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Optimal control and Regulation of Fluid output and Temperature in an industry using intelligent agent

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ABSTRACT: Water treatment plant is important for agricultural production and in crude oil processing facilities onshore and in offshore locations. It is therefore pertinent to learn how to control and regulate the parameters for increased output. Water being a universal solvent is suitable for agricultural use, construction, and advanced technology, as well as recenttechnologies in cement manufacturing industriesWater handling has become necessary in the manufacturing and agricultural sector in other to maximize its value. Its proper use in agriculture requires advanced technologies especially in the area of ICT. This paper presents a smart regulatory system based on multi-agent architecture using fuzzy logic. The work proposes a real and innovative solution to the problem of regulating cold and hot water flow in the industry. The problem of not having an accurate water controlling mechanism for an industrial process has led to insufficient output production capacities of such industries. This can be overcome by designing a membership function that will analyze the causes of irregularities in the control of cold and hot water used in the manufacturing industry. Designing a membership function that will detect irregularities in the quantity of liquid that would pass through cold and hot water tanks for industrial use is needed. Designing an intelligent rule that will control the required quantity of liquid in both cold and hot water tanks, train these rules to stick strictly to the control format and creating or designing a model for industrial processing water control for an increased output using intelligent agent. The result obtained is an increased output when an intelligent agent is used

KEYWORDS: Optimal control, Regulation, Fluid output, and Temperature, intelligent agent

I. INTRODUCTION

The control of many flexible processes, so that industrial applications can control the temperature and level of the liquid in the tanks, as well as the flow between the tanks, is a major challenge for the crude oil refining industry. With an electric water heater, a gas water heater is a system, but it is not allowed due to many technical problems [1] to achieve this level of fluid control within industrial installations, it is necessary to allow a smart agent to be incorporated into the control systems. Liquids are usually stored in both room temperature and higher temperatures; the manufacturing industries requires liquids to be stored in the tanks and then in other containers for use at any time when there is demand. In the study [2], it was discussed that the adoption of Artificial Intelligence (AI) technology are growing due to their ability to predict and obtain assistance [3]. Mainly due to Simultaneous growth and simultaneous operation; development of targeted marketing and pricing, as well as enriching user information have been exploited favorably. Hesitation to accept the use of artificial intelligence is a major market problem in the current situation [4]. In most cases, the liquid will be used in reservoirs, at predetermined temperatures and levels. If the tanks are connected to each other, and that tank levels are to be monitored by human machine interface; an intelligent agent has a part to play. Systems with more than one input and / or more than one output will be called a multi-input, multi-output (MIMO) system; they need automatic control and monitoring. It is important to consider this aspect, which hinders the realization of water optimal output and provides a solution to this problem at the level of water resource management systems used in various processes. The design of the control system is to understand how the tank, control systems, and the problem of power management affect the water output in a given

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community or industry. However, the interaction between loops complicates the design of PI and PID controllers [5]. The built-in system can be made easier to use when designed properly. Management systems use a variety of methods to perform any function in the manufacturing sector. The developments and changes that have taken place in the industry have recently entered a new phase in line with the development of computer technology, the intellectual field, and, finally, a whole new field of artificial intelligence. Fuzzy logic, unlike Boolean logic, in which the value of a variable is 0 or 1, fuzzy logic is a system, in which the value of a variable is between 0 and 1. The controller is designed using fuzzy logic to display a person's thinking process, which is programmed using fuzzy logic and language. The fuzzy logic process consists of the following steps • * Input/output of the membership function; • Resolution; • Decision-making, interpretation of norms) • * Defuzzification

1.1 Aim of the Study

This study aimed at performing an industrial processing water control for an increased output using intelligent agent.

1.2 The Objectives of Study

Demand on water supply quality and usage increased constantly during winter and summer. Therefore, the objectives of these research work would be stated sequentially from one step to the final step; the objectives are to

- To design a membership function that will analyze the causes of irregularities in the control of cold and hot water used in the manufacturing industry.
- To design a membership function that will detect irregularities in the quantity of liquid that passes through cold and hot water tanks for industrial use.
- To design an intelligent rule that will control the required quantity of liquid in both cold and hot water tanks.
- To train these rules to stick strictly to the control format.
- To design a model for industrial processing water control for an increased output using intelligent agent.

II. SCOPE OF PREVIOUS RELEVANT WORK:

Water resources management and maintenance, services are not given due attention by the Government. Therefore, it is important to consider this aspect, which makes it difficult to exercise the right in it, and provide a solution to this problem [6], as the water quality monitoring system is used in a variety of procedures. The entire process of the human body, as well as the fluid-carrying system, depends on a water-level control system. When a system is developed, it has to respond to changes in the variables that determine the optimal results of interest. However, the interaction between constraints makes it very difficult to design PI and PID controls that could respond perfectly. AI is still a vague concept, and many questions remain open in the new field. Embedded system when properly applied is very easy to use [7] . Management systems use a variety of methods to perform any function in the field of manufacturing, therefore care must be exercised in operating industrial control systems where programmable Logic Controllers (PLCs) are involved. Development and the changes that have taken place in the industry have recently entered a new phase associated with the development of computer technology [8]. Artificial intelligence (AI) has emerged as a powerful tool for solving real-world problems [9] and has received much attention due to its use in various fields. In recent years, AI techniques have also been used in water purification and desalination to improve the process and to provide effective solutions to water pollution and water scarcity (Kazeem, 2021). AI applications are also expected to reduce the operational costs of the water purification process by reducing costs and improving the use of chemicals, in a study conducted [9]. This review summarizes the various AI strategies and their use in focused water purification. in the marketing of pollutants [10]. Many AI models have successfully predicted the activity of different adsorbents to extract more effluents from water [11]. This review also highlighted some of the challenges and research gap regarding the use of AI in water purification. Apart from the few benefits that AI offers, there are certain restrictions that prevent the widespread use of these methods in real water treatment ([12]. Data acquisition and selection, poor reproduction, limited evidence of use in actual water purification are some of the key challenges that need to be addressed, [13]. Recommendations are being made to ensure the successful use of AI in future water-related technologies. This review is beneficial to marine and environmental researchers, engineers, students, and all stakeholders in the oil and gas / water industry

III. METHODOLOGY

The methodology requires in this work starts with the design of a membership function that will analyze the causes of irregularities in the control of cold and hot water used in the

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manufacturing industry; it requires to characterize the cooling and hot water system used in the industry and follow the steps outlined in the objectives above. Figure 1 below is the first step in realizing our initial objective

3.1 Designing a membership function that will analyze the causes of irregularities in the control of cold and hot water used in the manufacturing industry

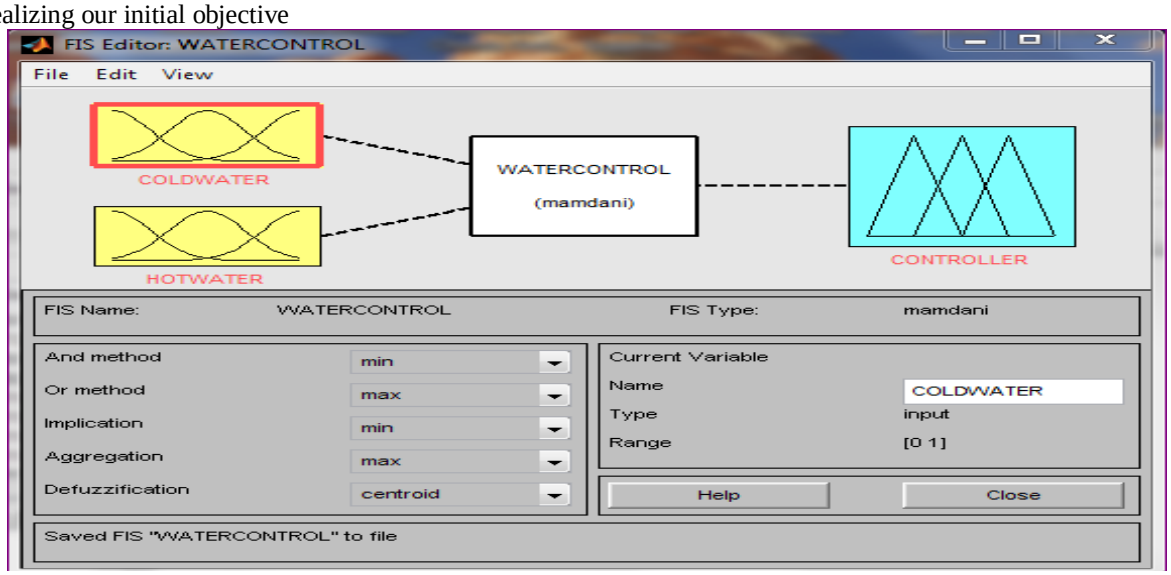

Figure 1. Fuzzy inference editor for Industrial processing water control for increased output using intelligent agent

Designing of membership function that will analyze the causes of irregularities in the water system starts by inputting the variables; in this case Cold water and hot water to the controller.

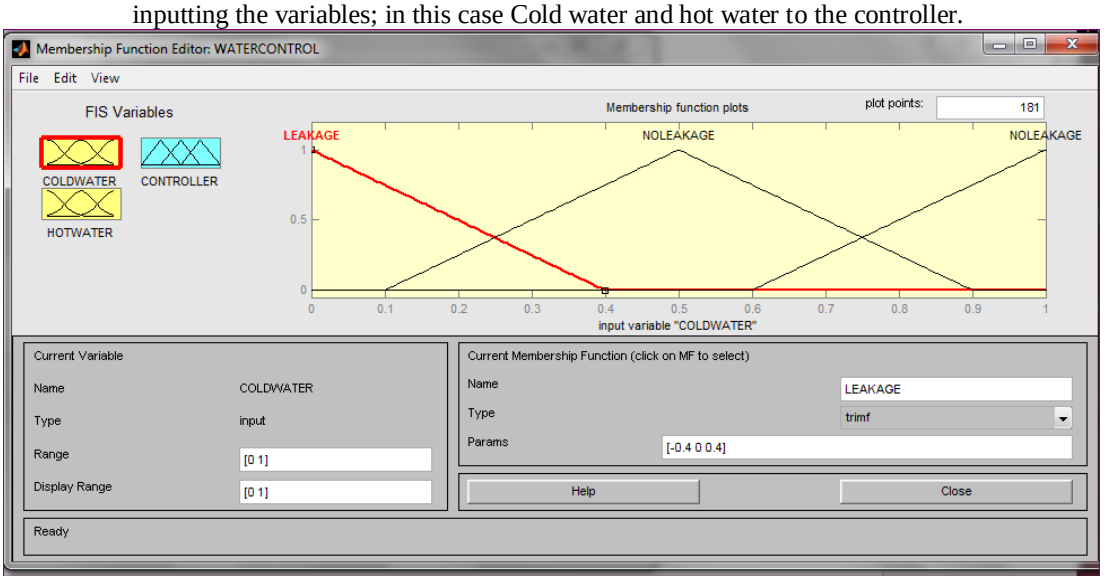

Figure 2.Designed membership function that will analyze the causes of irregularities in the control system.

3.2 Designing of a membership function that will detect irregularities in the water system

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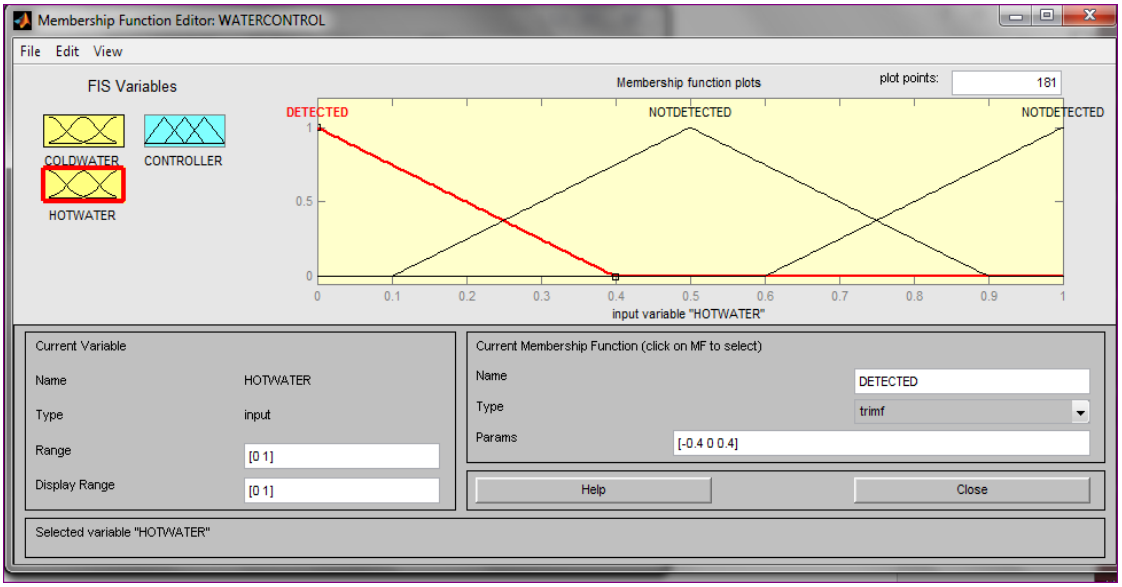

Figure 3. The design of a membership function that will detect irregularities.

3.3 Training the rules to stick strictly to the control format.

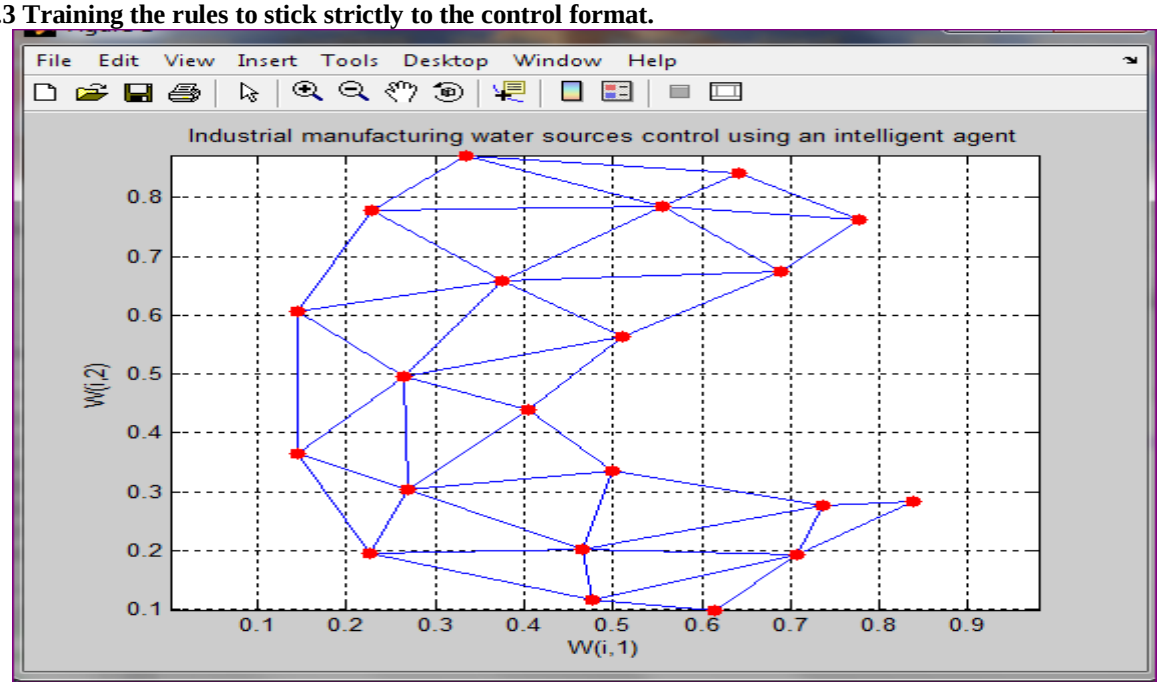

Figure 4. Trained rules to stick strictly to the control format

3.4 Designing of a model without intelligent agent for an industrial manufacturing water system

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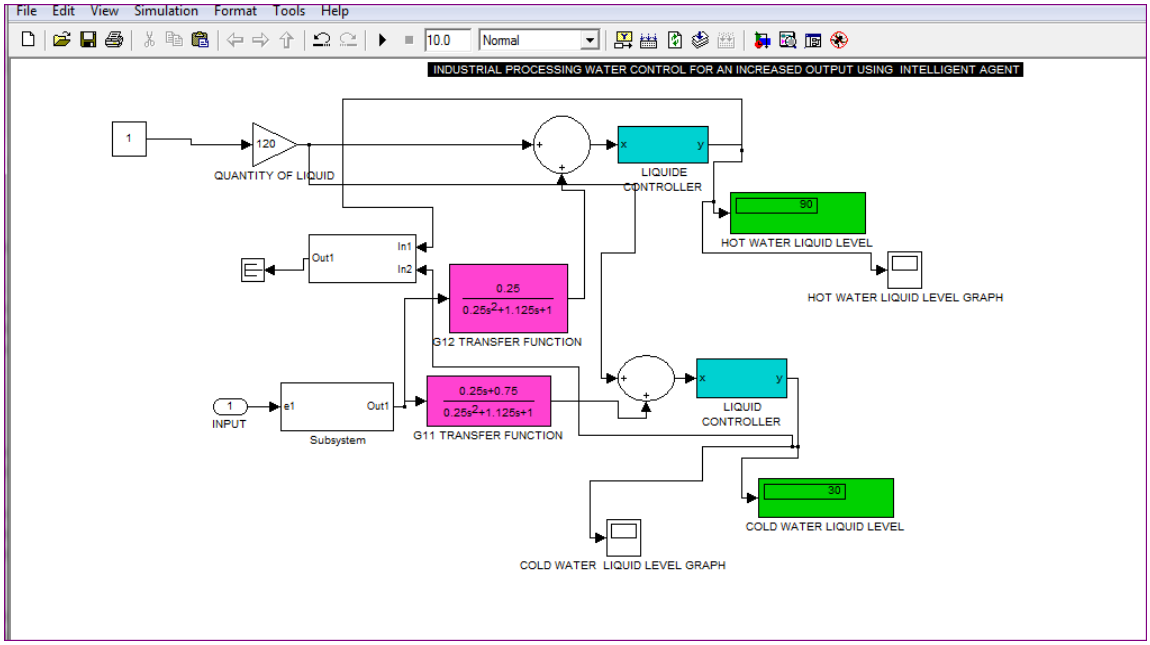

Figure 5.System without Intelligent agentfor increased output

3.5 Designing a model with intelligent agent for increased output

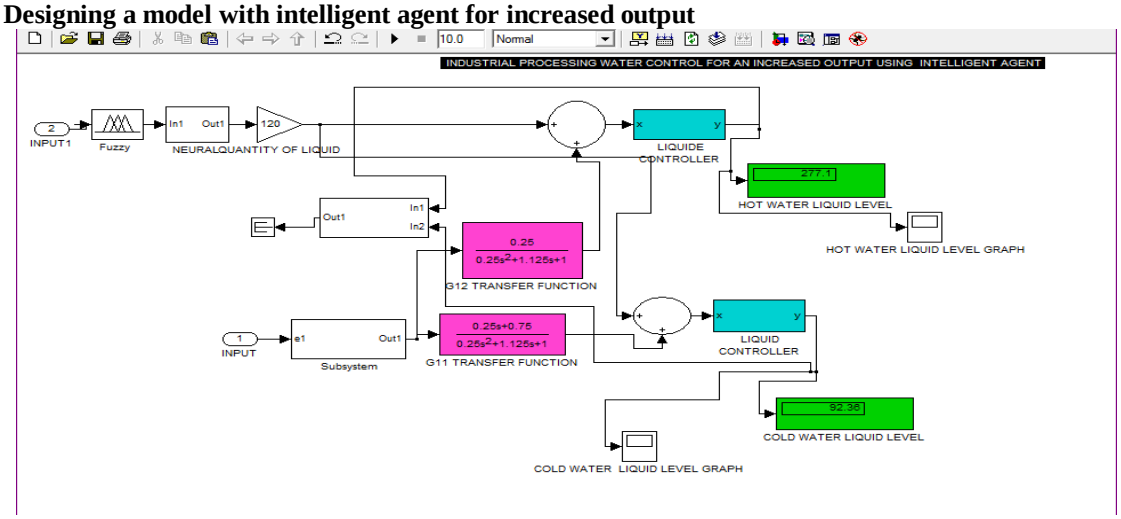

Figure 6. Designed model for Industrial processing water control for an increased output using intelligent agent

IV. RESULTS AND DISCUSSION

The following are the results obtained using the intelligent agent technology in the course of the study. Fig 1 shows FIS for industrial processing water control for an increased output using intelligent agent. There are two inputs of cold and hot water and also has an output of control.Figure 2,is the Designed membership function that will analyze the causes of irregularities in the control of cold and hot water used in the manufacturing industry. It identifies if there is leakage in the pipeline that is meant for cold and hot water in an industrial process. Figure 3 detects if there is irregularities in the quantity of liquid that passes through cold and hot water tanks for industrial processing; Fig 4 shows trained rules that stick strictly to control and increase the output of industrial processing water control. Fig 5 shows designed model for an industrial manufacturing water control for an increased output without using intelligent agent. The model is designed in a manner that the proportion of hot water to cold water for an industrial use should be 3:1; since industries use more of hot water than cold water for manufacturing process. In fig 5 when 120liters of water is used for industrial process 90 liters will be hot water while 30 liters will be for cold water. Fig 6 shows designed model for Industrial processing

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water control for an increased output using intelligent agent. Fig 6 shows that there is an increase output of hot water (277.1 liters) and cold water (91.36 liters) when 120 liters of water are used for the process. Table 1.shows the Volumes of hot water without and with intelligent agent, Fig 7 shows the comparison between volumes of hot water without and with intelligent agent; it also show that there is an increase output of 277.1 liters when an intelligent agent is incorporated in the system than when it is not used. Fig 8 shows that volume of cold water for an industrial process without an intelligent agent is 30 liters while its volume when an intelligent agent is incorporated is 91.36 liters which shows that there is an output increase when an intelligent agent is incorporated.

Table 1. Volumes of hot water without and with intelligent agent

VOLUME OF HOT WATER WITHOUT INTELLIGENT AGENT	VOLUME OF HOT WATER WITH INTELLIGENT AGENT	TIME
90	277.1	0
90	277.1	1
90	277.1	2
90	277.1	3
90	277.1	4
90	277.1	5
90	277.1	6
90	277.1	7
90	277.1	8
90	277.1	9
90	277.1	10

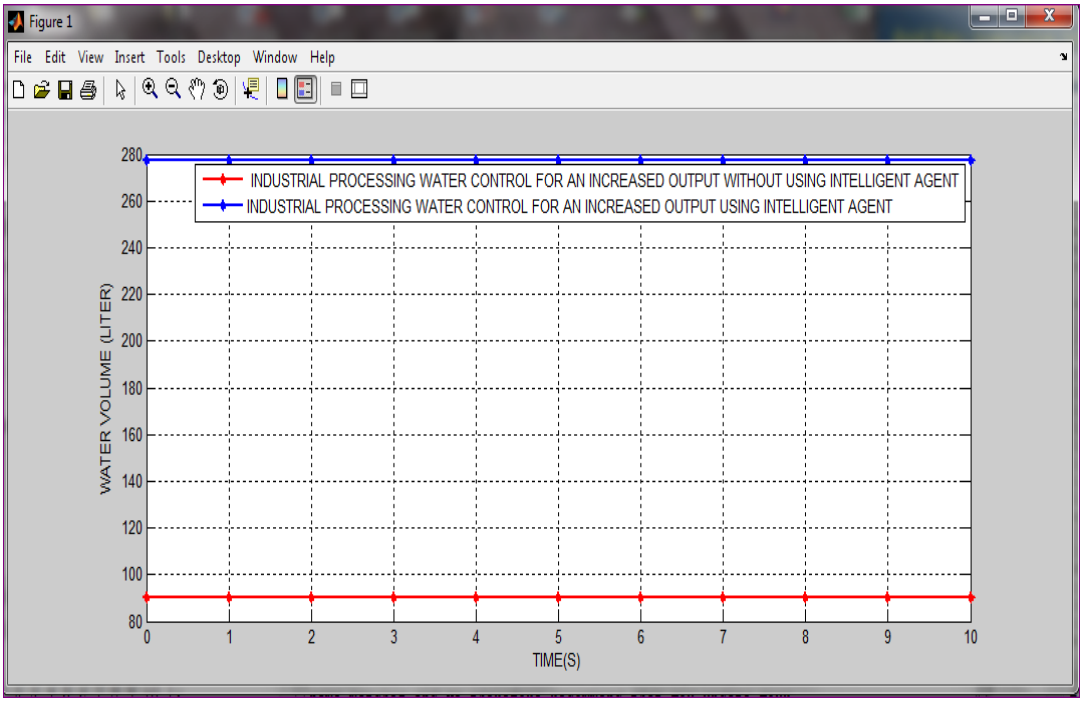

Figure7. Comparing volumes of hot water without and with intelligent agent.

Table 2.Comparison of the volumes of cold water without and with intelligent agent

VOLUME OF COLD WATER WITHOUT INTELLIGENT AGENT	VOLUME OF COLD WATER WITH INTELLIGENT AGENT	TIME

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30	91.36	0
30	91.36	1
30	91.36	2
30	91.36	3
30	91.36	4
30	91.36	5
30	91.36	6
30	91.36	7
30	91.36	8
30	91.36	9
30	91.36	10

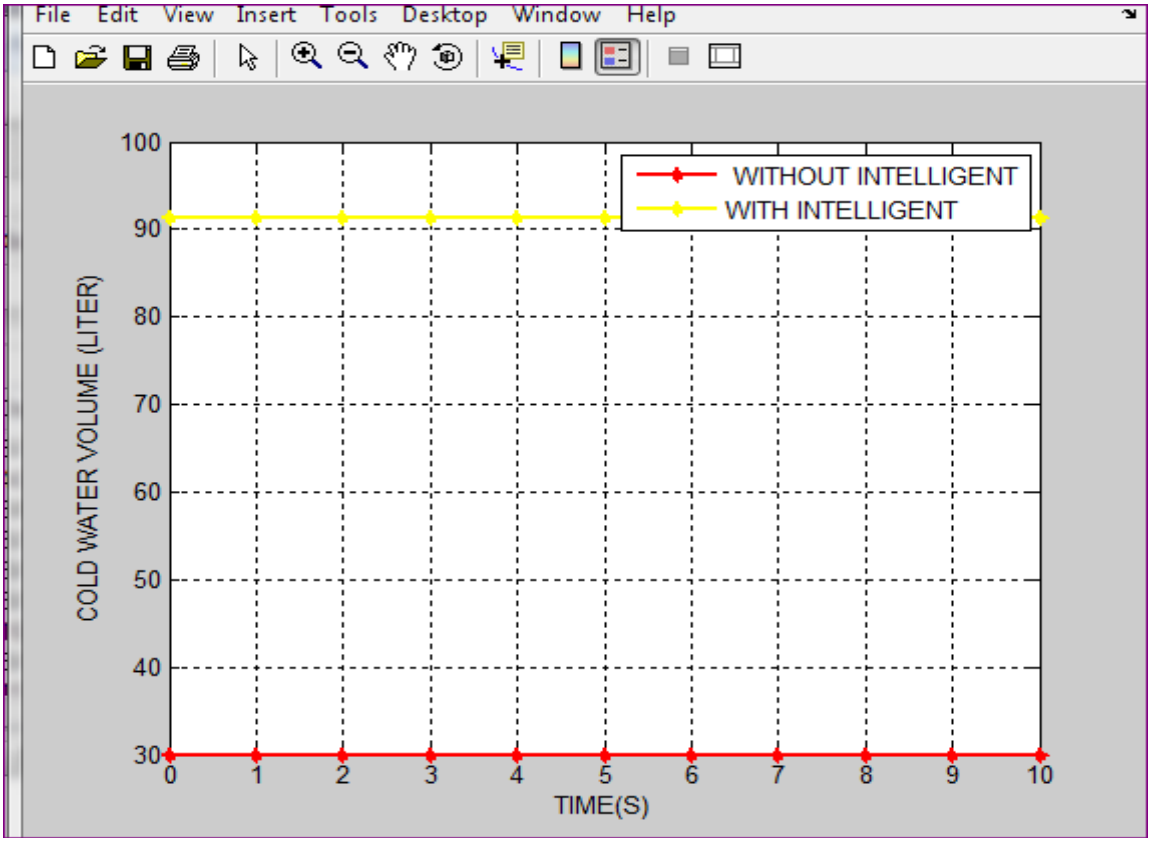

Figure. 8 comparing the volumes of cold water without and with intelligent agent

V. CONCLUSION

Intelligent agents and good knowledge of computer soft wares have a great potential in future as one of the best and effective ways of enhancing efficiency of machines. This work has presented an industrial processing water control for an increased output using intelligent agent. Some of the benefits of the proposed system are reduced cost, reliable and improved energy efficiency. A comparative analysis was also done for both with and without intelligent agent. The simulated results show potential results for favoring embedded systems with intelligent agents.

The incontrollable of the quantity of hot water used for industrial process has led to reduction of production output of such industries. This can be overcome by designing a membership function that will analyze the causes of irregularities in the control of cold and hot water used in the manufacturing industry, designing a membership function that will detect irregularities in the quantity of liquid that passes through cold and hot water tanks for industrial use, designing an intelligent rule that will control the required quantity of liquid inboth cold and hot water tanks, train these rules to stick strictly to the control

format and designing a model for industrial processing water control for an increased output using intelligent agent.

REFERENCES

[1]. Ude, K. et al (2021): Reducing Costs and Pollutant Emissions using Renewable Energy sources in Eket town,Nigeria. International Journal of Sciences and Applied Research.(IJSAR).Vol.8.issue 7.pages11-2

[2]. Bakare,K.,Ngang,N.B.(2021):) Energy Efficiency Improvement of Doubly fed Induction generator Machines using Adaptive Control Technique. International Journal of Research in Engineering and Science (IJAEM),vol.3.issue 7.pages:661-669 DOI: 10.35629/5252-0307661669

[3]. Akaninyene. et al.(2021):Optimized Electric Power Generation Expansion Planning Using Decomposition Technique.International Journal of Science and Business (IJSAB).

[4]. Anthony,L.A.,Uko, O.,Ngang,N.B.(2021): Enhancement of Data Network Robustness in Nigeria, Using Adaptive Modulation Technique.International journal of advances in engineering and management (IJAEM) Volume 3, issue 6, pp: 1470-1478. DOI: 10.35629/5252-030614701478.

[5]. Aneke,N.E. et al.(2021): Improving Loss Minimization in 33kV Power Distribution Network Using Optimized Genetic Algorithm. International Journal of Systems Engineering (IJSE), Vol.5.No. 1

[6]. Bakare,K. et al.(2021): Optimization of a Micro Grid Operation under Uncertainty Using Model Predictive Controller. International Journal of Research and Innovation in Applied Science (IJRIAS) |Volume 6,iIssue 6,2021.

[7]. Ngang, N.B.,Bakare,K.(2021): Improving Frequency Stability of the Nigerian 330kV Transmission Network using Fuzzy Controller. American Journal of Electrical Power and Energy Systems;vol.10.issue3,pages 43-50

[8]. [1]Banerjee, R. (2015) Water Level Controller by Fuzzy Logic. International Journal of Innovative Research in Advanced Engineering (IJIRAE).

[9]. International Conference for Convergence in Technology (2018). Temperature and Power Control of Water Geyser Using Learning Technique. Conference Paper · May 2018 DOI: 10.1109/I2CT.2018.8529715

[10]. Kaplan, A., & Haenlein, M. (2019). Siri, Siri, in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence. Business Horizons, 62(1), 15–25. https://doi.org/10.1016/j.bushor.2018.08.004

[11]. Killough, B. (2019). The Impact of Analysis Ready Data in the Africa Regional Data Cube. In IGARSS 2019 - 2019 IEEE International Geoscience and Remote Sensing Symposium (pp. 5646–5649). IEEE. https://doi.org/10.1109/IGARSS.2019.8898321

[12]. Kumar, N., Kharkwal, N., Kohli, R., & Choudhary, S. (2016). Ethical aspects and future of artificial intelligence. In 2016 International Conference on Innovation and Challenges in Cyber Security (ICICCS-INBUSH) (pp. 111–114). IEEE. https://doi.org/10.1109/ICICCS.2016.7542339

[13]. Lasi, H., Fettke, P., Kemper, H.-G., Feld, T., & Hoffmann, M. (2014). Industry 4.0. Business & Information Systems Engineering, 6(4), 239–242. https://doi.org/10.1007/s12599-014-0334-4

[14]. Liemberger, R., & Wyatt, A. (2019). Quantifying the global non-revenue water problem. Water Supply, 19(3), 831–837. https://doi. org/10.2166/ws.2018.129

[15]. Singh, H.D. (2013) Design of Water Level Controller Using Fuzzy Logic System. National Institute of Technology, Rourke.