



ARTIFICIAL INTELLIGENCE-BASED CONTROL FOR REACTIVE POWER OF ELECTRIC DRIVE SYSTEM FOR PUMP

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Abstract : This paper presents an effect system implementation arrange for the electrical drive system of a pump station supported analysis, this state of the management technique for the electrical drive system of a pump station, and existing challenges. The operation's findings show that this sort of management plan is possible, which by incorporating computer science, it will effectively save manual labor whereas conjointly sleuthing pump station failures, thence rising the voltage quality of the facility offer system. A nonlinear proportional operation processes the transmission signal of the pumping station's electrical drive system, and also the signal enters the nonlinear operate reckoner of the neural network controller, wherever the neural network's nonlinear mapping ability is employed to realize computer science management through the operate. Design thinking provides a framework that allows us. To raise the correct question at the correct time whereas building associate AI solution. Moreover, it promotes a attitude that accepts uncertainty, a significant part for many advanced AI comes.

Keywords: Electric drive system, Pump station, Power supply system.

I. INTRODUCTION

Traditional control technology has been unable to meet the control needs as science and technology have progressed. Artificial intelligence's rapid advancement offers a fresh solution to this dilemma. Artificial intelligence (AI) is a branch of science and technology that aims to improve human intelligence. Artificial intelligence-driven scientific and technological objects could act as a "container" for intellect in the future. Robots, language recognition, picture recognition, natural language processing, and expert systems are all part of this field's research. Artificial intelligence has progressed in theory and technology since its inception, and its application field has grown. Artificial intelligence-driven scientific and technological objects could act as a "container" for human intelligence in the future.. Artificial intelligence is capable of simulating human awareness and thought. Artificial intelligence is not the same as human intellect, but it can think like one and may even outperform it. Artificial intelligence control does not develop a systematic framework based on a typical mathematical model, but rather on the real effect of control. The artificial intelligence control system also has a nonlinear control function that allows it to keep making judgments and processing data based on the current situation. The pump station's electric transmission system is a prime mover mechanical system that uses a motor to transform electric energy into mechanical energy. The electrical power required to generate alternating and induced magnetic fields is known as reactive power. The motor, distribution transformer, and other components of the pump station's electrical transmission system provide reactive power. Only an alternating magnetic field can be used to transform and convey information. Design thinking only works if it is iterative.

II. LITERATURE SURVEY

Yu Honhshai, Shao Guoqiang. [1] "Artificial Intelligence Control for Reactive Power of Electric Drive System of Pump".

Sun qiuye, Yang lingxiao, zhang huaguang. [2] "Intelligent energy application and prospect of artificial intelligence technology in power system".

Zhou feng. [3]" Big Data and AI Enabling Professional Service, SW AAP system architecture and application introduction".

Li Bohu, Chai Xudong, Zhang Lin. [4] "Preliminary research on modeling and simulation technology for new artificial intelligence systems".

Yang Baohai, Wen Xiuhai, Sui Liming. [5] "Torsional vibration control method analysis of main drive system of cold continuous rolling mill".

Wen Boxuan, Wang Weida, Xiang Changle. [6] "Robust coordinated control of electromechanical compound drive system based on synthesis method".

Wang Weigang, Ding Tuanjie and Chu Xiaodong. [7] "Development of intelligent aviation flight control technology ".

Yang Xinmin. [8] "Application Status and Prospect of Intelligent Control Technology in Thermal Power Plants".

Dahhaghchi, I.,Christie, R.D. [9] "AI application areas in power systems".

III.EXISTING SYSTEM

To ensure the non-linear characteristics of the artificial intelligence control method for reactive power of the pump station electrical drive system, the fuzzy PID algorithm was selected, and the transmission signal was processed through a two-dimensional fuzzy algorithm structure. Fuzzy PID algorithm is a very good nonlinear intelligent control algorithm. The fuzzy PID controller can carry on the real-time on-line correction and the automatic adjustment to the proportion, the integral and the differential three parameters, it has the fuzzy control fast adjustment, the adaptability strong advantage, also has the traditional characteristic which the PID control precision is high. Therefore, the fuzzy PID controller can adjust the PID parameters of the electrical drive system of the pump station online, so that the electrode regulating system can adjust the current rapidly and stably, reduce the electrode oscillation and improve the robustness. It shows that the fuzzy PID controller performs fuzzy inference by virtue of the if then model of expert knowledge and optimizes the output value in real time and online, to adjust the parameters and obtain the optimal reactive power artificial intelligence control of the pump station electrical drives system. At present, although there are many kinds of fuzzy controllers, their working principles are basically the same. Mainly by means of fuzzy mathematical principles and methods and fuzzy rules expressed by fuzzy sets of conditions and operations, and its storage in the knowledge base, finally full use of computer fuzzy reasoning, self-tuning PID parameters. To highlight the convenience and response rapidity of fuzzy output, two-dimensional fuzzy control structure is the most widely used in production and life.

3.1 Disadvantages

- It follows traditional methods such as noting the defect occurring at the machine through notes.
- The major disadvantage is that manual work is required all of the time.

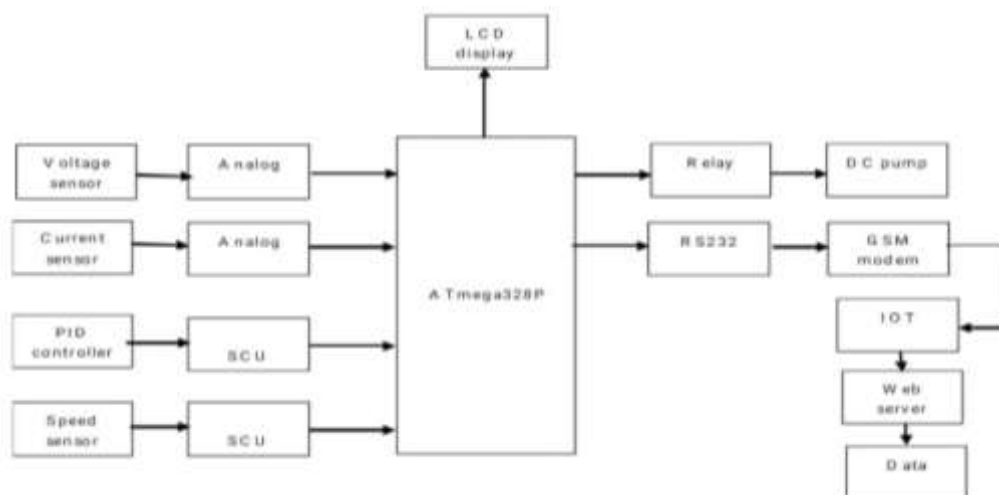
IV.PROPOSED SYSTEM

The fuzzy PID algorithm was chosen as the artificial intelligence control method for reactive power of the pump station electrical adrive system, and the transmission signal was processed through a two-dimensional fuzzy algorithm structure. The fuzzy PID controller can change the PID settings of the pump station's electrical drive system. The fuzzy PID controller adjusts the parameters and obtains the optimal reactive power artificial intelligence control of the pump station electrical drives system in real time and online, using the model of expert knowledge to perform fuzzy inference and optimise the output value. Online adjustments are made to the PID controller based on specific control requirements or objective functions. If there is a problem with the pump, it will be discovered and reported. The user then recognises the problem and fixes it properly. These records are kept on the server for future use. In the subject of artificial intelligence control, there are numerous algorithms. Through fuzzy PID and neural network algorithm controllers, a new reactive power management approach for the electrical transmission system of pump stations is proposed in these projects. The results reveal that the control approach used in these projects is superior to the traditional control method in terms of reducing the electrical drive system's reactive power, increasing its working efficiency, and monitoring faults via IOT.

4.1 Advantages

- The datas are stored in IOT cloud so that the datas will be and we can view for future analysis.
- There is no need for manual labour.
- By monitoring voltage and current, so we can reduce the fault in motor. The motor's lifespan will be increased.

V. BLOCK DIAGRAM



VI. MODULES DESCRIPTION

The hardware components used in the system is PID controller, Speed sensor, Current sensor, Voltage sensor, ATmega328P, Power supply, Electric motor, LCD.

6.1 PID Controller

A PID controller is a device that regulates temperature, flow, pressure, speed, and other process variables in industrial control applications. PID (proportional integral derivative) controllers are the most precise and stable controllers because they use a control loop feedback mechanism to control process variables. PID control employs closed-loop control feedback to maintain a process's real output as close as feasible to the target or setpoint output.

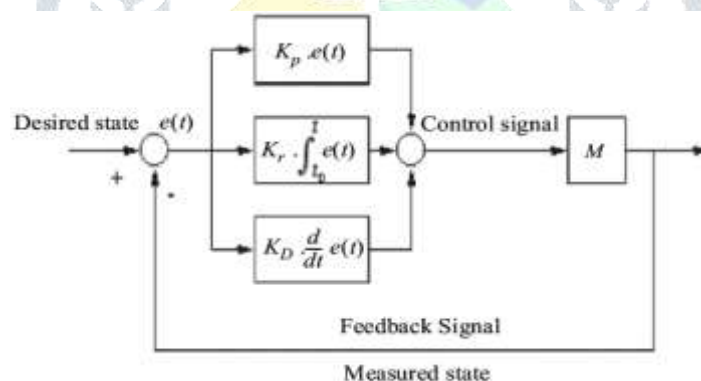


Fig.1- PID Controller Block Diagram

As the second input signal to the FIS, the fuzzy PID controller employs the change in output $-(y(k)-y(k-1))$ instead of the change in error $e(k)-e(k-1)$. This avoids the derivative action from being triggered directly by a step change in the reference signal.

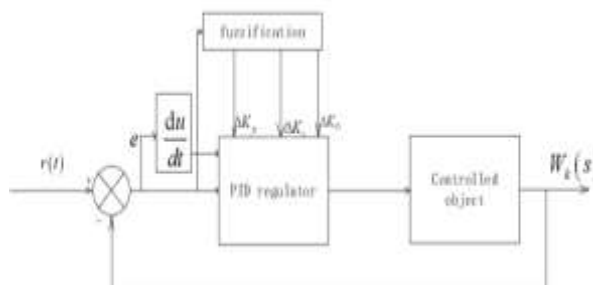


Fig.2- Fuzzy PID Controller Block diagram

6.2 Speed Sensor

The shaft speed and rotational direction are detected by the speed sensor. The sensor is attached to the end cover of a motor and detects the rotational speed of a magnet inside the motor. Controlling the speed of an electric or thermal motor also necessitates the usage of a speed sensor.

6.3 Current Sensor

A current sensor is a device that detects electric current in a wire and generates a signal proportional to that current. The generated signal could be analog voltage or current or a digital output. The generated signal can be then used to display the measured current in an ammeter or can be stored for further analysis in a data acquisition system or can be used for the purpose of control.

6.4 Voltage Sensor

A voltage sensor is a device that measures and calculates the amount of voltage in an object. Voltage sensors can tell whether the voltage is AC or DC. The voltage is the sensor's input, while the switches, analogue voltage signal, current signal, or audible signal are the sensor's output. Sensors are electronic or optical devices that can detect, recognize, and react to certain electrical or optical impulses. Voltage sensor and current sensor approaches have shown to be an excellent alternative to traditional current and voltage monitoring methods.

6.5 Electric Motor

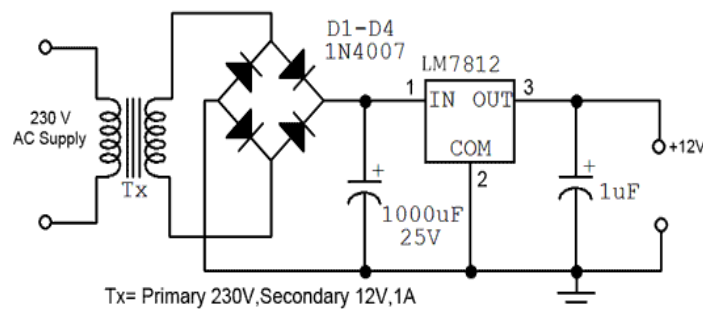
An electric motor is a machine that turns electricity into mechanical energy. Most electric motors work by generating force in the form of torque imparted to the motor's axis by interacting between the magnetic field of the motor and the electric current in a wire wrapping. An electric generator is physically equivalent to an electric motor, but it converts mechanical energy into electrical energy using a reversed flow of power.

6.6 LCD

Liquid crystal material is placed between two sheets of glass in a liquid crystal display (LCD). Liquid crystal molecules align in parallel with the glass surface even when no voltage is provided between clear electrodes.

6.7 Power Supply

The power supply should be +5V, with transients of no more than 10mV. The voltage (VL) at pin 3 should be adjusted properly to get a higher / adequate contrast for the display. A live circuit should not have a module installed or removed. The power supply's ground terminal must be appropriately separated so that no voltage is induced in it. The module should be isolated from the rest of the circuitry to prevent stray voltages from causing a flickering display.



3.8 ATmega328P

The ATmega328P is a RISC microcontroller with an 8-bit address space. 8-bit means the processor uses an 8-bit register that can handle 256 data values, which may appear insignificant by today's standards; however, the higher the bit count and processing speed, the more power the processor consumes, which is why microcontrollers are a good choice for low-power applications. Because of its advanced RISC design, the ATmega328P is a high-performance, low-power 8-bit AVR microcontroller that can execute 131 strong instructions in a single clock cycle. It's a CPU that's typically seen in Arduino boards like the Arduino Fio and Arduino Uno.

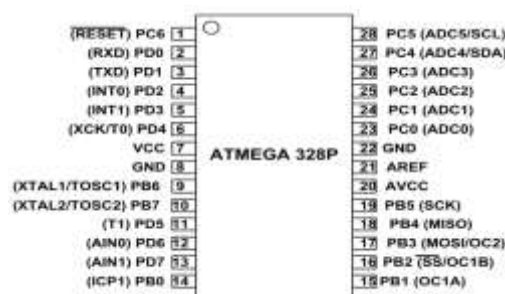


Fig.4- Pin Diagram of ATmega328P

VII. WORKING

We will change the PID controller module to a keypad-based arrangement that is directly connected to the microcontroller in order to lower the cost and size of the product. We can use switches to control the motor's RPM. Once we've set the limit, the motor will operate in accordance with it. The motor's speed is measured by a proximity sensor, resulting in a closed loop system. If the motor crosses the limit, the microcontroller will detect it and switch the motor to the predetermined limit. According to the programming, errors can be detected inside the microcontroller.

VIII. CONCLUSION

Artificial intelligence is to simulate the human brain's thinking way of thinking in work, and its learning is compared to traditional technology, as the prosperity and rapid development of human society, traditional technology and methods gradually cannot meet the requirements of industrial development becomes more and more complex, high-end, artificial intelligence is to simulate the human brain's thinking way of thinking in work, and its learning is compared to traditional technology, more and more industry will pay attention to the development of artificial intelligence, making it the mainstream. In the subject of artificial intelligence control, there are numerous algorithms. In this paper, a fuzzy PID and neural network algorithm controller is used to build a new reactive power control approach for the electrical transmission system of a pump system. The results of the experiments suggest that the control approach proposed in this paper is effective

IX. REFERENCES

- [1] Yu Honhshai, Shao Guoqiang, "Artificial Intelligence Control for Reactive Power of Electric Drive System of Pump", Wuhan Municipal Engineering Design and Research Institute Co. Ltd, vol. 978, no. 1, pp. 7281-3977, 2019.
- [2] Sun qiuye, Yang lingxiao, zhang huaguang, "Intelligent energy application and prospect of artificial intelligence technology in power system. Control and decision-making, vol. 33, no.5, pp. 173-184, 2018.
- [3] Zhou feng, "Big Data and AI Enabling Professional Service, SW AAP system architecture and application introduction", China certified public accountant, no. 12, pp. 22-24, 2017.
- [4] Li Bohu, Chai Xudong, Zhang Lin, "Preliminary research on modeling and simulation technology for new artificial intelligence systems", Journal of system simulation, vol.30, no. 2, 2018.
- [5] Yang Baohai, Wen Xiuhai, Sui Liming, "Torsional vibration control method analysis of main drive system of cold continuous rolling mill", Journal of Mechanical Design and Manufacturing, no. 6, 2018.
- [6] Wen Boxuan, Wang Weida, Xiang Changle, "Robust coordinated control of electromechanical compound drive system based on synthesis method", Chinese journal of mechanical engineering, vol. 54, no. 14, pp. 88-97, 2017.
- [7]. Wang Weigang, Ding Tuanjie and Chu Xiaodong, "Development of intelligent aviation flight control technology ", Journal of Flight mechanics, vol. 35, no. 3, pp. 1-5, 2017.
- [8]. "Key Technology Analysis of Artificial Intelligence Applied to Power Grid Regulation ", Journal of Power System Automation, vol. 43, no. 01, pp. 69-77, 2019.
- [9]. Yang Xinmin, "Application Status and Prospect of Intelligent Control Technology in Thermal Power Plants", Journal of Thermal Power Generation, vol. 47, no. 380, pp. 5-13, 2018.
- [11] Warwick K, Ekwue A and Aggarwal R, "Artificial intelligence techniques in power systems", The Institution of Electrical Engineers, London, 1997.
- [12] M.M. Saha and B.Kasztenny, The special issue on AI applications to power system protection, International Journal of Engineering Intelligent Systems, vol.5, no.4, pp.185-93. , December 1997.
- [13] Dahhaghchi, I., Christie, R.D., "AI application areas in power systems", IEEE Expert, vol. 12, no. 1, pp. 58-66, Jan/Feb 1997.
- [14] Anis Ibrahim.W.R, Morcos.M.M, "Artificial Intelligence and Advanced Mathematical Tools for Power Quality Applications", a survey, Power Delivery, IEEE Transactions, vol. 17, no. 2, pp. 668-673, April 2002.
- [15] Khedher M.Z., "Fuzzy Logic in Power Engineering", Regional Conference of CIGRE committees in Arab Countries, Doha, Qatar May 25-27 (1997).
- [16] Bachmann B., Novosel D., Hart D., Hu Y., Saha M.M., "Application of Artificial Neural Networks for Series Compensated Line Protection", Proc. of the Int. Conf. on Intelligent System Application to Power Systems, Orlando, pp.68-73, January 28 - February 2, 1996.
- [17]. Kirkpatrick S., Gelatt C. D., Vecchi M. P., 1983, "Optimization by simulated annealing". Science. New Series 220, pp.671-680.
- [18] Lai, Loi Lei, Intelligent System Applications in Power Engineering: Evolutionary Programming and neural networks, John Wiley & Sons, UK, 1998.
- [19] B. Kosko, Neural Networks and Fuzzy Systems, Prentice Hall, Englewood Cliffs, NJ, U.S.A., 1992.
- [20]. Alander J. T., An indexed bibliography of genetic algorithm in power engineering, Power Report Series 94-1, 1996.
- [21]. El-Hawary, Mohamed E., Electric power applications of fuzzy systems, John Wiley USA, 1998.
- [22]. Momoh James A., EL Hawary Mohamed E., Electric systems, dynamics, and stability with artificial intelligence, Marcel Dekker, Inc. USA., 2000.