Design and Prototyping The Automatic Fish Feeder Machine for Low Energy

by Nundang Busaeri

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on Sustainable Engineering and Creative Computing

Bandung, 20 - 22 August 2019

Proceedings

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The honorable,

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Keynote speakers,
Invited speakers,
Dean of Faculty of Computing,
All Heads of Study Program within both Faculties of Engineering and Computing,
Ladies and Gentlemen,

On behalf of all members of the committee, I am honored and delighted to welcome you to the International Conference on Sustainable Engineering and Creative Computing (ICSECC 2019), held from 20 to 22 August 2019, at Grand Tjokro Hotel, Bandung.

We are pleased to accept 81 papers from Indonesia, South Korea, Taiwan, and Netherlands. It is also a great pleasure to welcome 4 keynote speakers and 4 invited speakers from 5 different nationalities with us in this conference, where we hope they can share their knowledge and experience. The theme of the conference is "New Idea, New Innovation" with the wish that this event can be a place to share new ideas, new innovation, but furthermore to get new insights, and to make new friendships.

The ICSECC has been intended to focus on various areas of research in Engineering and Computing. The goal of this conference is to provide opportunities for professors, academics, researchers, and students from all over the world, to come together and to learn from each other. ICSECC 2019 aims to accelerate scientific discoveries and major milestones in the current situation, challenges and innovations related to Engineering and Computing.

As the General Chair of the conference, I realized that the success of this conference depends ultimately on the many people who have worked together in planning and organizing this conference. In particular I thank all the colleagues, who were involved in review process before the conference, are involved in technical program preparation during the conference, and will be involved in publication process after the conference.

Last but not least, I would like to thank IEEE Indonesia Section and CSS/RAS Joint Chapter, for the cooperation with ICSECC. All accepted and presented papers in the conference will be published in IEEE Xplore.

I remind again all authors to be cooperative and responsive in the communication with the Publication Chair, even though the conference days are already over. All the minor and major revisions must be completed so that your papers can be fully accepted and can be published.

I hope this conference can be an inspiring experience for you. Also, I hope that you can enjoy your participation in the ICSECC 2019, in beautiful city of Bandung, Indonesia.

Best regards,
Dr.-Ing. Erwin Sitompul
ICSECC General Chair

43

Proceedings of the

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The first deadline of paper submission will 21 June 2019. Reviewers will be chosen based on field of expertise and non-student priority. Reviewers can also be experienced members of organizing committee. Thus, we strongly believe in the review results in the paper of the International Conference on Sustainable Engineering and Creative Computing (ICSECC 2019) will be strict and thus ensure high quality presentations.

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CONFERENCE PROGRAM

53

International Conference on Sustainable Engineering and Creative Computing (ICSECC 2019)

Grand Tjokro Hotel, Bandung, 20-22 August 2019

Day 1: Tuesday, 20 August 2019

Time	Agenda
14:00 - 17:00	Registration

Day 2: Wednesday, 21 August 2019

Time	Agenda
07:30 - 08:15	Registration
08:15 - 08:30	Safety Induction
08:30 - 09:00	Opening Ceremony National Anthem "*Indonesia Raya*" Welcome Speech from General Chair Welcome Speech from IEEE Indonesia Welcome Speech from Rector of President University
09:00 - 10:15	Keynote Speeches *Eur. Ing. Prof. J. Scott Younger, OBE* *Prof. Poki Chen, Ph.D.*
10:15 - 10:20	Token of Appreciation
10:20 - 10:45	Photo Session with All Participants and Coffee Break
10:45 - 12:00	Keynote Speeches *Prof. Datuk Mohd. Razali bin Muhamad* *Assoc. Prof. Tohru Suwa*
12:00 - 12:05	Token of Appreciation
12:05 - 13:00	Lunch Break
13:00 - 15:00	Parallel Session 1
15:00 - 15:05	Announcement of Session Best Presenter
15:05 - 15:30	Coffee Break
15:30 - 17:00	Parallel Session 2
17:00 - 17:05	Announcement of Session Best Presenter
17:05 - 17:30	Distribution of Conference Certificates
19:00 - finish	Gala Dinner Closing Speech

Day 3: Thursday, 22 August 2019

Time	Agenda
8:00 - 14:30	Bandung City Heritage Tour (optional)

PARALLEL SESSION SCHEDULE

Parallel Session 1A

Time	Speaker
13:00 - 13:30	Invited Speaker : Indonesian Maritime Challenges as Part of Sustainability (D. Wignall)
13:30 - 13:45	The Solution of the Capacitated Vehicle Routing Problem Using Variable Neighborhood Search with Threshold (A.Imran, F.Ramadhan)
13:45 - 14:00	Design and Prototyping Automatic Fish Feeder Machine for Low Energy Consumption (N. Busaeri; N. Hiron; A. Andang)
14:00 - 14:15	Development of Automatic CAD Drawing for Tyre Mould Design (N.A.Sutisna)
14:15 - 14:30	Analysis of Risk Priorities in Medical Record Unit at the Hospital (K.Syahputri, R.Sari, I.Rizkya, I.Alona, V.D.A.Zati)
14:30 - 14:45	Machine Tonnage Optimization by Reused Scrap Material Applied for Car Propeller Shaft Guard (V.A.Pratiwi, L.Anggraini)
14:45 - 15:00	The Performance of a Three-blades Fish-ridge Turbine in an Oscillating Water Column System for Low Waves (N. Hiron; I.A.D. Giriantari; I.N.S. Kumara; L. Jasa)

Parallel Session 1B

Time	Speaker
13:00 - 13:30	Invited Speaker : Waste to Energy – A Necessary Modern Day Application (M. I. Murray)
13:30 - 13:45	ZT: An Adaptive Learning Tool for Chinese L2 Learners (S. Darmowinoto)
13:45 - 14:00	Design of Distribution Routes Using Saving Matrix Method to Minimize Transportation Cost (I. Rizkya, N. Matondang, M. Ningsih)
14:00 - 14:15	Six Sigma Method for Improvement of Crude Palm Oil (CPO) Quality (K. Siregar)
14:15 - 14:30	Design of Testing Results of Reduction and Migration of Write off Transaction Data in POTS Segment Using Integration Testing on SAP Application (R.L.S. Sianturi)
14:30 - 14:45	Prototyping of Automatic Braking System Using Fuzzy Logic (A.N.D. Dewa, O. Wahyunggoro, P. Nugroho)
14:45 - 15:00	Maintenance Strategy Optimization in Uniformity Machines (Y. Syafei, J. Runtuk, D. Ruswandi)

Parallel Session 1C

Time	Speaker
13:00 - 13:30	Invited Speaker : Interoperability of Process Control in RAMI 4.0 (E. Joelianto)
13:30 - 13:45	Value Engineering in Crude Palm Oil Industry to Minimize Cost (I.Rizkya, R.Sari, K.Syahputri, E.Sitorus, I.Siregar)
13:45 - 14:00	Preliminary Study on Tamarindus Indica Seeds Kernel as Natural Coagulant for Color Removal of Synthetic Textile Wastewater (H.Kristianto, C.Handriono, J.N.M. Soetedjo)
14:00 - 14:15	Mapping of Communal Waste Water Treatment Plant User Group in Citarum River Areas Using Geographic Information System (A.S.P.Harris, A.Kurniawati, A.F.Rizana)
14:15 - 14:30	WOTEC Technology as the Potential Renewable Energy in East Nusa Tenggara (L.O.R.N.Prakasa, H.Sholichah, T.Wikaningrum)
14:30 - 14:45	Building Industrial Symbiosis at Automotive Supply Chain (Y.Ismail)
14:45 - 15:00	Estimation Model Using Cost Driver in Aggregate Level for Mould Manufacturing (A. Maukar)

Parallel Session 1D

Time	Speaker
13:00 - 13:30	Invited Speaker : The Increase of Brain Activity in Frontal Lobe After One Hour Methadone Intake (A. Turnip)
13:30 - 13:45	Data Mining Based Privacy Attack Through Paper Traces (M. Adithia, E. Yudhistira)
13:45 - 14:00	Architecture Enterprise Design Based on Cloud Computing Using TOGAF (Y. Osadhani, D. Rizkiputra, A. Maulana, E.R. Kaburuan)
14:00 - 14:15	Big Data Forecasting Applied Nearest Neighbor Method (A.R. Lubis, M.Lubis, A.Khowarizmi)
14:15 - 14:30	Mapping and Grouping of Farm Land with Graham Scan Algorithm on Convex Hull Method (A. Wibowo, H. Santoso, A. Rachmat, R. Delima)
14:30 - 14:45	Electro-tactile Cues for a Haptic Multimedia Finger Motoric Learning System (D. Pamungkas, A. Turnip)
14:45 - 15:00	The Relation Between Internet Use and Societal Development in Indonesia (T.Setiawan, A.Suhartomo)

Parallel Session 1E

Time	Speaker
13:00 - 13:15	Development of a Simple Ultrasonic Motor Driver (T.H.Yu, T.C.Lu)
13:15 - 13:30	The Implementation of Naïve Bayes Algorithm for Classifying Tweets Containing Hate Speech with Political Motive (R.R.E. Putar; R.N.Shofa; Supratman, M.I. Paripurna)
13:30 - 13:45	System Modelling Using Neural Networks with External Recurrence and Exponential Quadratic Cost Function (R.Sitompul)
13:45 - 14:00	Determination of Technical Characteristics in Panel Button and Control Seat Using Quality Function Deployment (K.Syahputri, I.Siregar, I.Rizkya Sari)
14:00 - 14:15	The Performance of a Single-phase Shunt Hybrid Active Power Filter with FCS MPC and Hysteresis Control (A. Andang; R.S. Hartarti; I.B.G. Manuaba; I.N.S. Kumara)
14:15 - 14:30	A Two-Phase Metaheuristic Method for Solving Travelling Repairman Problem (F.Ramadhan, A.Imran)
14:30 - 14:45	Development of Synoptic Automatic Weather Station Based on Internet of Thing at the Kemayoran Meteorological Station (Sugiarto, S.K. Wijaya, M.Rosid)
14:45 - 15:00	Swarm Intelligence on Color-Embedded-Grayscale Image (Heri Prasetyo; Esti Suryani)

Parallel Session 1F

Time	Speaker
13:00 - 13:15	The Relationship Between Absorptive Capacity, Knowledge Sharing Capability, and Green Dynamic Capability: A Conceptual Model (R. Amaranti)
13:15 - 13:30	Bottleneck Reduction at the Shoes Production Line Using Theory of Constraint Approach (E. Prasetyaningsih; R. Amaranti; C. Deferinanda)
13:30 - 13:45	Stability Analysis in a Technology Transfer Model with Competing Followers (H. Husniah; N. Anggraeni; A.K. Supriatna)
13:45 - 14:00	Development of Flexible Production Scheduling by Applying Gantt Charts in Manufacturing Module Open Source ERP (Case Study CV. XYZ) (C. Nafianto; W. Puspitasari; M. Saputra)
14:00 - 14:15	Parking Service Management with Hybrid Code Technology (HCT) (N. Herlina; N. Hiron)
14:15 - 14:30	The Validation of Linear Method in Cascade Reservoir System for Prediction of Energy Production to Optimize Supply and Demand (Empung; I.N. Norken; M.I. Yekti; I.G.A.A. Putera; N. Hiron)
14:30 - 14:45	Green Campus Energy Measurement Using Three Measurement Approaches for Green Campus Concept (A Case Study at: Siliwangi University) (N. Busaeri; I.A.D. Giriantari; W.G. Ariastina)
14:45 - 15:00	Multistage Fuzzy Inference System for Solving Problems in Performance Appraisal (H.A.Azwir)

Parallel Session 2A

Time	Speaker
15:30 - 15:45	CARDUINO: An Effort Towards Commercial Autonomous Public Vehicles Based on Arduino (R.Roestam, N.Hadisukmana)
15:45 - 16:00	Voice Activity Detector for Device with Small Processor and Memory (T.W.Sen)
16:00 - 16:15	Assessing Trust Variable Impact on the Information Technology Governance Using Business-IT Alignment Models: A Model Development Study (R. Setyadi)
16:15 - 16:30	Machine Learning as a Prediction for Talent Acquisition (E.R.Kaburuan, I.Ranggadana, M.E.Johan, F.Fernandus, M.F.Rizqon, G.Wang)
16:30 - 16:45	Compressive Sampling for Robust Video Watermarking Based on BCH Code in SWT-SVD Domain (L.Novamizanti)
16:45 - 17:00	Smart Postpaid Electricity Meter Using Arduino (A.Ghofir, R.Roestam)
17:00 - 17:15	

Parallel Session 2B

Time	Speaker
15:30 - 15:45	Bidik as a Location Midwife & Clinical Search Plarform and Health Services to Meet Family Health Needs (O.Soleh, A.Ariessanti)
15:45 - 16:00	Sentiment Analysis of Social Media Users Using Naïve Bayes, Decision Tree, Random Forest Algorithm: A Case Study of Draft Law ... (K.Virra, R.Andreswari, M.Hasibuan)
16:00 - 16:15	Wood Classification Based on Fiber Texture Using Backpropagation Method (M.I.Taqyudin, B.Irawan, C.Setianingsih)
16:15 - 16:30	OBD-II Sensor Approaches for the IMU and GPS Based Apron Vehicle Positioning System (B.Suwandi, W.Pinasko, R.Roestam)
16:30 - 16:45	Flow Analysis of Payment Transactions in SAP Reduction of Data with Some Testing Method in PT XYZ (R. Nuzuli; W. Puspitasari)
16:45 - 17:00	Determination of Reactor Diameter of Wastewater Treatment for Vehicle Wash Facilities Using RA 52 Modified Zeolite Filtration Media (M.G.Harahap, H.Pradiko)
17:00 - 17:15	Batik Image Retrieval Using Maximum Run Length LBP and Sine-Cosine Optimizer (H. Prasetyo; J.W. Simatupang)

Parallel Session 2C

Time	Speaker
15:30 - 15:45	Analog Behavioral Model of Underdamped Free Oscillation of Cantilever Beams (H.Tarigan, E.Sitompul)
15:45 - 16:00	Blockchain-Enabled 5G Autonomous Vehicular Networks (S. Rahmadika)
16:00 - 16:15	Evaluation of Governance Information System Using Framework Cobit 5 in Banking Company (N.Legowo)
16:15 - 16:30	Identification of Green and Sustainable Campus Indicators in Its Implementation at President University (R. Hakiki)
16:30 - 16:45	Counting of Aedes Aegypti Eggs using Image Processing with Grid Search Parameter Optimization (S. Bandong; E. Joelianto)
16:45 - 17:00	A Blue Robotic Sensor for Tech_SAS V1 ROV Depth Controller (S. Siregar; M.I. Sani; R. Febriansyah; S.T. Parlindungan)
17:00 - 17:15	Prototype of Postpaid Electricity and Water Usage Monitoring System (M. Galina; M. Ramadhani; J.W. Simatupang)

Parallel Session 2D

Time	Speaker
15:30 - 15:45	Sound Visualization Using Typography Composition Based GIF (C. Fadillah; R.R.R.A.R. Rahayu)
15:45 - 16:00	Aesthetic Affordances of Buto's Shape and Texture Characters in Wayang Kulit Through Digital Sculpting (A. Ardiyan)
16:00 - 16:15	Designing Video Campaign Using Visual Rhetoric: Irony to Increase Awareness of Millennial in Using Social Media Wisely (.Walewangko, R.Mulcki, N.Iskandar)
16:15 - 16:30	The Mapping of Strategic Concept Through 5C Model Theory as a Visual Communication Design Tool for Jakarta City Branding (D.C. Kertasari)
16:30 - 16:45	Packaging Local Identity: Redesigning the Brand and Package of 'Tenteng Malino of South Sulawesi (D. Wijaya; F. Rachel; Aziz)
16:45 - 17:00	The Role of Active Participation and Satisfaction Towards Community Promotion and Behavior Change for Effective Marketing Outcomes of ... (F.Zarani, I.Tarigan, A.S.Santoso)
17:00 - 17:15	Exploring the Drivers of Peer-to-Peer (P2P) Lending Mobile Application Service Quality in Indonesia (R.Ghazali, J.O.Haryanto, W.H.Utomo, A.Santoso, R.Nughara, B.Asgha)

Parallel Session 2E

Time	Speaker
15:30 - 15:45	Heart Rate Monitoring Using ECG Sensor in Android (Rosalina)
15:45 - 16:00	Stream Control Transportation Protocol (SCTP) Towards MANET Routing: Comparison of DSR and AODV (A.R.Lubis, .Lubis, F.Lubis)
16:00 - 16:15	Detection of Potentially Students Drop ut of College in Case of Missing Value Using C4.5 (S.Mutrofin, R.V.H.Ginardi, C.Fatichah, Y.A.Sari, A.M. Khalimi, E.Kurniawan)
16:15 - 16:30	Prediction Analysis of Student Specialization Suitability Using Artificial Neural Network Algorithm (S.N.Latifah, R.Anreswari, M.Hasibuan)
16:30 - 16:45	Realistic or Iconic 3D Animation (Adaptation Study with Theory Uncanny Valley) (F.Limano)
16:45 - 17:00	Encryption Application Using Verifiable Secret Sharing Scheme (N.Hadisukmana, R.Roestam)

Parallel Session 2F

Time	Speaker
15:30 - 15:45	Reducing Wastes in Laboratory Activities Using DMAIC Method (A.Saptari, C.Monika, I.Halim)
15:45 - 16:00	The Quality Metric Design to Control Quality of Telecommunication Construction Project Using Internal Control Method (F.Nabilah, I.A.Puspita, W.Tripiawan)
16:00 - 16:15	Semi-Automatic Machine with Programmable Logic Controller in the Mendong Woven industrial (N. Hiron; F.M.S. Nursuwars; Supratman; Sutisna)
16:15 - 16:30	Design and Implementation of Internet of Things Based Remote Monitoring System at Electrical Engineering Laboratory in esident University (I. Bukhori; R. Thiara; A. Suhartomo)
16:30 - 16:45	Extraction of P and T Waves from Electrocardiogram Signals with Modified Hamilton Algorithm (A. Turnip; C. Wijaya; E. Sitompul)
16:45 - 17:00	A Comparison of Continuous and Periodic Review on Inventory Components of Dump Trucks (M.Toha, D.Prastyo, A.Saptari)
17:00 - 17:15	The Performance of Microcontroller Equipment to Save Fuel Consumption for Motorcycle (F. Ariani, T. B. Sitorus, Tugiman, H. Helmi)

TABLE OF CONTENTS

TABLE OF CONTENTS

Design and Prototyping The Automatic Fish Feeder Machine for Low Energy

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***Abstract*— The focus of this paper is to propose the design of energy-efficient automatic feed machines with reasonable accuracy. This paper also presents the results of measurements of electrical energy consumption. Observations carried out include the consumption of electrical energy in each unit with feed weights of 2 mm and 4 mm. Each feed sample was measured based on electrical energy consumption, optimizing machine work processes for feed weight, and identification of optimization in the ejection system. The results of this study have succeeded in making the design of an automatic feeder machine have been proposed with the performance characteristics being that the total electrical energy consumption and the duration of the process for each feed size are 2 mm and 4 mm. Feed size 2 mm with a weight of 2 kg requires a total consumption of electrical energy amounting to 0.085Wh. A feed with a 4 mm size requires electrical energy consumption of 0.0907Wh. The duration of the process for 2 mm feed size with a weight of 2 kg is 1 minute and feed size 4 mm with a weight of 2 kg requires a process duration of 1.2 minutes.**

Keywords—feeder, energy, fish, automatic, machine.

I. INTRODUCTION

The fish livestock industry has become one of the sources of regional income in Indonesia. Therefore, this industry has received more attention from policyholders. One problem in the terrestrial fish farming industry, exceptionally for large scale industries is the lack of quality livestock production due to lack of attention in providing fish feed. The use of human labor in feeding requires high costs; also, the accuracy and consistency of feeding time are less than optimal. Some entrepreneurs use robots or fish-feeding machines so that the consumption of fish feed can be organized with the appropriate quantity. The use of a feed machine can guarantee the weight of fish as needed [1], [2].

Researchers have developed several models of fish feeding machines [2], [3], [4]. Then a fish feeding machine design with automated technology in [2], [2]–[6], [7] has also been developed. Fish feeder machine with Arduino based was proposed by M.Endebu in 2016 for small scale [4]. Feed throwing techniques into ponds using DC motors with turbines have not been proposed in previous studies. Several models and products that have been offered do not provide fish feed throwing facilities to the pond. Therefore, this paper proposed to design and manufacture an automatic fish feeding machine with a throwing system. The feed machine is designed so that the working procedure of the machine can be programmed. In this paper, a control system is proposed using an AT-Mega type of Arduino-Uno microprocessor.

Machine performance is measured only on the consumption of electrical energy, the accuracy, and consistency of each machine unit during work and based on the size and weight of the feed processed to the machine. Machine control technique using AT-Mega microprocessor is one of the solutions in the control industry. The advantage of the control system with a microcontroller is that it is easy to program, is inexpensive, and has excellent working accuracy [8], [9]. Additionally, AT-Mega allows machines to communicate wirelessly [10].

II. METHOD

A. Work Flow Procedure

Fig.1 shows the flowchart of the automatic fish feeder machine design. The work procedure of the machine starts with the scheduling system of the control board module. On the control board, the user can enter two parameters, namely the quantity of feed and the unit of kg and time of feeding. Then at the specified time on the control board, the machine starts to open. Hence, gate A will open, and the load sensor weighs the feed. The load sensor will stop if the feed weight has been validated and as desired through the program control board, then gate B closes. Spiral conveyors deliver feed to the ejection system, and feed is ejected until the feed in the ejection system is exhausted. Then gate B is closed again for the machine to repeat the work procedure.

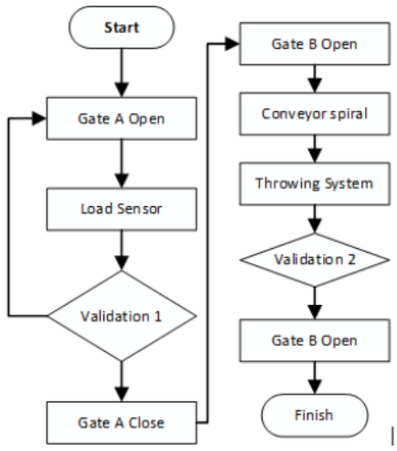

Fig.1. Flow chart system.

B. Machine Layout Design

Fig.2 is the proposed machine layout. The machine consists of six main parts, namely container, Gate A, load sensor, gate B, spiral conveyor, ejection system. Gate A is a valve to move feed from the container to the feed weight

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system. The feed weighing system consists of Gate B and load sensors. The working principle of the feed weighing system is to weigh the feed. After the feed in the weighing system is validated according to the program, feeding the sensor will provide a trigger to the control board to close gate A and open gate B. The spiral conveyor functions to direct the feed to the thrower system after weighing. Throwing system serves to catapult feed into the pond at a certain distance so that the feed is given indirectly to the middle of the pond or the place according to the target.

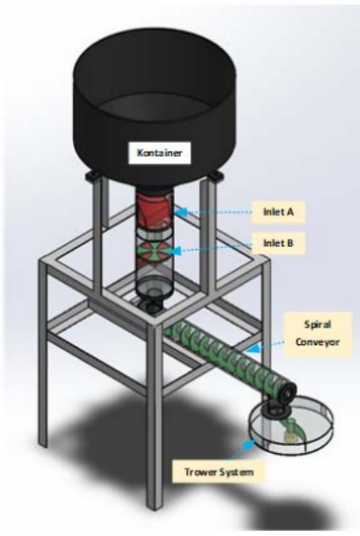

Fig.2. Machine layout design.

C. *Board Diagram System*

Fig.3 shows the overall system block diagram. Block diagrams consist of Arduino-Uno, displays, relay modules, power supply, load sensors, gate A, gate B, spiral conveyor, thrower system. Arduino-Uno acts as the central board controller system which controls the drive system on the load sensor unit (load cell), gate A, gate B, spiral conveyor, thrower system, besides that, Arduino gets a signal from the load sensor as a trigger. The LCDs the time feed data on the control board.

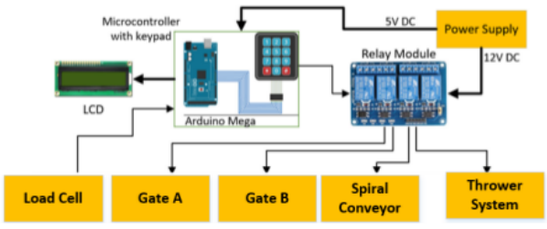

Fig.3. System board diagram.

D. *The layout of the Controller Board*

Fig.4 shows the layout of the controller board. The control board consists of three task inputs, each of which contains a schedule for feeding, feed weight, and the task record button. LCD to display time and weight information to be stored in Arduino memory. The control board design shows the position of the feeding time setting button placed next to the feed weight adjustment button, which will be provided for each service by the machine. The enter button is also placed adjacent to the other buttons. This is dedicated to being easily used by users who have high anxiety about technology.

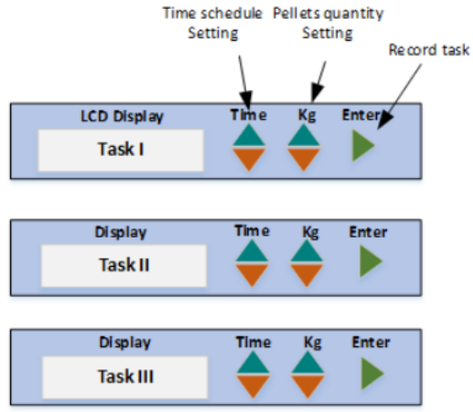

Fig.4. Front end controller board layout.

Fig.5 shows the arrangement of the modules inside the control board of the feeding machine. The laying is arranged in such a way so that the wiring module becomes neat and competent in using space. The modules in the control board consist of seven modules, namely power supply, Arduino-Uno as MCU, DC motor speed control, RTC, load sensor interface, IO module, relay module.

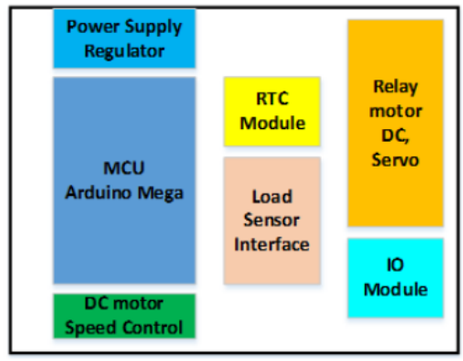

Fig.5. Back end controller board layout.

E. *Testing Method*

Machine testing techniques are carried out on variations in different feed sizes, namely the size of 2 mm and 4 mm. The order was applied to machines for various weights, from 0.5 kg to 5 kg with multiples of 0.5 kg for each system trial. This feed size is a measure commonly used in the large-scale fish farming industry. There is a process for each type of feed size, then measured the voltage and current values for each unit (module), measured changes in speed. Measurement of the duration of each process cycle of the machine is measured using a stopwatch, while energy consumption, voltage, and electric current are measured using a Kyoritsu Kew 6315 measuring instrument, the speed of rotation in each module is measured using a digital tachometer.

III. Result and Discussion

The feed machine assembly, as shown in Fig.6. Sequentially from the top position are the feed container, gate A, gate B, load sensor, spiral conveyor, thrower system. The results of testing the energy consumption of one time the working cycle of the machine for a sample size of 2 mm feed with a weight of 1kg obtained that the consumption of electrical energy is 0.0048Wh with 3 seconds duration of work. The results of testing the energy consumption of a single work cycle of the machine for a sample size of 4 mm feed with a weight of 1kg obtained that the consumption of electrical energy is 0.007Wh with a working duration of 3.5 seconds.

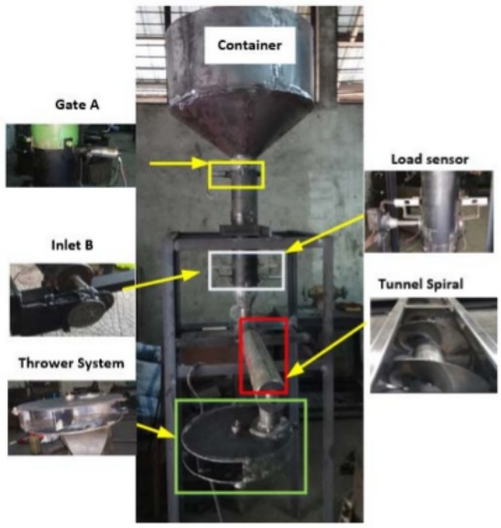

Fig.6. Assembling of feeder machine.

In tests with feed weights above 2 kg, energy requirements increase significantly, while the duration of the work cycle for feed weights above 2 kg does not experience significant changes. Nevertheless, the electrical current needed by the system is increasing, so that electrical energy increases significantly, from Fig.7, it can be concluded that the proposed feed machine can work optimally in one work cycle with a maximum feed weight of 2 kgs.

Fig.7 shows the results of feed rate testing on the main inlet conveyor (inlet A). At 2 mm feed size with feed loads ranging from 0.5 kg to 5 kg, a change in the rate of feed is obtained with time. The highest value of feed transfer rate is obtained at 2 kg load, and this applies to the 2 mm and 4 mm feed sizes. Thus, it can be concluded that the optimal feed rate is at 2 kg of feed weight.

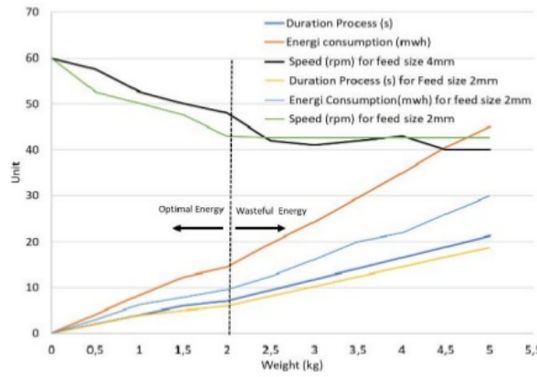

Fig.7. The results of the measurement of the duration of the process and feed displacement energy at 2 mm feed size.

Fig.8 shows the relationship between feed size and electrical energy consumption in a spiral conveyor. Measurement data shows that the larger the feed size, the higher the energy consumption needed. The 2 mm feed size and 1 kg weight require 32s duration of the process and requires 0.0381Wh. Feed size 4 mm and weighs 1 kg requires a duration of the process of 42s and requires the energy of 0.0497Wh. Rotation of spiral conveyor for feed weight of 1 kg is 90 rpm. This condition is still acceptable, given that the minimum rotation of a spiral conveyor with a DC motor drive is 40 rpm.

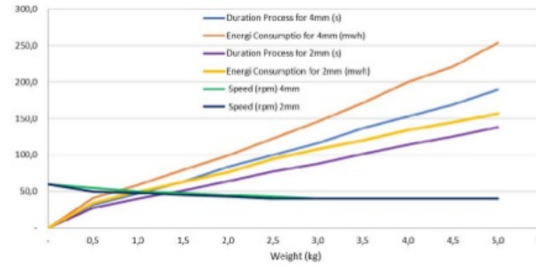

Fig.1. The results of the measurement of the duration of the process and feed displacement energy at 2 mm and 4 mm feed sizes in the spiral tunnel.

Fig.9 shows the results of the feed rate testing on a spiral tunnel (spiral tunnel). At 2 mm feed size with feed loads ranging from 0.5 kg to 5 kg, a change in the rate of feed is obtained with time. The higher the feed load, the greater the feed flow rate in grams per second. Nevertheless, the feed flow rate tends to be stable at a feed load above 3.5 kg, the feed rate occurs at 25 grams / s for feed sizes 4 mm and while at feed loads above 4.5 kg, the feed rate at 36 grams / s occurs for 2 mm feed size.

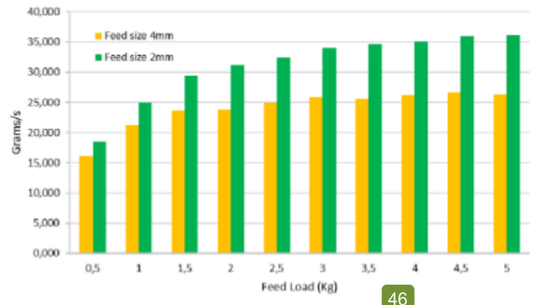

Fig.2. Feed Speed Transfer Rate in Spiral Tunnel with a feed size of 2 mm and 4 mm.

Fig.10, shows the changes in energy consumption, process duration, and rotational speed of the given feed load. At a maximum feed weight of 2 kgs with a 2 mm feed size, electricity consumption reached 74.8mWh, and the process duration was 64 seconds, while at 4 mm feed size, electrical energy consumption reached 98.2mWh and the process duration was 84 seconds.

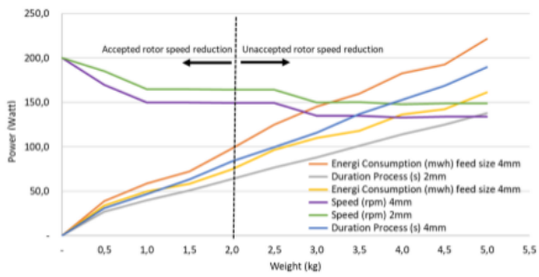

Fig.3. The results of measuring the duration of the process and energy consumption in the thrower system for feed sizes of 2 mm and 4 mm.

The performance of the ejection system is shown in Fig.11, where a feed of 2 mm in size requires 1645 rpm to be used to feed the fish to the center of the pond. In the 4 mm feed, the rpm decreases to 1297rpm. It is tested on 2 mm feed sizes with weight variations ranging from 0.5 kg to 5 kg. The result is that the feed rate in the ejection system will continuously be started at 3.5 kg of feed weight, but the driving motor on the spiral conveyor gets hotter. Therefore, the working conditions of a safe spiral conveyor for 2 mm feed size are 2 kg in weight, while for 4 mm feed size it can be done at 1 kg.

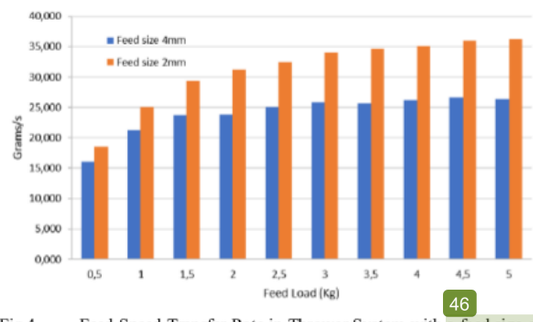

Fig.4. Feed Speed Transfer Rate in Thrower System with a feed size of 2 mm and 4 mm.

Fig.12, is the total electrical energy consumption and process duration for each feed size are 2 mm and 4 mm. The 2 mm feed size with a weight of 2 kg requires a total electrical energy consumption of 0.085Wh. A feed with a 4 mm feed size requires electrical energy consumption of 0.0907Wh. The duration of the process for 2 mm feed size with a weight of 2 kg is 1 minute and feed size 4 mm with a weight of 2 kg requires a process duration of 1.2 minutes.

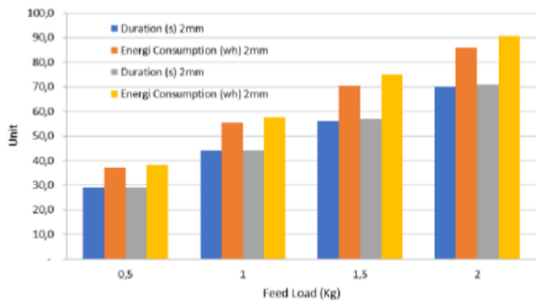

Fig.12. Total electricity consumption, process duration for feed sizes of 2 mm and 4 mm.

IV. Conclusions

The design of an automatic feeding machine has been proposed with the performance characteristics that the total electrical energy consumption and the duration of the process for each feed size are 2 mm and 4 mm. 2 mm feed size with a weight of 2 kg requires a total electrical energy consumption of 0.085Wh. Feed with a 4 mm feed size requires electrical energy consumption of 0.0907Wh. The duration of the process for 2 mm feed size with a weight of 2 kgs in 1 minute and feed size 4 mm with a weight of 2 kgs requires a process duration of 1.2 minutes.

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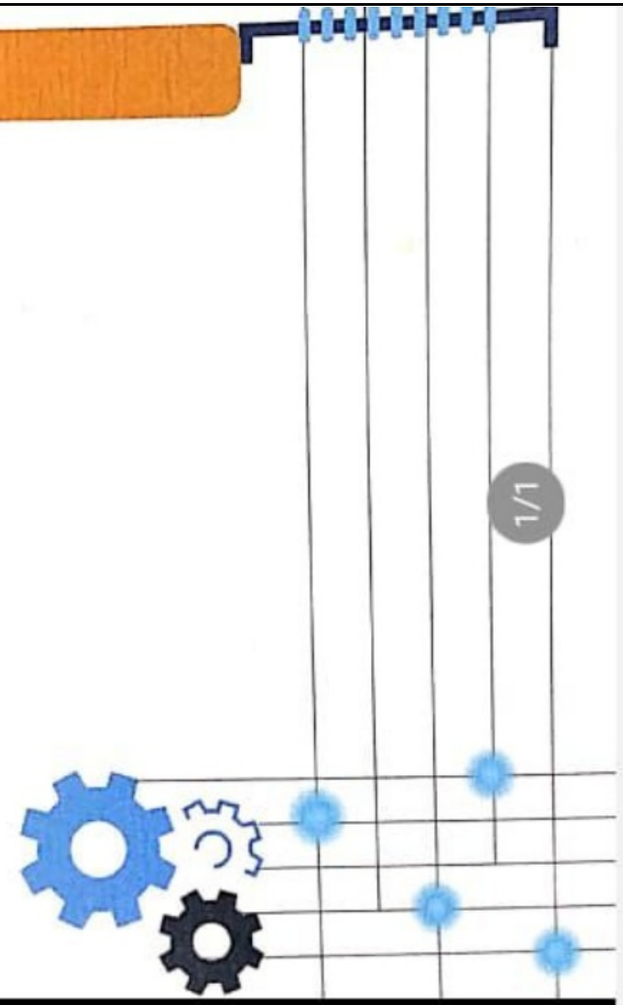

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