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Fuzzy Logic Controller and IoT Based DC Motor Drives

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Abstract: *In the advance engineering and science, the automatic control has played a vital role. The control of direct current (DC) motor is a common in industries thus the implementation of DC motor controller speed is important. The main purpose of proposed paper is to control motor speed, keep the rotation of the motor at the present speed and to drive a system at the demand speed. The project purpose is to control speed of DC Series Wound Motor using fuzzy logic controller. The DC Series Wound Motor is identical in industrial application and control systems as of the high torque density, high efficiency, and small size. In proposed paper, controlling speed of DC Series Wound Motor using Fuzzy Logic Controller (FLC). The main aim is to get the best performance compared to dc motor without controller in terms of settling time (Ts), rise time (Tr), peak time (Tp) and percentage peak overshoot (%MP) in Fuzzy Logic Controller*

Keywords: DC motor, Demand speed, Fuzzy logic controller, High torque density

I. INTRODUCTION

When the development of power electronics resources, the direct current machine became more and more useful. Nowadays their uses are not limited in the car applications (electrics vehicle), in applications of weak power using battery system (motor of toy) or for the electric traction in the multi-machine systems too. The speed of DC motor can be adjusted to a great extent as to provide controllability easy and high performance. The controllers of the speed that are conceived for goal to control the speed of DC motor to execute one variety of tasks.

IoT-enabled motor speed control and monitoring depend on sensors and the cloud for data processing. IoT technology studies variations in parameters such as voltage, current, and temperature to control the speed of a motor.

Speed control and motor monitoring are critical in industrial and home applications. One can achieve these 'motors optimum performance by processing the sensors' data. It helps in understanding the current performance of the motor and predicting upcoming repair requirements if any.IoT helps to control and monitor motors to ensure optimal use for desired results. Besides providing robust operational efficiency, it helps to maintain power usage while minimizing maintenance needs. On-going monitoring can help notice abnormality early on and prevent any fault in the motor. IoT-based monitoring of engines helps in reducing the following:

Electrical faults like reverse phase sequencing fault, single phasing fault, overload fault, oversupply voltage, or earth fault.

Environment faults occurring due to moisture or temperature fluctuations. These may lead to vibration of the motor.

Mechanical faults due to broken rotor bar, winding defect in stator and rotor, or use of faulty bearing.

II. OBJECTIVE

- To control the DC motor speed with conventional controlling methods.
- To control the DC motor speed with fuzzy logic controller. Compare the different speed controlling techniques.
- To control the dc motor to give a variable speed, which has high performance, reliability, and adaptability for different dc motor ratings with good speed response, and develop a system with constant speed at any load condition automatically.

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- To keep the rotation of the motor at the present speed and to drive a system at the demand speed.
- To compare and analyse the performance of each controller.

III. PROBLEM STATEMENT

To encounter this problem, the controller is needed and this project Fuzzy Logic Controller will be used. The selection of DC motor because it provides excellent torque load properties to the system which other motor of this class cannot provide.

Fuzzy Logic Controllers were proposed to achieve the speed control of a DC motor using combined armature voltage and field current by varying the armature voltage in the constant torque region and the field current in the constant power region.

3.1 Proposed System

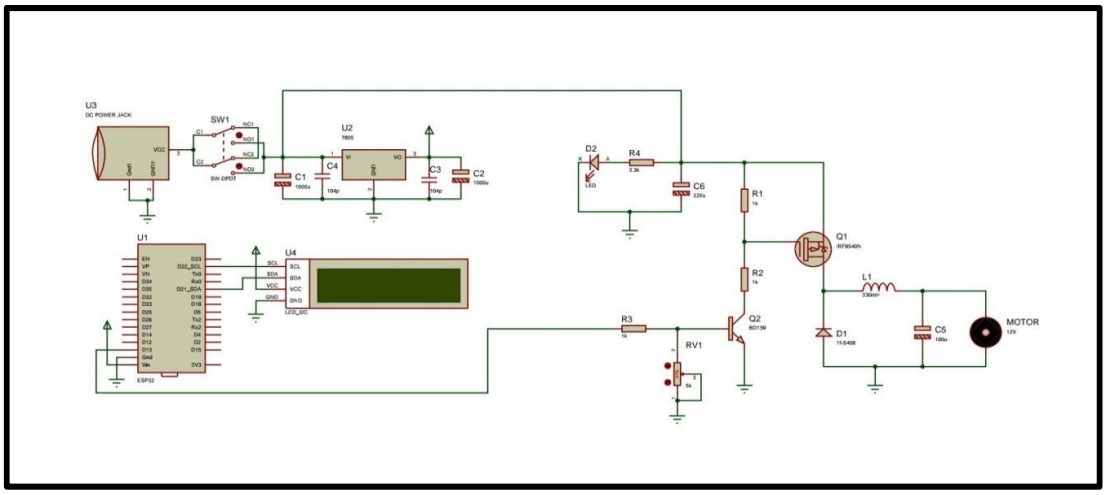

Fig: Circuit diagram

3.2 Processes

The following is a general procedure for implementing a "fuzzy logic controller and IoT-based DC motor drive" system:

- **Determine the DC motor specifications:** Identify the specific DC motor to be controlled and determine its voltage and current requirements, as well as its speed and torque characteristics.
- **Design the control system:** Design the overall control system, including the fuzzy logic controller, IoT sensors, and data analytics platform. Determine the input and output variables for the fuzzy logic controller and the sensors to be used to collect data about the motor's performance.
- **Develop the fuzzy logic controller:** Develop the fuzzy logic controller using a programming language such as MATLAB or Python. Design the fuzzy rules and membership functions based on the input variables, output variables, and the motor's performance requirements.

Table component used for projects with their ratings

Sr. no.	Used Components		
	Components	Specifications	Quantity
1	Microcontroller	ESP-32	1
2	LCD	Alphanumeric	1
3	F2C	LCD-F2C	1
4	Power Supply	12 V/Amp	1

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Sr. no.	Used Components		
	Components	Specifications	Quantity
5	Voltage Regulator	ZC-7805	1
6	Electrolatic Capacitor	1000 uF/25 V	2
7	Ceramic Capacitor	104uF	2
8	PCB	Glassy Poxy	1
9	MOSFET	IRF 9540	1
10	Diode	IN 5819	1
11	Motor	12V	1
12	Electrolatic Capacitor	100uF	2
13	Inductor	330uH	1
14	Electrolatic Capacitor	10uF/16	2

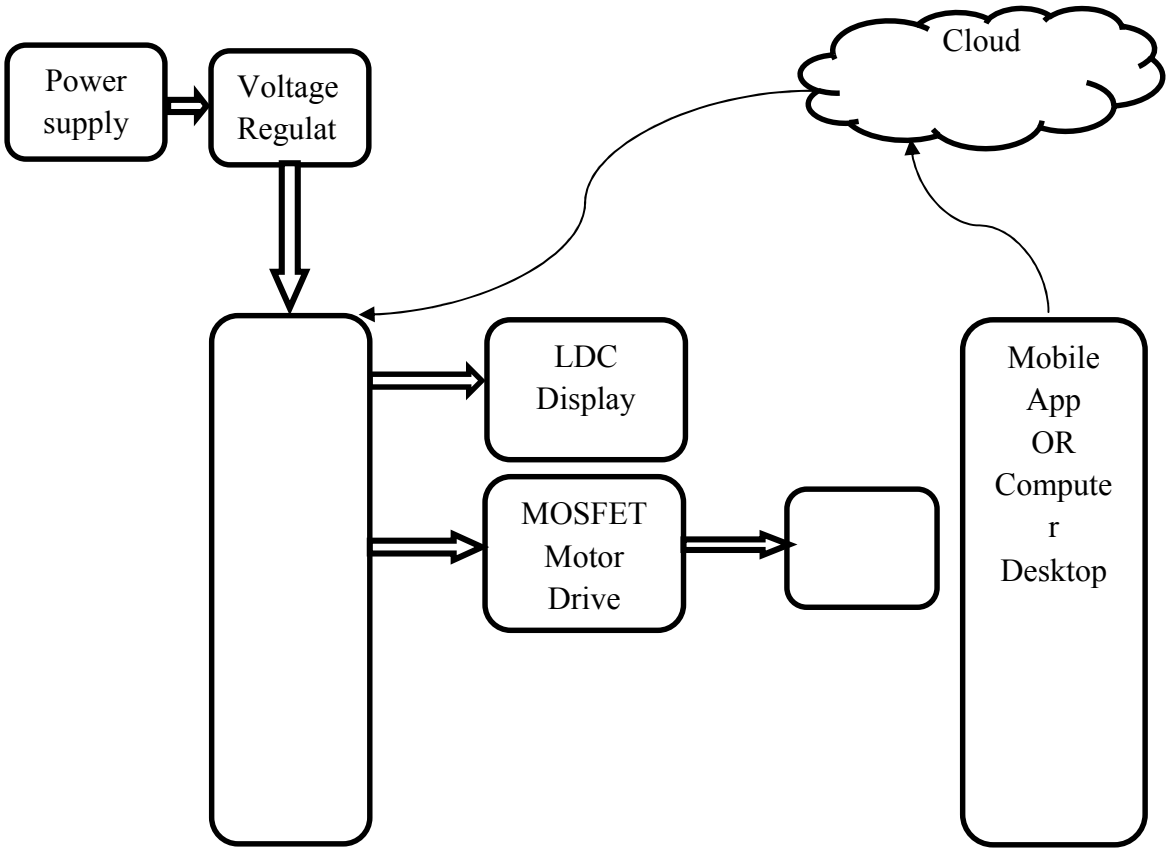

Fig: Block diagram

IV. CONCLUSION

In this paper, the speed of a DC Motor drive is controlled by means of fuzzy logic controllers. The optimal fuzzy logic is designed using various algorithms.

According to the results of the computer simulation, is the best controller which presented satisfactory performances and possesses good robustness (no overshoot, minimal rise time, Steady state error = 0).

The major drawback of the fuzzy controller is the insufficient analytical design technique (choice of the rules, the membership functions, and the scaling factors).

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That we chose with the use of the genetic algorithm for the optimization of this controller in order to control DC motor speed. Finally, the proposed controller provides drive robustness improvement.

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