). The test result prove that the algorithm can work according to design and the execution time of algorithm below data rate of WAVE (20 ms).*

Keywords*: overtaking, connected vehicles, overtaking intention.*

1. Introduction

Communication between vehicles or vehicular to vehicular (V2V) communication, or also known as car to car (C2C) communication continues to be developed with the main objective to improve the safety and comfort in driving. Before the development of wireless communication systems between vehicles, have developed the cooperative awareness message (CAM) is a device that allows the vehicle to be sent information about the position and speed to other vehicles in the vicinity every 0.5 seconds. Besides CAM also developed the Decentralized Environment Notification Message (DENM). This device is similar with CAM, but only send a message when certain conditions such as accident [1].

Safety aspects of vehicles is expected to increase with the use of means of communication that connects between vehicles. Development of Intelligent Transportation System (ITS) which utilizes communication between vehicles is done by [2], [3], and [4]. In [2] developed traffic information dissemination mechanism using WAVE, route-based vehicular traffic management using WAVE and WAVE prototype for ITS are discussed in [3] and [4].

Utilization of communication between the vehicles used to improve the performance of Intelligent Driver Assistance System (IDAS), among others, performed by [5], [6], and [7]. [5] research, communication among vehicles used to improve the overtaking assistance system using video transmission. [6] and [7] using inter-vehicle communication system to improve performance of overtaking assistance system using See-Through System and Fuzzy Logic.

This paper discusses a method for the identification of overtaking situations by utilizing the means of communication between vehicles. This method is useful for realizing the COAS and CAOS cooperative or automatic overtaking system is to be an element of autonomous vehicles.

2. METHODOLOGY

Identification of the overtaking situation on the connected vehicles environmental utilizing periodic messages transmitted by each vehicle via WAVE. WAVE is one of VANET architecture standardized by IEEE 802.11p [8].

A. Messages Dissemination in WAVE

The dissemination of the message in WAVE is done in two modes, namely broadcasting and unicasting. Illustration of broadcasting mode can be seen in Fig. 1.

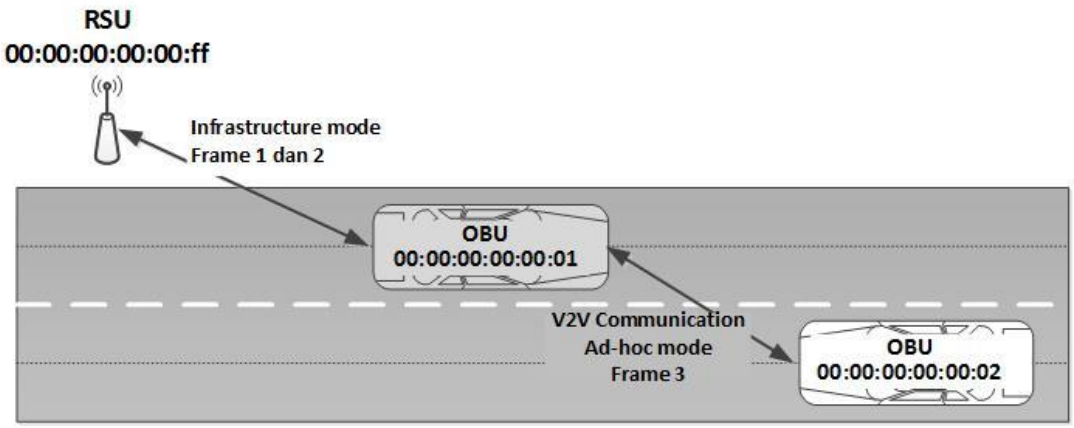

Figure-1. Broadcast mode in WAVE

In broadcast mode the message contains informations as shown on Table 1. This message is sent every 20 ms in 50 Hz data rate.

Table-1. Format And Data Source

Field	Format	Data source
Time	hhmmss.sss	GPS (UTC)
VID	00:00:00:00:00:00	MAC OBU
Position	xxx.xxxxxx:yyy.yyyyyy	GPS (DD
Speed	ss.ss	GPS (m/s)
Heading	hhh.hh	GPS
Attribute	vv	MAC OBU

Unicast mode is used for special purposes, namely for the delivery of messages related to safety. Examples of the use of this mode of active safety device is sending safety messages in the Cooperative Overtaking Assistance System (COAS) and Cooperative Adaptive Cruise Control (CACC) [9].

B. COAS and CAOS using WAVE

COAS and CAOS are operated with communication device such as WAVE. Figure 2 shows an illustration of use WAVE at COAS and CAOS.

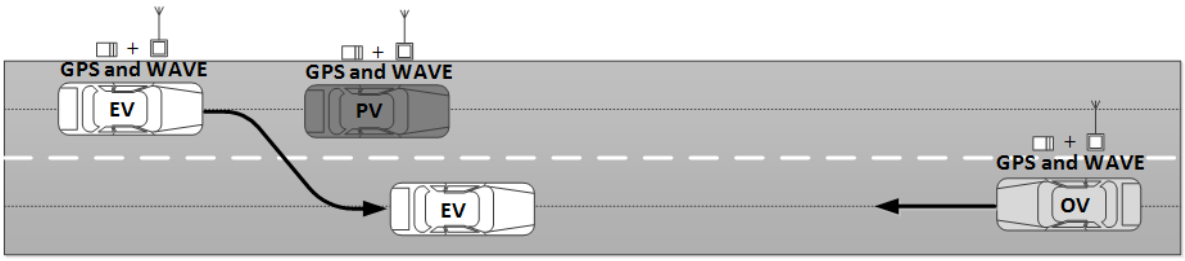

Figure. 2. COAS dan CAOS using WAVE

Before the EV overtake the vehicle PV, EV should make the process of identifying situations whether overtaking can be done or not. If identification of overtaking situation should lead to the decision not to overtake, then EV will follow PV until overtaking opportunity occurs. The main problem of this research is how to process the data transmitted periodically by each vehicle to identify situations whether it is feasible to overtake or not.

C. Identification Method

The identification process is done by utilizing broadcast messages periodically sent by all vehicles have facilities WAVE. Message containing information about the position, velocity, acceleration, direction, and type of vehicle to be received by each other through the On Board Unit (OBU) in vehicles. Identification of the overtaking situation can be divided into three phases:

1. Building Vehicles in Neighborhood Table (VNT)
2. Building Vehicles in Maneuver Table (VMT)
3. Calculation of overtaking intention

1) Building Vehicles in Neighborhood Table (VNT): VNT is the table that is continuously made by each vehicle fully-WAVE. This table serves to provide information in real-time situations for the driver as well as COAS and CAOS. VNT is build by utilizing the information sent in broadcast mode of WAVE. VNT table form designed can be seen in TABLE II.

Table-2. Vehicles In Neighborhood Table

Time	VID	Position	Speed	Heading	Attr
124721.156	00:00:00:00:00:01	-6.880621, 107.578862	13.02	-90.00	01
124721.212	00:00:00:00:00:18	-6.880579, 107.579033	12.24	-90.12	01
124721.302	00:00:00:00:00:71	-6.880515, 107.579216	15.12	-90.02	41
124721.411	00:00:00:00:00:36	-6.880462, 107.579420	12.76	-90.11	01
124721.513	00:00:00:00:00:13	-6.880419, 107.579538	13.60	-90.20	01
124721.612	00:00:00:00:00:76	-6.880408, 107.579559	13.67	-90.23	01
124721.756	00:00:00:00:00:32	-6.880611, 107.579237	11.23	90.21	01
124721.821	00:00:00:00:00:14	-6.880557, 107.579441	11.31	90.21	01

The content of VNT is vehicle data from broadcasting messages carried by OBUs in several vehicles at a radius of 400 m. VNT is updated every 20 ms in accordance with the data rate of WAVE 50Hz. Illustration of listed vehicles in VNT can be seen in Fig. 3. In the illustration vehicle numbers 13 and 18 will not be listed in the VNT.

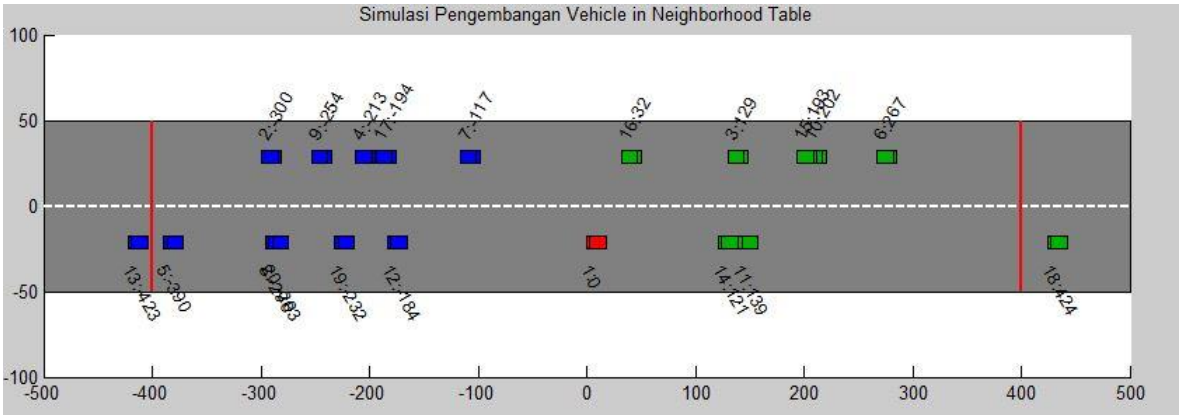

Fig. 1. Vehicles in VNT

Algorithm 1: Building and renewal VNT

1. According to the heading of vehicles specify the direction of the vehicles, the same direction or the opposite direction with EV.
2. Calculate distance between EV and other vehicle, if distance less than 400 m listed the vehicle in VNT.
3. Perform periodic renewal VNT by repeating 1 and 2 using the latest data.

2) Building VMT: Before building a VMT defined naming the vehicle on the situation overtaking as can be seen in Fig. 4 and TABLE III.

Table-3. Description Of Vehicle Naming

Number	Name	Description
1	Ego Vehicle	overtaker vehicle
2	Partner Vehicle	overtaken vehicle
3	Obstacle Vehicle	Vehicle blocking maneuver of EV
4	Neighbor Vehicle	Vehicles that helped the implementation of maneuvers by EV
5	Surrounding Vehicle	SV can be a vehicle behind the OV or NV

VNT vehicle data on further processed into VMT. At the VMT selection process and the naming of the vehicle. Vehicles entering the restricted VMT 8 vehicles, ie vehicles that affect the maneuverability overtaking. List of vehicles involved in overtaking maneuvers can be seen in TABLE IV.

Table-2. Vehicles In Maneuver Table

Time	VID	Position	Speed	Heading	Name
124721.156	00:00:00:00:00:01	-6.880621, 107.578862	13.02	-90.00	SV1
124721.212	00:00:00:00:00:18	-6.880579, 107.579033	12.24	-90.12	NV
124721.302	00:00:00:00:00:71	-6.880515, 107.579216	15.12	-90.02	EV
124721.411	00:00:00:00:00:36	-6.880462, 107.579420	12.76	-90.11	PV
124721.513	00:00:00:00:00:13	-6.880419, 107.579538	13.60	-90.20	OV2
124721.612	00:00:00:00:00:76	-6.880408, 107.579559	13.67	-90.23	OV3
124721.756	00:00:00:00:00:32	-6.880611, 107.579237	11.23	90.21	OV1
124721.821	00:00:00:00:00:14	-6.880557, 107.579441	11.31	90.21	SV2

Algorithm 2: Preparation VMT

1. Based on data VNT select two vehicles behind EV and calculate the distance of the two vehicles. The closest vehicle is NV and other vehicles SV1
2. Based on data VNT select three vehicles ahead and calculate the direction and distance of the vehicle to the EV. Based on the proximity of the EV specify consecutive PV, OV2 and OV3.
3. Based on data VNT select two vehicles in front of and opposite direction with EV and EV calculate the distance to the vehicle. Based on the proximity of the EV specify OV1 and SV2.

Vehicles listed in the VMT can be illustrated as in Fig. 5.

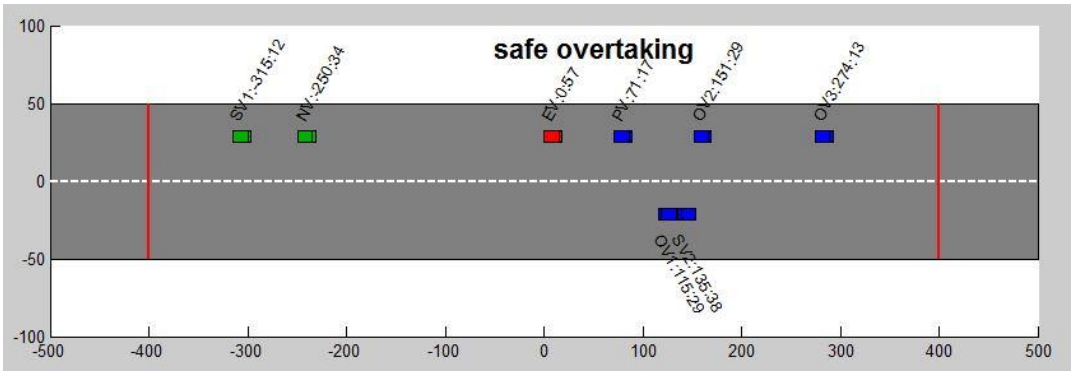

Fig. 2. Vehicles in VMT

3) *Intention overtaking calculation*: Overtaking intention is determined by equations from [10] and the illustration for overtaking intention calculation is shown in Fig. 6.

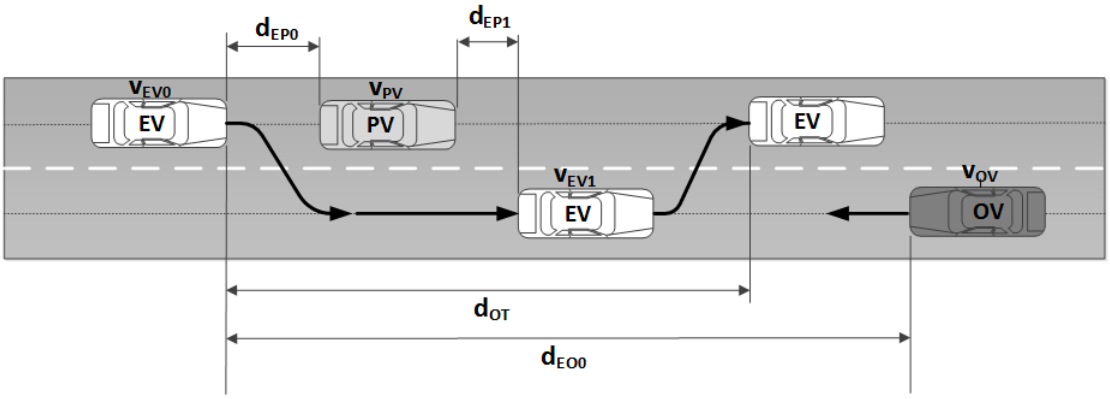

Fig. 3. Illustration for overtaking intention calculation

The time is required for accelerated motion of the EV can be calculated by Equation (1) This time is the time required by the EV to the process for lane changing.

$$t_{lc} = \frac{V_{EV1} - V_{EV0}}{a} \quad (1)$$

where,

V_{EV1} : speed while overtaking of EV (m/s)
V_{EV0} : speed before overtaking of EV (m/s)
a : acceleration factor

After the process of lane changing, the EV will make the process of passing and then back to its original lane (lane returning). The time required to perform the two stages can be calculated by Equation (2).

$$t_{pr} = \frac{0{,}5 * a * t_{lc}^2 + t_{lc} * (V_{EV0} - V_{PV0}) - d_{OT}}{V_{PV0} - V_{EV1}} \quad (2)$$

where,

d_{OT} : overtaking distance, calculated using Equation (3)
V_{PV0} : speed of PV (m/s)

$$d_{OT} = d_{EP0} + l_{EV} + l_{PV} + d_{EP1} \quad (3)$$

where,

d_{EP0} : distance EV and PV

l_{EV} : EV vehicle length

l_{PV} : PV vehicle length

d_{EP1} : safe distance for lane returning

The time is required for the overtaking is calculated by Equation (4).

$$t_{ot} = t_{lc} + t_{pr} \quad (4)$$

The time is required by OV for reaches EV is calculated by Equation (5).

$$t_{ov} = t_{lc} + \frac{d_{EO0} - 0{,}5 * a * t_{lc}^2 - t_{lc} * (V_{EV0} + V_{OV0})}{V_{PV0} + V_{OV0}} \quad (5)$$

where,

d_{EO0} : overtaking distance, calculated using Equation (3)
V_{OV0} : speed of PV (m/s)

Overtaking can be done if $t_{ov} > t_{ot}$ but to ensure the safety then the safety factor (sf) is added.

$$t_{ov} > sf + t_{ot} \quad (6)$$

where,

sf = 1 for $V_{EV} \leq 50$ km/hour
2 for $V_{EV} > 50$ km/ hour

If Equation (6) is true then the value of overtaking intention is 1, otherwise 0. If there is no barrier the value of overtaking intention will be used as a decision to overtake. Barriers that may exist between the other is a vehicle in the right lane blocking EV when it will move to the right lane.

Implementation of the overtaking maneuver is generally performed with the assumption that the vehicle will be overtaken and vehicles from the opposite direction does not change speed or position. This assumption is not entirely correct because it takes a vehicle monitoring PV and OV continuously and need to develop cooperative systems between vehicles involved in the process of overtaking.

III. RESULTS AND DISCUSSIONS

Validated algorithm developed in a way to simulate the vehicle to do the overtaking when overtaking intention is 1. Besides this algorithm developed also tested complexity to the analysis of Big O. The basic algorithm will be validated by calculating the distance of EV and EV OV during the same lane with OV. See **Error! Reference source not found.**.

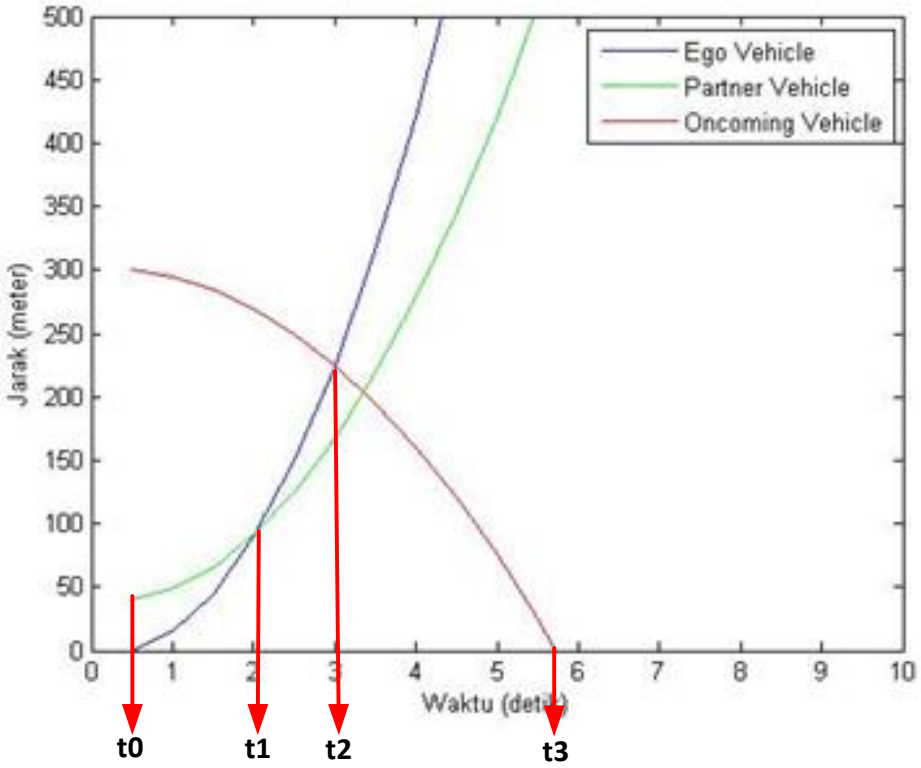

Figure-2 Vehicles position when overtaking

EV distance and OV at the moment in the same lane is ds. Ds large safe minimum for EV and OV in this experiment is 10 meters. The test results showed the decision to overtaking in accordance with the results of the validation. Results of the validation by using a special program created shows that identification can be done with the overtaking situation either with a success rate of 100%.

Analisis kompleksitas Big O: Based on the analysis of Big-O complexity of the algorithm developed belongs to the group of linear or satisfy the equation T (n) = O (n), which means that the execution time is proportional to the amount of data (vehicle). The execution time includes the establishment of VNT and VMT and counting overtaking intention.

WAVE in a radius of 1000 meters and assumed each vehicle requires a 20-meter long street, then the maximum amount of vehicle data on two-lane roads / paths that can be accepted by each OBU is 200 vehicles. Based on the graph obtained simulation algorithm execution time to the number of vehicles as shown in Fig. 4.

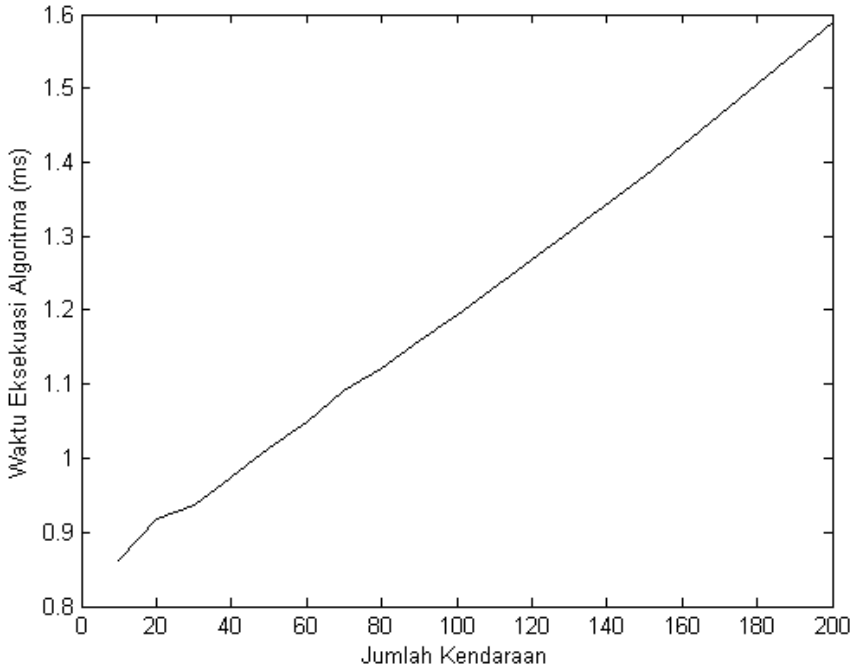

Fig. 4. Algorithm execution time to the number of vehicles

IV. CONCLUSIONS

Identification of the overtaking situation in the vehicle connected beneficial for the development of automatic overtaking. The identification process carried out in three phases: VNT formation, VMT, and counting overtaking intention. Validation results with specially tailored programs shows that overtaking identification can be done well. The execution time of algorithm does not exceed 20 ms

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SECTION 2 :

LIFE SCIENCES AND BIOMEDICAL ENGINEERINGS

Biowaste based Carbon Nanospheres and Their Application

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Abstract. *Biowaste materials are becoming more popular due to the unconventional burning which might cause environmental pollutions. To over come this many researchers tried several ways to utilise these biowaste materials in to useful products in the area of nanotechnology [1, 2]. Converting biowaste materials in to spherical shaped nano particles is the state of the art research where with controlled pyrolysis technique without adding any catalyst, one can able to tune them in to perfect shape [3]. Here in this talk, we are going to show biowaste based carbon nanospheres which are well characterized using several techniques (with size ranging from 50-100nm) and then electrochemical analysis were conducted. Our studies revealed that, these materials are potential to use as supercapacitors, treatment of water, antimicrobial nature and also cancer cell imaging.*

Keywords*: biowaste, carbon nanospheres*

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Machining of Bones from Manufacturing Process Point of View

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Abstract. *Over 10 million orthopedic surgery and dental implantation procedures are performed annually. Most of them involve machining of bones and cartilage. Despite the large number of bone machining procedures, the theoretical and analytical study on bone machining is lagging behind its practice and implementation. In fact, there is no guidelines on setting of bone machining parameters or definitive criteria for successful or optimum bone machining. To contribute towards those fundamental issues, a new perspective is offered by viewing bone machining as a manufacturing process. Our recent works on turning and drilling on bovine femur and mandible bones are to be presented. Machining conditions, including cutting parameters and tool geometry were varied and the machining responses were observed. Quantification of the effect of machining conditions to the machining responses was developed using design of experiment approach. In conducting this study on bone machining, we hypothesized that bone, like other brittle materials, can be machined in ductile mode given suitable machining conditions. Ductile mode machining of bone is preferred since it induces low cutting forces and very fine surface finish on brittle materials, which in this case might mean less invasiveness to the machined bone tissues. Some findings towards proving that ductile bone machining exists and can be achieved are also presented.*

Keywords*: bone machining, bone*

Low-cost Simulator for Evaluator of Oscillometric Noninvasive Blood Pressure Measurement

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Abstract. *Blood pressure simulator usually used as reference value for evaluation of automatic noninvasive blood pressure monitor, since it is not possible to use real human blood pressure as the reference due to the stability of its value in repetitive measurements. The objective of this project is to develop low-cost simulator for automatic noninvasive blood pressure measurement which uses oscillometric method. DC motor based micro air pump is used to simulate the oscillation of oscillometric that corresponding with the heart rate. The oscillation characteristic refers to an existing device at Balai Pengamanan Fasilitas Kesehatan Jakarta. The micro air pump generates oscillation which the magnitude depends on the pressure detected by a pressure sensor to determine the Mean Arterial Pressure (MAP). A prototype successfully developed, that able to simulates systole/diastole at 120/80 mmHg with the generated MAP is 98.9±0.6 mmHg. Prototype's development cost for the hardware is around three million rupiah, much cheaper than final price of commercial existing device which cost more than a hundred million rupiah in Indonesia.*

Keywords*: blood pressure, oscillometric, precision, simulator, mean arterial pressure*

1. Introduction

Static characteristics, such as accuracy and precision, are important parameters for a measurement instrument. Calibration usually performed by comparing the measured value of the instrument and reference value, to determine the static characteristics. Reference value is considered as the standard value of the measurand.

Blood pressure simulator usually used as reference value for automatic noninvasive blood pressure (NIBP) monitor, since it is not possible to use real human blood pressure as the reference due to the stability of its value in repetitive measurements.

There are two basic types of NIBP simulators, limb simulator and waveform simulator. Limb simulator uses an artificial arm with pulsating fluid to simulate the blood pressure, while waveform simulator generates oscillation waveform to be fed to the NIBP monitor that being evaluated. Waveform simulator is dominantly used today [1]. This simulator is used to evaluate automatic NIBP monitor which uses oscillometric method. This method is very popular in automatic NIBP monitor; one of the reasons is simplicity of the hardware which no needs external sensors [2].

Systolic pressure and diastolic pressure in oscillometric method will be calculated from the detected MAP[3]. Each manufacturer has different algorithm to calculate those values. Therefore an NIBP simulator is not suitable for evaluation of accuracy; it is more suitable for evaluation of repeatability and reproducibility [1].

Evaluation of NIBP monitor is important. Moreover for automatic NIBP monitor that usually used for self-measurement by patients with hypertension. Error could leads to wrong medical action. However the simulator to evaluate NIBP monitor is quite expensive. One of available commercial products in Indonesia, based on e-catalogue of purchasing system of the government of Indonesia, cost more than a hundred million rupiah.

The objective of this project is to develop a low-cost blood pressure simulator for automatic NIBP measurement with oscillometric method. The simulator will simulate oscillation signal that corresponding with heart rate. This kind of simulator can be used in calibration agency, hospital for in house regular evaluation, or NIBP monitor manufacturer for quality checking process. To limit the scope, this paper will discuss simulation for systole/diastole value at 120/80 mmHg with heart rate 80 beat per minute (BPM) as the proof of concept.

A prior concept has proposed by Ruiter et.al, which uses elastomeric bladder that driven by a linear actuator, preferably a stepper motor and cam, to simulate the oscillation. Orientation of the cam is maintained by the actuator in order to generate the desired pulse pressure [4]. The proposed system in this paper uses a DC motor based micro air pump to simulate the oscillation. This kind of actuator is common used in NIBP monitor system to pump the cuff. Due to the different actuator, the control system is also different with the aforementioned prior concept.

2. Research Method

The development refers to reference data that taken from an existing commercial device in Balai Pengamanan Fasilitas Kesehatan (BPFK) Jakarta, a government agency for evaluating medical devices and facilities. The data taken using deflation method, which means taken during the cuff's pressure decreasing. Important characteristics are as follow [5]: (1) for heart rate 80 BPM, the oscillation appear every 750 millisecond, 250 millisecond rising phase and 500 millisecond falling phase; (2) oscillation begin at pressure 20 mmHg above preset systole; (3) oscillation slowly decreased linearly until a certain pressure point, 5 mmHg under preset diastole; (4) mean arterial pressure (MAP) for blood pressure 120/80 mmHg is 96 mmHg.

The proposed system basically uses an oscillometric system with an additional actuator to generate small pressure to simulate oscillation as in oscillometric characteristic. Besides the processor, two main components in oscillometric system are pressure sensor and band pass filter (BPF) to monitor cuff pressure and oscillation that corresponding with heart rate respectively. Figure 1 depicts the block diagram of the proposed system. DC motor based micro air pump that commonly used as pressure pump in NIBP monitor will be used as actuator, as shown in Figure 2.

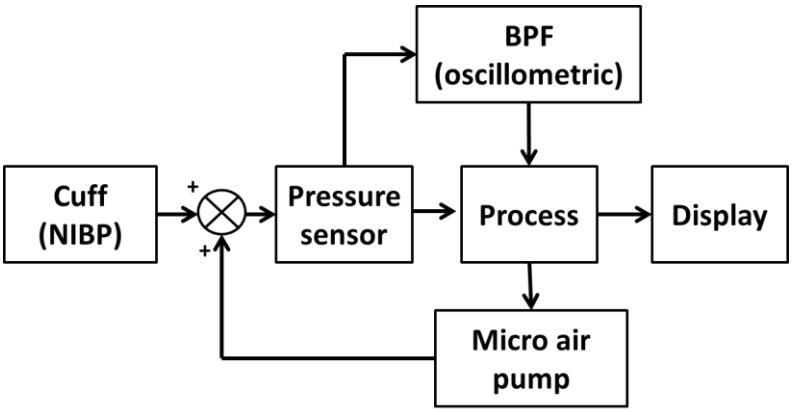

Figure 1. Block diagram of proposed NIBP simulator

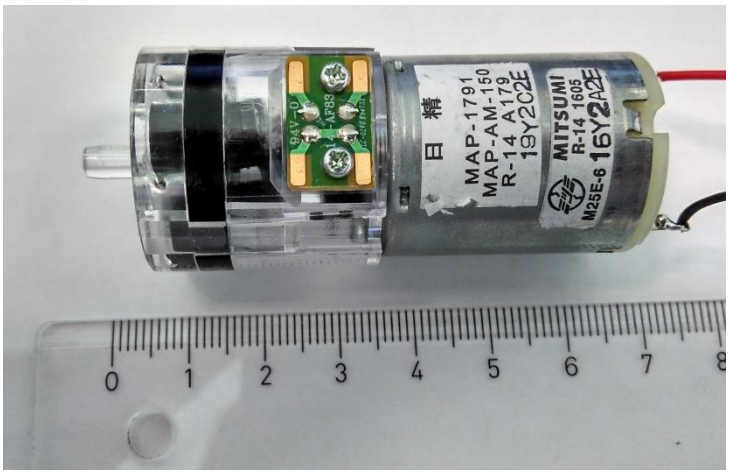

Figure 2. Mitsumi DC micro air pump

The cuff will be connected to NIBP monitor and simulator through a T junction. NIBP monitor then will pump the cuff until a certain pressure point while simulator will add small pressure oscillation based on the detected cuff pressure at the time.

Pressure sensor type MPX5100GP is used to monitor the cuff's pressure. The output of this sensor can be directly fed to analog digital converter. The sensor has calibrated in BPFK Jakarta using static pressure test device in range 0-300 mmHg.

The BPF is designed with bandwidth 0.5-5 Hz, corresponding with heart rate 12-120 BPM. Figure 2 shows the circuit of the BPF, while Figure 3 depicts Bode plot of the BPF, simulated with Multisim 11.0. Real testing cannot be done since the start frequency is very low (less than 0.5 Hz).

To generate oscillation that corresponding with heart rate, the actuator will pumps air to the NIBP's cuff for several millisecond and stop it afterward to replicates rising phase and falling phase respectively. For instance, to replicates 80 BPM heart rate, actuator will pumps air for 250 milliseconds and wait for 500 milliseconds for the next pumping. The generated oscillation will be adjusted to replicate oscillometric characteristics by adjusting the pumping power. It can be done by controlling the speed of the DC motor using pulse width modulation (PWM) method. The actuator then should be tested to approximate its PWM characteristics at different pressure points.

A microcontroller used to processes information from sensor and BPF, and also to controls actuator and display. Display is not essential for generating oscillation, only for user interface.

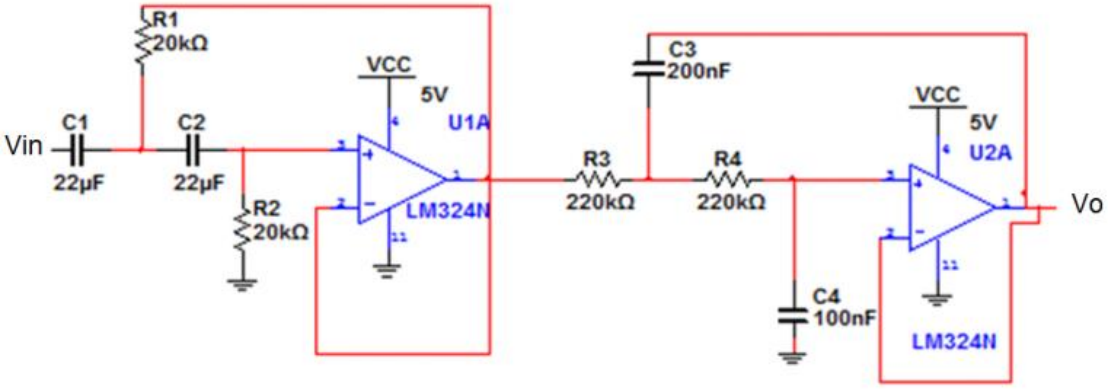

Figure 3. Band pass filter Sallen Key 2nd order

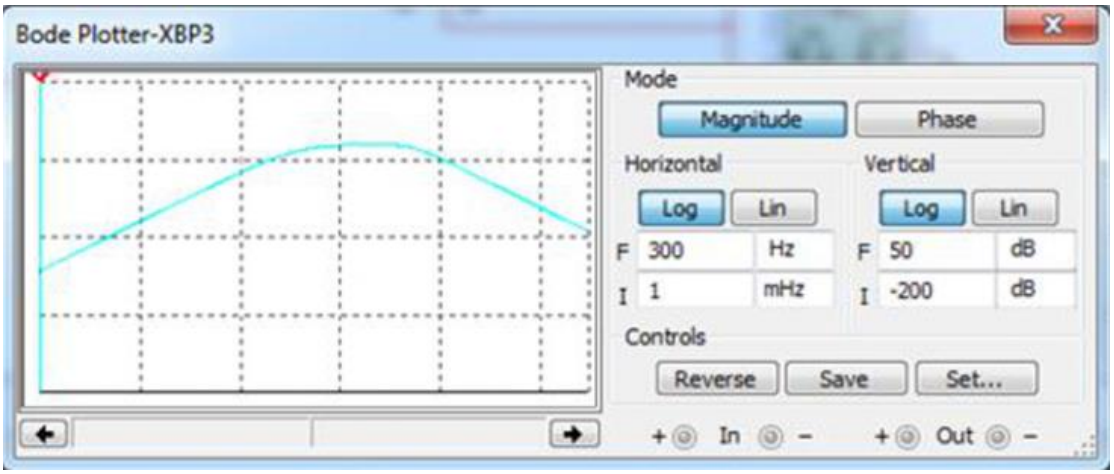

Figure 4. Simulated Bode plot of the BPF

Target envelope of the oscillation has been set based on reference data characteristics, with the peak is at desired MAP value. Current cuff's pressure and previous oscillation will determine the power of the generated oscillation. If cuff's pressure is in oscillation range, difference between previous oscillation and target envelope at particular pressure point will be calculated. The difference then will be used to determine duty cycle of PWM according the actuator characteristics. Figure 5 and Figure 6 describe the algorithm in more detail.

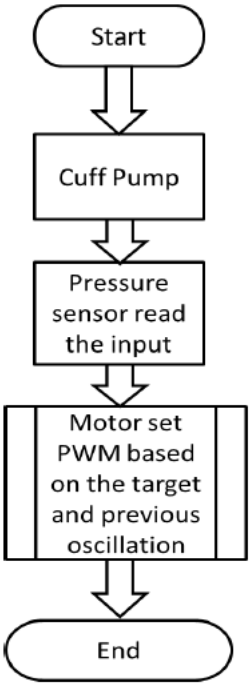

Figure 5. Main flowchart

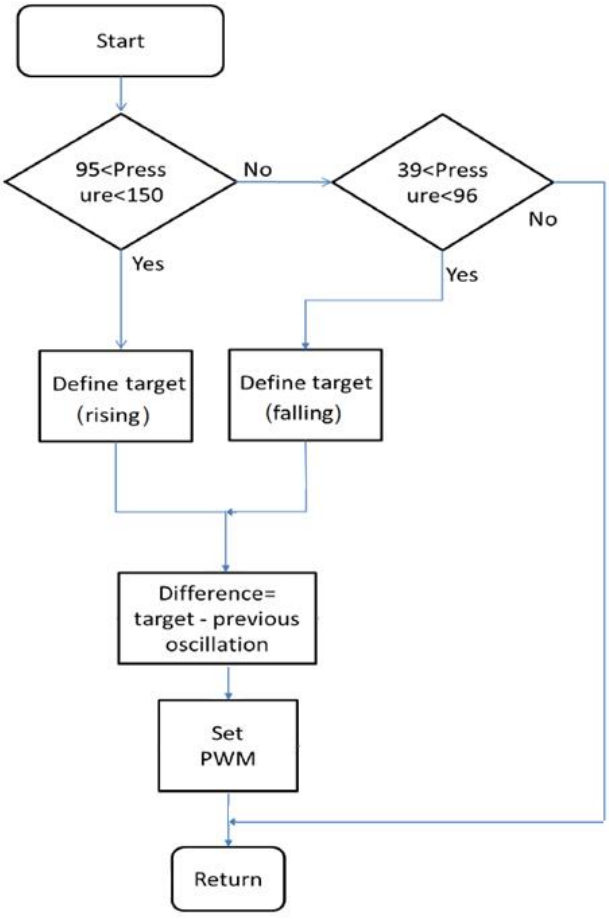

Figure 6. Set oscillation flowchart

3. Results and Discussion

Proof of concept of the proposed simulator system has successfully developed; with approximation total cost of the hardware is around three million rupiah as shown in Table 1.

Table 1. List of hardware

Item	Approx. price (IDR)
Pressure sensor MPX5100GP	350,000
Arduino Mega ADK	1000,000
DFRobot Motor Driver Shield	500,000
BPF based on op-amp LM324	50,000
Mitsumi Micropump MAP-AM-265	60,000
Power supply	500,000
LCD	500,000
TOTAL	**2,960,000**

One of the test results of reference device and the developed prototype is shown in Figure 8 and Figure 9 respectively.

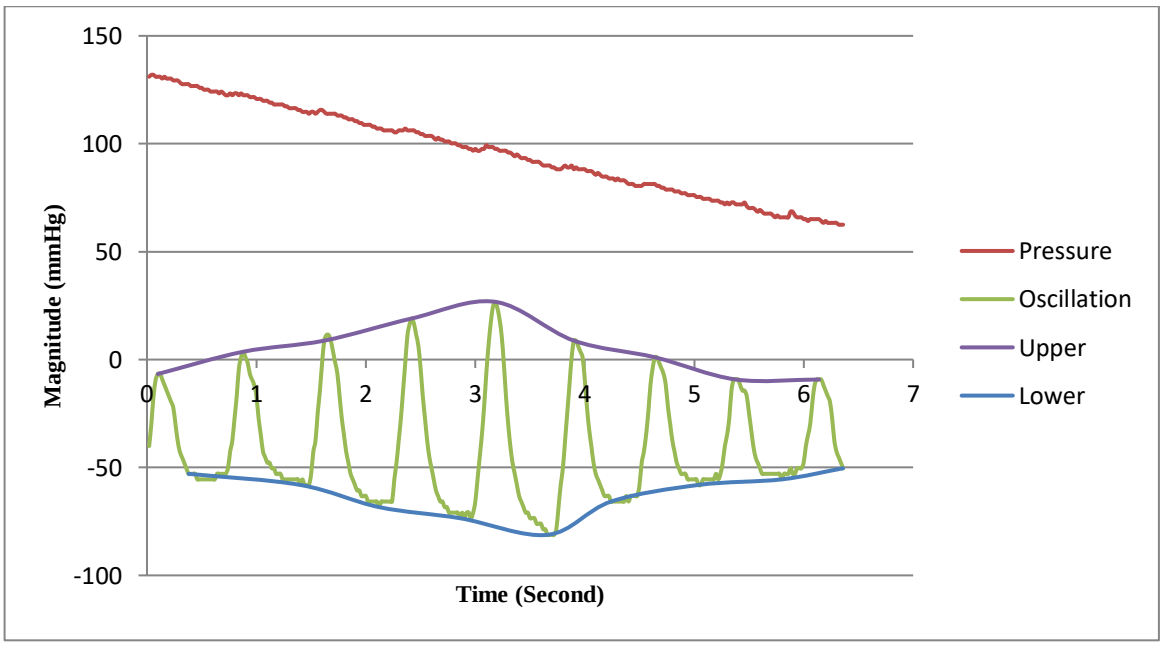

Figure 8. Test output of Omron NIBP monitor tested by the reference device

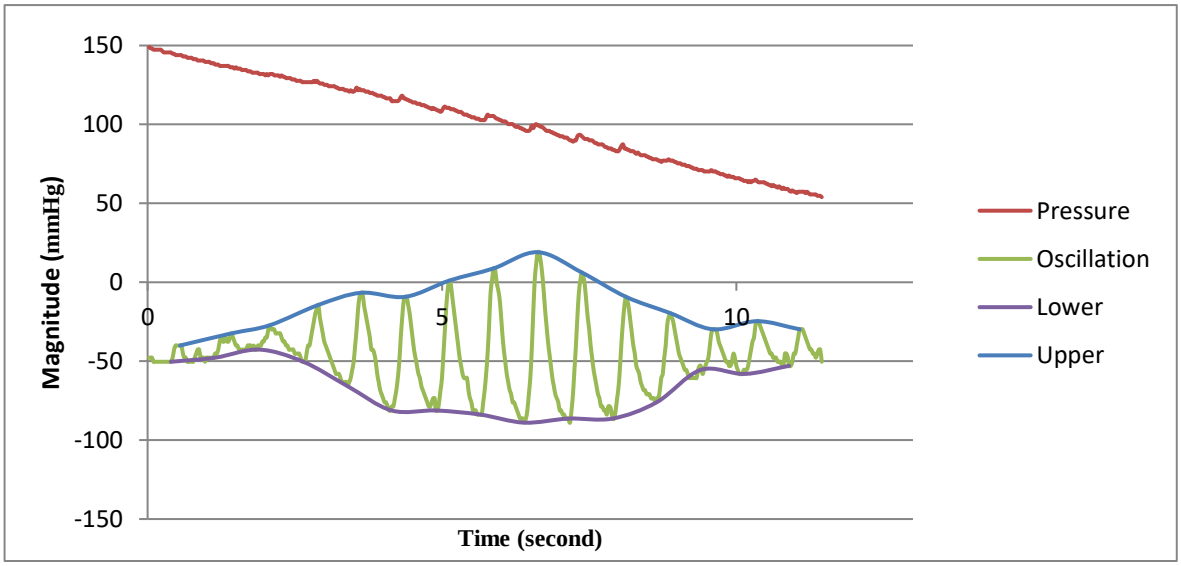

Figure 9. Test output of Omron NIBP monitor tested by the developed prototype

The slope of the oscillation envelope of the developed prototype is quite linear. But the generating oscillation algorithm still need to be improved to yield better accuracy for diastole value compared to the reference device as shown in Table 2. Since the reference data taken with deflating method, relation between diastole point and oscillation could not be determined easily as systole point. Hence the target envelope needs to be revised.

Table 2. Comparison of reference device and the developed prototype

	Systole (mmHg)	Diastole (mmHg)	Heart rate (BPM)	MAP (mmHg)
Reference	119±1	80±1	80±1	100.4 ± 3.0
Error	0.8%	0.0%	0.0%	2.5%
Prototype	118±2	77±1	80±1	98.9 ± 0.6
Error	1.7%	3.8%	0.0%	1.0%

4. Conclusion

Prototype of non-invasive blood pressure simulator for oscillometric method could be developed using common hardware that can be easily found in the market, although the algorithm may needs several improvement to improve the characteristic and feature. Approximation total cost for the hardware is around three million rupiah, much cheaper than final price of commercial existing device which cost more than a hundred million rupiah in Indonesia.

The performance of the developed prototype tested to evaluated NIBP monitor is as follows.

- Average generated MAP is 98.9 mmHg with standard deviation 0.6 mmHg and error to the target (98 mmHg) is 1.0%.
- Average generated systole is 118 mmHg with standard deviation 2 mmHg and error to the target (120 mmHg) is 1.7%.
- Average generated diastole is 77 mmHg with standard deviation 1 mmHg and error to the target (80 mmHg) is 3.8%.
- Average generated heart rate is 80 BPM with standard deviation 1 BPM and error to the target (80 BPM) is 0.0%.

Reference data should be completed with inflating method, so the relation of diastole point and oscillation could be determined. Combined with deflating reference data, target envelope could be revised to yield better accuracy for all parameters.

The most important part from the reference device is the assurance of the result. Therefore the final product later should be tested and certified with corresponding standard.

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SECTION 3 :

AGRICULTURE ENGINEERING AND FOOD SCIENCE

The Roles of Interdisciplinary Research in Developing Knowledge-based Economy

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Abstract. *This paper examines the roles of interdisciplinary research in developing knowledge -based economy, taking the case mostly on the Indonesian economy. The pathway towards the knowledge-based economy that has been established during the previous government administration seems to deviate a bit further as the global economy downturn significantly affects the Indonesian economy. Major macroeconomic indicators have show some declines in recent years as the global price decline of important commodities have affected the Indonesian economy and the regional economy relied on natural resources. The Indonesian performance of innovation and competitiveness has declined seriously in the last two years, mostly due to lack of direction in and consistency in developing the strategy of knowledge-based economy. In this paper, the knowledge-based economy (KBE) is defined as the economy that has effective systems of education and skills, information and communication technology (ICT) and data technology (DT), research and development (R&D) and innovation, and economic and institutional regimes conducive for knowledge. Interdisciplinary roles play important and strategic roles in integrating these four major components of the knowledge-based economy, from the very beginning of ideas development, stability and adaptation of research results in the real world conditions to the adoption and application level in the economy. The development and continuous improvement of knowledge creation, knowledge as a source of value and the sustainability of knowledge-based economy should be conducted both at micro and industrial scales and at macro and policy level. The paper strongly recommends that interdisciplinary research (and trans-disciplinary) should start from campus before being applied to private sectors and public institutions. The government and universities could establish centers of excellence to strengthen coordination between research and development (R&D) in public institutions and private industries. Indonesia is really in needs of increasing budget allocation for R&D and Rfor-D at least 1 percent of the gross domestic product (GDP), from the public funds, state-owned enterprises (SOEs) and private sectors, and empowering innovation networks, involving academics, business, government and civil society (ABGC). Therefore, Indonesia needs continuous improvement and capacity building of researchers and research institutes and strengthening the institutions of extension system in the country. Finally, new and futuristic policies are needed to remove key barriers to establishing, developing and financing creative industries and creative economy that would shape the future of knowledge-based economy in Indonesia.*

Keywords*: knowledge-based economy*

The Effect of Embossing on the Rigidity of Wheel for Agricultural Tractors

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Abstract. *The fin wheel of agricultural tractors, as the essential part of the hand tractor, was frequently damaged during operation because the rigidity of fin wheel cannot able to hold the soil resistance. The experiments were conducted to determine the effect of embossing on pressure load, deflection, and the rigidity of fin wheel of hand tractor. The carbon steel plate (Ultimate strength of 42 kg/mm^2) was used as material of fin wheel. The type of embossing has 2 pieces with the different high (i.e. 4 mm, 5 mm, and 6 mm). The experiments were started from designing the punch and dies, preparing plates as raw of fin wheel, forming plates to be fin wheel, testing with pressure loading until due to deflection. The result of experiments was presented that increasing of embossing high and embossing quantity will be increase the pressure load as well as the rigidity of fin was increase*

Keywords*: Embossing, Deflection, Fin wheel, Pressure Load, Rigidity*

1. Introduction

Agricultural tractor was designed to use a driving machine to replace the animals. Hand tractor is one of the farm machinery that is used to attract tillage equipment (such as plow fields) on wet soil and dry soil [1-2]. Mechanization replacing manual and animal-draft tillage and spread in Asia and Africa [3-4], and even now there are a large number of two-wheel tractors (2 WT) operating in South Asia and Africa [5] showed a great interest among small farmers in mechanical processing. Most minimum tillage systems have confirmed the cost savings and increased grain yield [6]. Hand tractors have a high adaptability to land conditions in Indonesia. Hand tractors consist of several components, and one of the important components is the fin wheel tractor that has a function to crumble the soil in the paddy fields.

Paddy soil conditions and tractor construction is a factor that determines the shape of the fin design tractor wheels. Resistance ground reaction forces in the vertical direction to the fin wheel is 162.5 kg (1.6 kN) and in the horizontal direction for tensile loads and fin wheel roll resistance force of 0.9 kN in a wheel. Fin wheel tractor for brand Quick G 600 has a specification of 27 cm x 8 cm x 4.5 mm and is made of steel [7]. The process of bending and forming embossing will be able to increase the strength and stiffness of metal sheets, so that the cost of making the fins tractor wheels can be reduced by using a thinner sheet metal [8]. Bending and forming embossing process is widely used in metal forming to make products

and components in the manufacturing process such as electronic panel components, automobile panels, hand tractors, etc. [9].

Studies on the effect of embossing the plate have been investigated experimentally and by simulation. The study results showed that the embossing technique can be used to improve the rigidity of the sheet plate by considering several parameters such as the amount, position, height and distance of the embossing. This technique not only focuses on the increased the rigidity of the sheet metal but also to create the desired shape such as panels, car doors, and other components [10-11].

2. Research Method

This research was conducted by the following process as: designing and making punch and dies in the CAD/CAM laboratory, making the specimen in the laboratory CNC, testing the specimen the tensile strength of laboratory mechanics. Fin wheels were formed before testing on bending load conducted in the laboratory mechanic. The equipment used in this experiment such as CNC milling, drilling machines, gas welding, grinding hand, caliper, Universal Testing Machine (UTM), press brake bending machine V, and dial test indicator (DTI). The specimen was formed by using a punch and dies in the press brake bending machine V in the mechanical workshop.

In this experiment, a mild carbon steel plate was used as workpiece materials for the fin material with mechanical properties such as in Table 1.

Table 1. Specification of fin wheel material

Specification	Units
Tensile strength (kgf/mm^2)	42.640
Yield strength (kgf/mm^2)	38.945
Elongation (%)	29

3. Results and Analysis

The fin wheel which has a size of 270 x 80 x 3.8 mm (for type of hand tractors Quick G 600), which formed by the addition of embossing through the sheet metal forming process by using punches and dies as shown in Figure 1.

Figure 1. Experimental Methods for Embossing on Fin Wheel Using Bending Press Brake V

Figure. 2. Results of Experimental Embossing with Two Pieces

Figure 2 shows the results of a tractor wheel fins that are formed with one and two pieces of embossing, and height variations embossing 4, 5 and 6 mm. Fin wheel has been formed by the addition of embossing which performed bending test to determine the rigidity as shown in Figure 3. The deflection that occurs in the bending test was measured with a dial indicator precision of 0.01 mm. The results of the bending test each specimen is shown in Figures 6, 7 and 8.

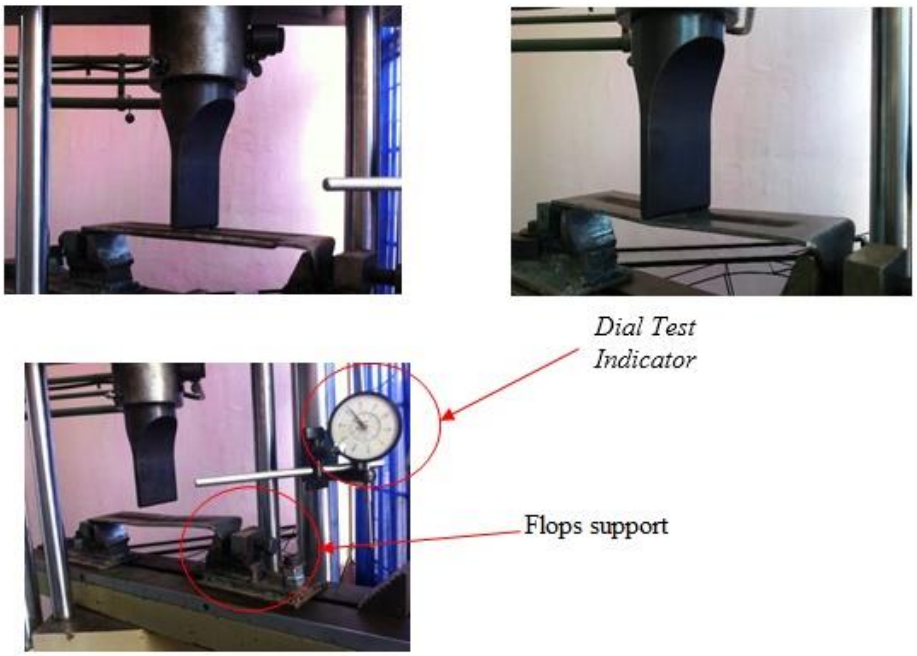

Figure 3. The Process of Bending test on the Universal Testing Machine (UTM)

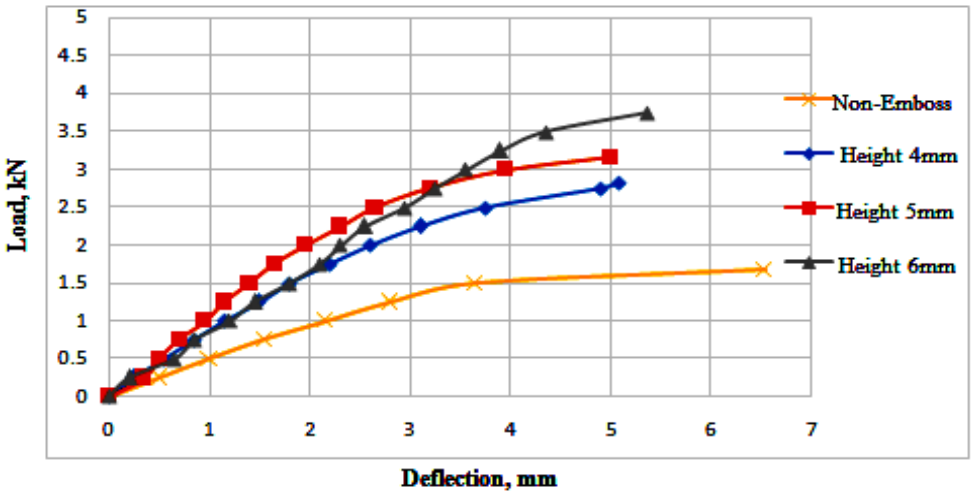

Figure 4. Deflection Versus Loading for Two Pieces Embossing

Figure 4 shows the relationship between the loads versus deflection that occurs in a triangular fin with one and two embossing. In these graphs show that the greater the applied load will cause increased deflection occurs. Fins without embossing has a maximum bending load is smaller than the fins have embossing, while the maximum deflection obtained on the fins without embossing compared with embossing.

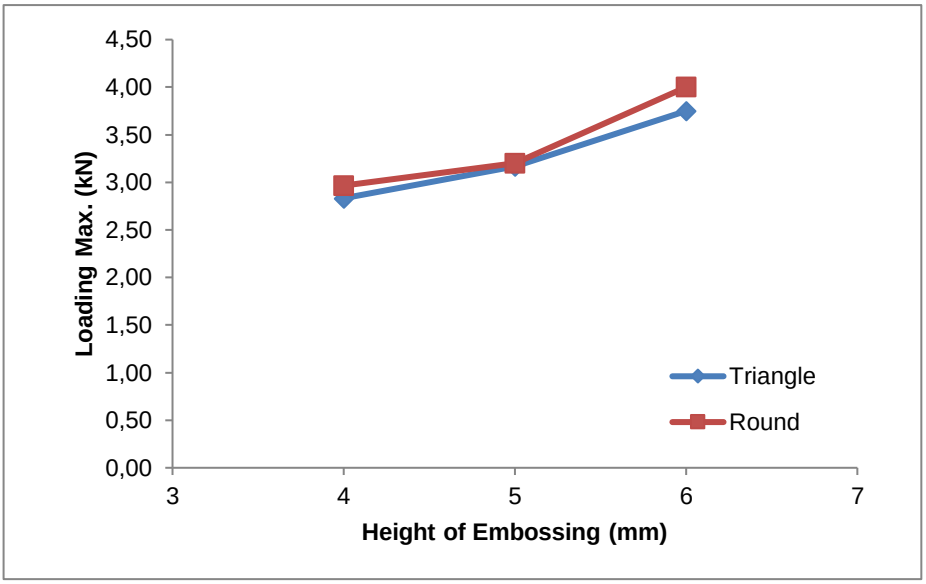

Figure 5. Height of Embossing Versus Loading

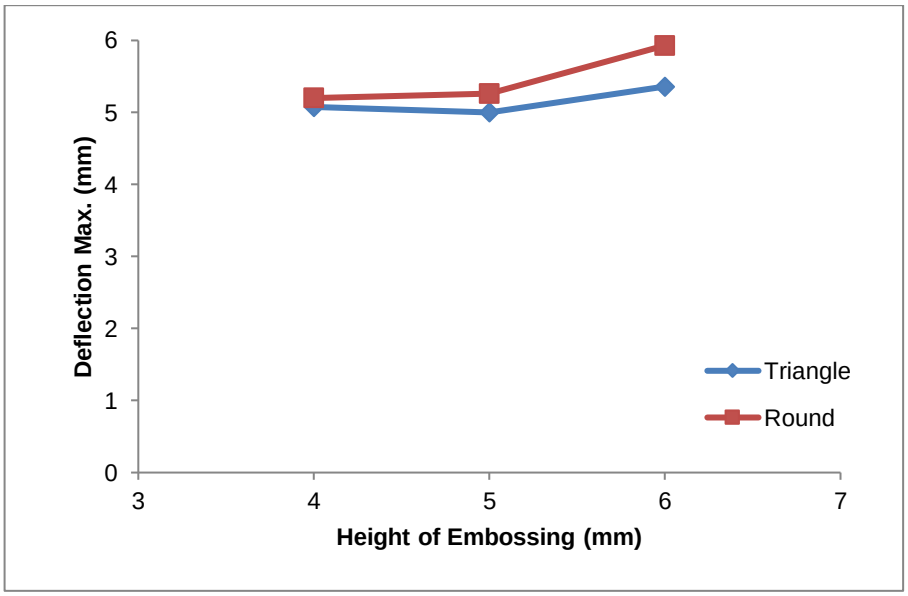

Figure 6. Height of embossing versus deflection

Figure 5 shows that the higher of embossing height will be result in the increasing bending load for both of one and two embossing. Fin wheel of two embossing have a greater bending loads and better rigidity than the one embossing. While Fig 6 shows that the fin wheel tractor for the embossing has a fin deflection greater than two embossing. Deflection that occurs tends to become smaller with increasing height embossing The lowest maximum bending load on the tractor wheel fins was obtained on the fin with the one of embossing and 4 mm of embossing height with a load was 2500 N, while the highest load obtained at number two embossing with embossing height 6 mm is equal to 3750 N. While the maximum bending load for fin-wheel tractor with no embossing is 1766 N. soil resistance force on the

wheel tractor is 162.5 kg (1600 N) and the rolling resistance force is 900 N, so that a large of resultant force acquired resistance was 1837 N [7]. This indicates that the fin wheel tractor that has embossing has a higher rigidity than without embossing. Wheel tractor fin thickness of 3.8 mm carbon steel (Strength of 42 kgf/mm^2) which has a maximum embossing bending strength greater than the resistance of the soil force. For other investigation such determining the power demand on bending process, it can be performed to calculate the power demand through the turning process that was done by Nur (2016) and Nur et al (2014). They were analyzed the use of the power demand in the turning process of AISI316L stainless steel and aluminum alloy respectively.

4. Conclusion

The experiment results conducted with the formation of embossing on the fin wheel tractor shows that the addition of embossing can increase the stiffness of the fin wheel tractor. Increasing rigidity of fin-wheel tractor which has embossing adds the ability to resist the pressure the soil compared to the fins without embossing. Fins with two embossing has a higher rigidity of than one embossing. The greater the height of embossing the rigidity of fin wheels also the larger. For fin wheel tractor with a thickness of 3.8 mm has maximum bending load is greater than the soil resistance.

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Aqueous Extraction Optimization of *C. citratus for* Development of Food Ingredients with Alpha Glucosidase Inhibitory

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Abstract. *Aqueous extracts of three Indonesian local plant species Cymbopogon citratus, Musa paradisiaca, Allium cepa L. var. aggregatum, were shown to inhibit >75% activity of sucrase at 500 µg/ ml concentration with C. citratus shown to have least citotoxicity in Brine Shrimp Lethality Test. Further temperature challenges treatment to the species using hot extraction temperature on 60 °C, 70 °C, and 80 °C with 10, 20, and 30 minutes of extraction time, resulted in the finding of C. citratus as species with most heat-stable activity. Further processing with spray drying required certain amount of minimum total soluble solid, and therefore, extraction optimization guided by TSS as desired yield were done to test the impact of ratio, method and time. Extraction method selected was aqueous extraction 70^{0}C, 40 min and using stirrer with ratio material water 3:10, that resulted in 2.0% of TSS. Optimized aqueous extract of C. citratus showed relatively high inhbition against sucrase and amylase activity at concentration 0.3g/ml (100% inhibition sucrase and 82%inhibition amylase).*

Keywords*: Alpha Glucosidase Inhibitor; extraction, optimization*

1. Introduction

Previous researches showed the potencies of Indonesian medicinal plants as the sources of alpha glucosidase inhbitors for diabetic treatments [3-6]. Exploration of more than fifty methanolic extracts of Indonesian medicinal plants used for diabetic treatment resulted in several potential species with high inhibition activity against sucrase [8], [2]. Further development for these active species into dried food ingredients would be more practical if the activities could be extracted using water extraction and they retain the inhibition against heat challenges. This study further screened the active species based on their glucosidase inhibition activity stability in water extraction and against heat challenge, followed by extraction optimization for the purpose of further processing into ingredents.

2. Research Method

A. Material

All of the plant samples, were purchased from CV Sekar Utami, Indonesia. Plant samples were dried until 10% of moisture content using oven. The drying process was done using the temperature of 60 °C for 24 hours.

Glucosidase enzyme from rat intestinal acetone powder was supplied from Sigma-Aldrich Singapore Co. Potassium phosphate buffer pH 7, Ethylenediaminetetraacetic acid (EDTA) were supplied from Sinopharm Chemical Reagent Co., Ltd. Methanol and maltodextrin were technical grade and purchased from PT Bratachem Indonesia. All other chemicals were analytical grade and acquired from Merck, Germany unless stated otherwise.

B. Plant samples extraction

In the first determination of samples with high inhibitory against sucrase in water extraction, plant samples were macerated using water for 24 hours in room temperature. Each plant samples that showed potential inhibition in its aqueous extract, was challenged with three different heat extraction temperatures (60 °C, 70 °C, and 80 °C) at different extraction time (10, 20, 30 min). Plant samples activity in water extraction and against heat challenges were determined using in-vitro sucrase inhibitory activity assay. For the purpose of food ingredients development, prior heat challenge, plant samples were also tested for their citotoxicity using Brine Shrimp Lethality Test.

Samples with the best inhibition stability against heat challenge was then selected for the next step of extraction optimization with variation of raw material:water ratio (1:10; 2:10; 3:10 and 4:10), extraction methods (shaking, sonication, and stirring) and extraction time (20, 30, 40, 50 and 60 min). As initial research stage for further ingredients development with spray drying pulverization process, optimized extraction were determined using total soluble solid analyzer.

C. Rat intestinal sucrase inhibitory activity assay.

Sucrase inhibitory activity was determined using method described previously in Gunawan-Puteri and Kawabata (2010) with slight revision. Rat intestinal acetone powder was cold-grinded and dissolved in 0.1 M potassium phosphate buffer (pH7.0) containing 5 mM EDTA and centrifuged at 10,000 rpm, 4 °C, 60 minutes.

The inhibitory activity against sucrose hydrolysis was measure by the following procedures. Two test tubes, as sample and control, containing 0.20 ml sucrose solution (56 mM) in potassium phosphate buffer (0.1 M, pH 7) and two test tubes, containing 0.40 ml potassium phosphate buffer (0.1 M, pH 7) as each blank were pre-incubated at 37 °C for 5 min. The control and control blank defined as 100% and 0% enzyme activity, respectively. The working samples diluted in water (0.10 ml) were added to the sample and sample blank test tubes while 0.10 ml water was added to the control and control blank test tubes. And then crude rat intestinal sucrase (0.20 ml) was added only to the test tubes containing sucrose solution (sample and control). The reaction was carried out at 37 °C for 15 min and stopped by adding Tris–HCl buffer (2 M, pH 6.3, 0.75 ml).

The reaction mixtures were then passed through a short column of basic alumina (30 x 5 mm) for removing phenolics which may interfere with the following glucose quantification. Each mixture was taken 0.5 ml to other test tubes and was added with 0.5 ml DNS solution. All mixtures were incubated for 5 minutes in boiling water. The absorbance (Abs) was measured using UV-Vis spectrophotometer at 540 nm wavelength. Inhibitory activity was calculated by the following equation:

$$\text{Inhibitory activity (\%)} = \frac{(Abs_{control} - Abs_{controlblank}) - (Abs_{sample} - Abs_{sample\ blank})}{(Abs_{control} - Abs_{controlblank})} \times 100\%$$

The experiments were done in duplicate at 500 µg raw material/ml concentration (unless stated otherwise), and the results were presented as % inhibition, which define as the sucrase inhibitory activity at certain concentration under the assay conditions.

In spray drying trials, inhibition degradation was calculated by the following equation:

$$\text{Inhibition activity degradation (\%)} = \frac{Act_{beforespraydry} - Act_{afterspraydry}}{Act_{beforespraydry}} \times 100\%$$

D. Brine Shrimp Lethality Citotoxicity

Citotoxicity determination was determined using method described previously [7].

Each of the parent sample 500 µg samples with 3 milliliters of sea salt water and 10 µg DMSO 100% were dissolved with water into 1000 ppm and dilluted into 100 and 10 ppm. Each sample was added with total amount of 10 nauplii of *Artemia salina* larvae. The samples were left for 24 hours. The exepriments were done in triplicate and the data collection was done by counting the amount of the mobile nauplii.

3. Results and Analysis

In previous study, 57 methanolic extract from 56 species and 43 families were observed for their inhibition activities against sucrase. Among them, 8 samples showed high inhibitory activity at concentration of 0.10 g/ml and five samples have more than 50% AGIs activity (Soedarma, 2015). Those five samples were re-extracted using water as solvent and their inhibition activities determination showed >75% inhibition activity at the concentration of 500 µg/ ml for *Cymbopogon citratus, Musa paradisiaca,* and *Allium cepa L. var. aggregatum* respectively. Further cytotoxity analysis of these three samples resulted in the finding of *C. citratus* with highest concentration to cause 50% lethality in the species brine shrimp lethality test, hence least cytotoxity (Table 1).

Table 1. Cytotoxicity of *C. citratus, M. paradisiaca,* and *A. cepa* aqueous extracts

Sample	LC_{50} (µg/ml)
Cymbopogon citratus	**36.38**
Musa paradisiaca	6.99
Allium cepa	1.32

Above three samples were submitted for spray drying trials (maltodextrin filler, inlet temperature of 130°C). All samples encounter reduction on the sucrase inhibitory activity when it is being applied as a spray dried product despite the application of maltodextrin that may reduce the heat exposure to the extract. In term of visual powder appearance, *A. cepa* has best powder texture, followed with slightly caked-powder of *C. citratus,* spray-dried *M. paradisiaca* has hard textures and sticky, that does not even resembles powder product. According to [1], sticking on the powder particles was caused by the amount of sugar compounds in the samples, whereas *M. paradisiaca* or banana peel used as sample is known to have high content of sugar. The spray dried product was further submitted for sucrase inhibitory activity assay and the result was compared with prior spray drying extract. Inhibition degradation calculation showed that *C. citratus* has the least inhibition degradation in the spray drying condition (Table 2).

Table 2. Yield and percentage of sucrase inhibition degradation of *C. citratus, M. paradisiaca,* and *A. cepa* upon spray drying treatment (inlet 130°C)

Sample	Yield (gram)	Sucrase Inhibition degradation (%)
Cymbopogon citratus	**2.20**	**26.09**
Musa paradisiaca	1.33	90.00
Allium cepa	5.42	70.78

Above three plant samples were then further challenged with water extraction using three different temperatures (60 °C, 70 °C, and 80 °C) and three different infusing times (10, 20, and 30 minutes). *M. paradisiaca* showed highest inihibition activity in almost all time and temperature treatment, amongst other species tested. However the spray drying showed large degradation inhibition activity sucrase inhibition activity (Table 2), most possibly due to its high sugar content. *M. paradisiaca* also showed significant drop of inhibition activities upon extraction in 80 °C, 30 minutes, showing that active compounds playing roles in the sucrase inhibition activities might not very stable to treatments of 80 °C or higher temperature (Table 3).

C. *citratus* showed considerably high and stable sucrase inhibition activities in various time and temperature challenge, though 10 minutes extraction at 60-70°C seemed not sufficient to extract the activities, while the active compounds stability also decreased, though not as sharp as *M. paradisiaca*, at the 30 min extraction of in 80 °C water extraction. Most inhibition in *C. citratus* was shown on the extraction at 70°C for 30 min (Table 3). The stability of *C. citratus* against heat challenge together with lower inhibition degradation in spray drying trial and also lowest cytotoxicity among tested sample showed its potencies to be chosen for the next stage of extraction optimization with 70^0C and in 30 minutes was selected as the based extraction method for the next stage of extraction which the aim was for optimize the yield of extract.

Table 3. Yield and sucrase inhibitory activities *C. citratus, M. paradisiaca,* and *A. cepa* in various temperature and time extraction of heat challenge assay

Sample	T (°C)	t (min)	Yield (gram)	Sucrase Inhibitory Activity (%)
Cymbopogon citratus	60	10	0.53	0.00
		20	0.81	62.54 ± 1.25
		30	0.80	65.54 ± 5.11
	70	10	0.68	15.15 ± 1.86
		20	1.00	65.95 ± 4.67
		30	1.30	100.00
	80	10	0.42	72.17 ± 5.34
		20	0.41	85.95 ± 3.93
		30	0.62	44.94 ± 1.66
Musa paradisiaca	60	10	0.88	70.23 ± 3.24
		20	1.46	100.00
		30	1.06	100.00
	70	10	4.23	100.00
		20	4.48	100.00
		30	**2.33**	**100.00**
	80	10	1.39	100.00
		20	1.27	100.00
		30	0.77	8.17 ± 3.67
Allium cepa	60	10	1.23	0.00
		20	1.86	8.75 ± 3.45
		30	2.26	0.00
	70	10	1.76	0.00
		20	2.08	2.80 ± 1.04
		30	2.35	2.42 ± 0.16
	80	10	1.15	4.58 ± 2.79
		20	1.5913	0.00
		30	1.3646	0.00

In the first optimization trial, *C. citratus* was macerated in water with several ratio of plant and water. As expected, more plant material used will result in more total soluble solid (TSS), as shown by highest TSS resulted from ratio 3:10. Increase of the %TSS was linear with increase in the amount of plant material used (Table 4). Beside, this three variables ratio at 4:10 was also done, but, due to the amount of solid (plant) was too many and can not be drawn in the solvent the results were instable which is not showed in the table above.

Table 4. Impact of water:solid ration, extraction method, and extraction time extention to total soluble solid of *C. citratus* aqueous extract

Ratio (plant:water)	Method	Time (minutes)	% TSS
I. Impact of plant:water ratio to total soluble solid			
1:10	Maceration (70^0C)	30	0.3 ± 0.00
2:10	Maceration (70^0C)	30	0.6 ± 0.00
3:10	Maceration (70^0C)	30	0.9 ± 0.00
II. Impact of extraction method to total soluble solid			
3:10	Sonication (70^0C)	30	1.7 ± 0.00
3:10	Stirring (70^0C)	30	1.7 ± 0.00
3:10	Shaking (70^0C)	30	1.2 ± 0.00
III. Impact of extraction time extention to total soluble solid			
3:10	**Stirring (70^0C)**	**40**	**2.0 ± 0.00**
3:10	Stirring (70^0C)	50	2.0 ± 0.00
3:10	Stirring (70^0C)	60	2.0 ± 0.00

In the second optimization, treatment of sonication, stirring, and shaking was added rather than only maceration. Compare to the first method which only using water bath resulted in 0.9% TSS, use of sonicator, stirrer and shaker increased total soluble solid into 1.7%, 1.7% and 1.2%, respectively (Table 4). Sonication and addition of stirrer gave a same result, however stirring might be more applicable in term of cost and practicality in further potential scale up.

In heat challenge assay, time extraction tested was only up to 30 minutes. In base extraction used at 70°C it shows gradual increase of extracted activities from 10-30 minutes (Table 3). It is assumed that further extraction time might be able to extract even more active compounds. Extension of extraction time did increased total soluble solid from 1.7% in 30 minutes to 2.0% in 40 minutes. However the time extension of more than 40 minutes did not improve total soluble solid and was assumed not to improve extraction result. Based on the result of these three optimization, selected extraction procedures for *C. citratus* was extraction with water at 70°C for 40 minutes, using ratio plant:water = 3:10 and continuous

stirring. Following analysis at concentration 0.3 g/ml of the extract showed 100% inhibition activity against sucrase.

4. Conclusion

Cymbopogon citratus, Musa paradisiaca, and *Allium cepa L. var. aggregatum* aqueous extracts showed >75% inhibiton activities at 500 µg/ ml concentration. *C. citratus* showed lowest cytotoxicity (LC_{50} 36.38 µg/ml), lowest sucrase inhibition degradation (26.09%), and relatively stable sucrase inhibition activity at 60-80 °C, with optimum extraction temperature at 70 °C. Further extraction optimization showed that most yield, as shown with %TSS, was acquired at extraction with water at 70°C for 40 minutes, using ratio plant:water = 3:10 and continuous stirring. Results of the finding may suggest further application of *C. citratus* processing into dried ingredient, especially using spray drying pulverization, with sucrase inhibition activity for anti-diabetic treatment.

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