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	(71)**Name of Applicant :**
	  1)**Mr. Pushpendra Kumar Kushwaha**
	    Address of Applicant :Mr. Pushpendra Kumar Kushwaha,,Research Scholar, Department of Mechanical Engineering, Jaypee University of Engineering and Technology,Raghogarh, Guna, Madhya Pradesh-473226,pkushwaha1021@gmail.com,Mobile no:8982241285 ----------- -----------
	  2)**Mr. Rakesh Kumar,**
	  3)**Mr.Md.Arman Ali,**
	  4)**Dr. R. Kumaravelan**
	  5)**Dr. Mrutyunjay Padhiary**
	  6)**Mr. K .Nagaraju ,**
	  7)**Mr. Vivek Vishnu Bamane**
	  8)**Mrs.K.Kavitha,**
	  9)**Dr.Saranu Ravikumar**
	Name of Applicant : NA
	Address of Applicant : NA
	(72)**Name of Inventor :**
	  1)**Mr. Pushpendra Kumar Kushwaha**
	Address of Applicant :Mr. Pushpendra Kumar Kushwaha,,Research Scholar, Department of Mechanical Engineering, Jaypee University of Engineering and Technology,Raghogarh, Guna, Madhya Pradesh-473226,pkushwaha1021@gmail.com,Mobile no:8982241285 ----------- -----------
	  2)**Mr. Rakesh Kumar,**
	Address of Applicant :Mr. Rakesh Kumar,Assistant Professor, Department of Civil Engineering, ABMSP'S Anantrao Pawar College of Engineering and Research, Parvati, Pune - 411009. Maharashtra ,Email: rk88mi@gmail.com ----------- -----------
	  3)**Mr.Md.Arman Ali,**
	Address of Applicant :Mr.Md.Arman Ali, Assistant Professor, Department of Civil Engineering, Motihari College of Engineering, Motihari, Fursatpur, Bairiya, East Champaran, Bihar, India-845401 aa7425@gmail.com ----------- -----------
	  4)**Dr. R. Kumaravelan**
	Address of Applicant :Dr. R. Kumaravelan ,Professor & Head, Department of Mechanical Engineering, Velalar College of Engineering and Technology, Thindal, Erode, Tamil Nadu-638012 rkumaravelan@gmail.com ----------- -----------
	  5)**Dr. Mrutyunjay Padhiary**
	Address of Applicant :Dr. Mrutyunjay Padhiary,Assistant Professor, Department of Agricultural Engineering, Triguna Sen School of Technology, Assam University, Silchar, Assam-788011. email: mrutyu@gmail.com ----------- -----------
	  6)**Mr. K .Nagaraju ,**
	Address of Applicant :Mr. K .Nagaraju , Assistant Professor, Department of Mechanical Engineering, Avanthi Institute Of Engineering And Technology, Narsipatnam. AndraPradesh-531113 knraju306@gmail.com ----------- -----------
	  7)**Mr. Vivek Vishnu Bamane**
	Address of Applicant :Mr. Vivek Vishnu Bamane, Assistant Professor, Department of Mechanical Engineering, V V P Institute of Engineering & Technology, Solapur, Maharashtra, India-413008 bamane.vivek@gmail.com ----------- -----------
	  8)**Mrs.K.Kavitha,**
	Address of Applicant :Mrs.K.Kavitha, Assistant professor,Department of Computer Science,A.D.M College for Women (Autonomous), Nagapattinam,Tamilnadu-611001, kavithaadmc@gmail.com ----------- -----------
	  9)**Dr.Saranu Ravikumar**
	Address of Applicant :Dr.Saranu Ravikumar, Associate Professor, Department of Mechanical Engineering, Bapatla Engineering College, Gbc Road, Mahathamajipuram,Bapatla,Andhrapradesh-522102 ,srksaranu1981@gmail.com ----------- -----------

(57) Abstract :
The Smart Hydraulic System with Integrated Predictive Maintenance and Control is an innovative solution designed to enhance the performance, reliability, and efficiency of hydraulic systems across various industries. Traditional hydraulic systems often rely on reactive or time-based maintenance approaches, leading to costly unplanned downtimes and inefficient operations. This invention integrates advanced technologies such as real-time monitoring, predictive maintenance, and intelligent control to address these challenges and transform hydraulic system management. The system uses a network of sensors to continuously monitor key parameters like pressure, temperature, fluid levels, and flow rate. The data collected from these sensors is analysed using machine learning algorithms, which can detect early signs of component wear or failure. Predictive maintenance algorithms forecast the remaining useful life of critical components, enabling proactive maintenance and reducing the risk of sudden system failures. Additionally, the system includes an automated control mechanism that adjusts system parameters in real-time, such as pressure and flow rate, to ensure optimal operation and prevent damage to components. This dynamic control helps improve overall system efficiency and performance. The system also optimizes energy consumption by adjusting operational parameters based on real-time data, leading to reduced energy costs and a smaller environmental footprint. By combining predictive maintenance, real-time monitoring, and intelligent control, the Smart Hydraulic System minimizes downtime, reduces maintenance costs, extends component lifespan, and enhances operational efficiency. Its ability to predict failures, optimize energy use, and provide actionable insights makes it a significant advancement over traditional hydraulic systems, offering industries a more sustainable and cost-effective solution for managing hydraulic operations.

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