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## Automated control of valves and pump of a biodiesel plant

Srinidhi Gowda

[srinidhif2@gmail.com](mailto:srinidhif2@gmail.com)

P. E. S College of Engineering and Technology,  
Mandya, Karnataka

M Subramanyam

[msubramanyam71@gmail.com](mailto:msubramanyam71@gmail.com)

P. E. S College of Engineering and Technology,  
Mandya, Karnataka

### ABSTRACT

*Biodiesel production involves the transesterification process, where the triglyceride lipid source converts as fatty acid methyl esters and glycerol. A large amount of waste cooking oil is produced globally and will dispose of the available energy. According to the Health Laws of Waste Cooking Oil, it does not need to be recycled in the food industry. In this research, the main objective was to create a small and medium-sized enterprises (SME) plant for the production of biodiesel from improving the process requirements and from waste cooking oil. The product can be used in place of petroleum diesel for automotive and industrial applications without any environmental impact and ensures the same performance of internal combustion engines with essential changes. The aim is to develop an automated machine to produce biodiesel from waste cooking oil. The machine is building alternative methods for re-use of waste cooking oil to make biodiesel. Biodiesel can be used to produce waste vegetable oil as a raw material. Waste vegetable oil is easily available and cheaper and the process of converting waste vegetable oil into biodiesel takes time, and biodiesel production requires an operator to run the system. Due to these requirements, a typical biodiesel system requires much operator interaction which is not overcome by the existing system. The system was designed and built in conjunction with pumps, valves, temperature sensors, etc., to completely handle the production of biodiesel with minimum operator interaction. The developed system circulates the fluid throughout the system and presenting the end user with biodiesel upon completion of a full cycle.*

**Keywords:** Automated Control, Solenoid Valves, Sensors, Microcontroller, Biodiesel Plant.

### 1. INTRODUCTION

Biodiesel refers to vegetable oil or animal fat-based diesel fuel, which consists of a long chain alkyl group (methyl, ethyl, or propyl) esters. Biodiesel is typically made by chemical reaction to lipids with alcoholic fatty acid esters. Biodiesel is made up of a chemical process called transesterification, which divides the oil into two parts: alkyl ester and glycerine; Ester is fuel, but the remaining glycerine is used to make soap and other beauty products. Manual control is a time-consuming work, coordination, and timing that is a key necessity of this activity, which can cause accuracy loss, so automation of so automation of valve and motor control is one of the solutions for above problem and we have attempted this by “Automated Control Of Valves and Pump Of a Biodiesel Plant”.

The main objective of the project is To Design an automated biodiesel system. And To develop a proto type for continuous biodiesel esterification process through the reduction of the operator intervention in the valve and pump control using a closed loop controller.

### 1.1 System Model

The system model focused on the design, development and the implementation of the automated biodiesel plant with a closed loop. Wi-Fi module is used as a control device, it sends the information (like level, depth readings) to the Controller. It will process the information and perform the operation, and it is displayed on the Serial monitor. Ultrasonic sensor detects levels of the liquid in the 2<sup>nd</sup> stage. And it sends the data to the controller, if there is any change in the level of the liquid, information is send to the controller. Then the system send the quantity of liquid level to the end user via Wi-Fi module.

The system overview which is implemented as follows.

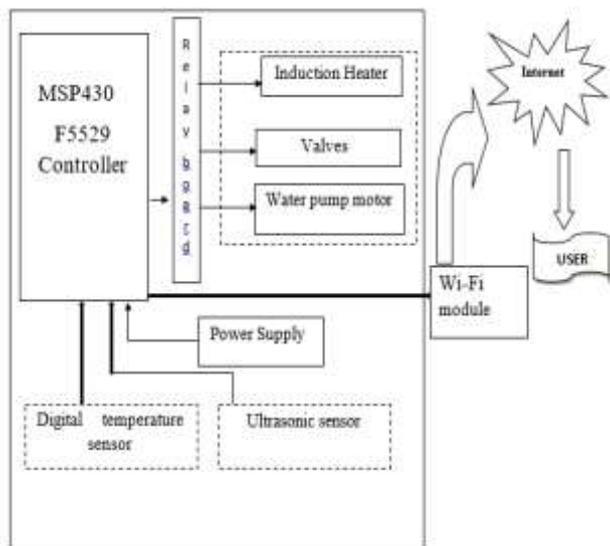


Fig.1 shows the overview of the system

1.1 Proposed Methodology

The block diagram of the proposed system is as follows fig 2. The automated Biodiesel plant is a proto type for continuous biodiesel esterification process through the reduction of the operator intervention in the valve and pump control using a closed loop controller. The proposed work consists of Solenoid Valve, Induction heater, Water Pump Motor, Temperature Sensor, Ultrasonic sensor, Relay board, MSP430F5529 controller, power supply. The automated control of biodiesel plant is as shown in fig 2.

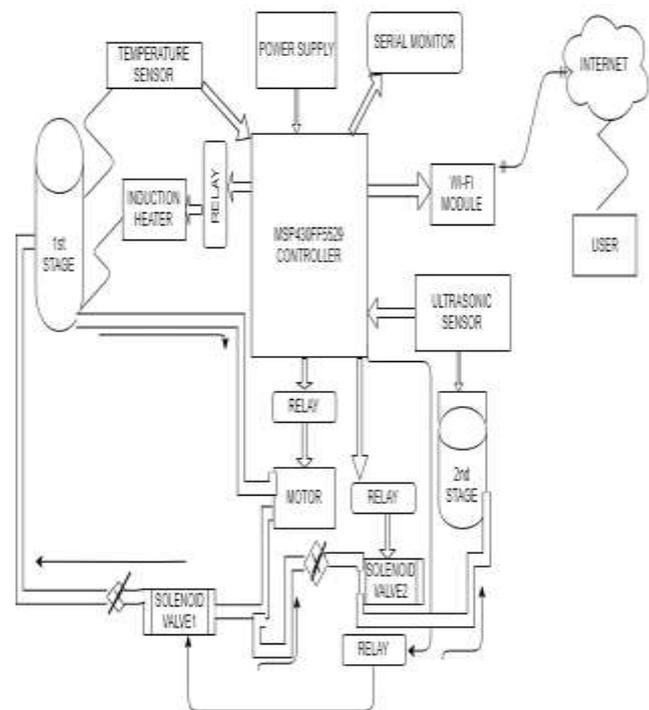


Fig 2. Block Diagram of Proposed automated Biodiesel Plant control system

In biodiesel plant has two stages.

The 1<sup>st</sup> stage (tank) filled with the crude oil, then heating process start. To distribute the heat throughout the tank, the recirculating system is used. The recirculating system consists of solenoid valve1, water pump motor. First turn ON valve1, Motor1 using a relay which in turn by the

controller. A liquid temperature sensor is used to monitor the temp in the tank. The crude oil is set to a 60 degree centigrade for certain period of time after that period Valve1, heater1 is made OFF.

Shift the content to 2<sup>nd</sup> stage through valve2. The volume of the container is monitoring using ultrasonic sensor after beyond specified quantity of oil, the motor is set to OFF, and Valve2 is set to close. And the quantity of oil contained in the tank is measured, send through a mail using WI-FI module to end user.

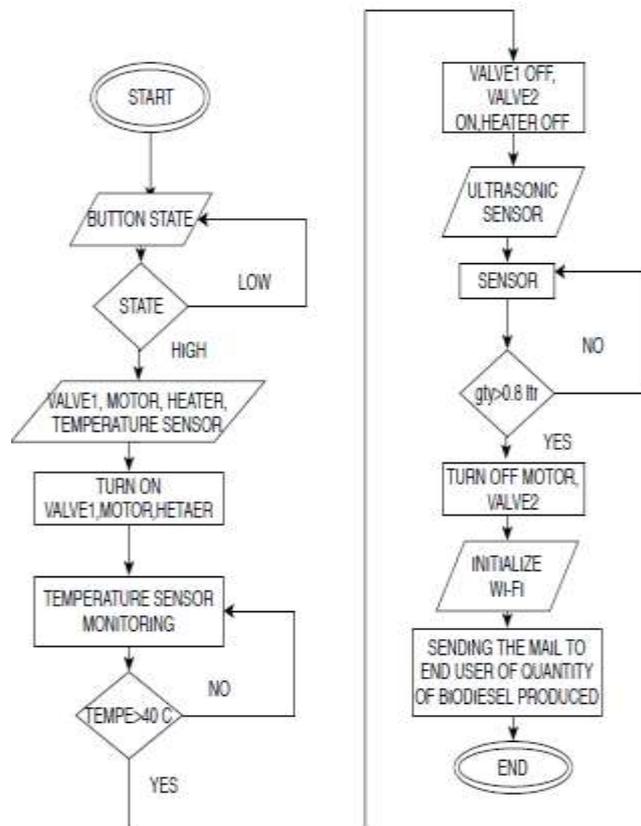
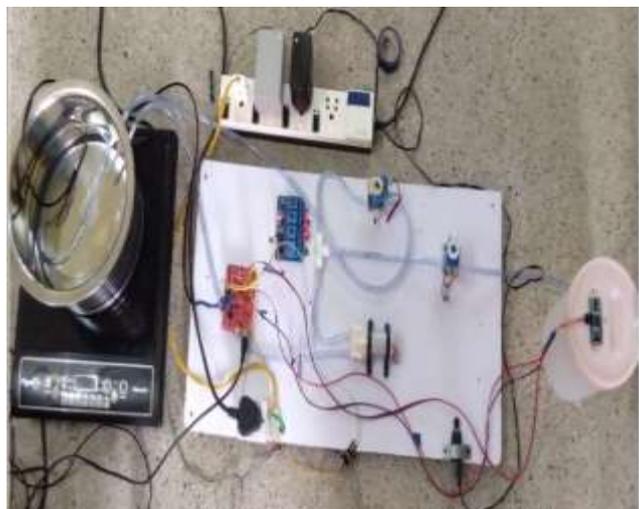


Fig 3. Flow chart of the proposed system

1.2 Simulation/Experimental Results

Hardware Implementation of a prototype of biodiesel plant is shown in figure 4. The digital temperature sensor which is used to convert physical parameter into electrical parameter using A/D converter. The digital signal is received by the board. The analog signal is converted into digital form using A/D converter in board. The microcontroller based on the digital input displays output in the monitor. As the temperature exceeds above the specified limit, the liquid is shifted to 2<sup>nd</sup> stage through the motor and the valve. In order to measure the level of the liquid in the 2<sup>nd</sup> stage or distance, Ultrasonic sensors HC-SR04 is used.



**Fig 4. A prototype of a Biodiesel Plant**

In order to transmit the output of water level measurement from the board to server database Wi-Fi module is used. Wi-Fi module transmits water level values from the board to the database.

## **2. CONCLUSION**

The type of automation is easy to implement compared to other automation. Automation implemented includes both hardware and software. The automated biodiesel plant is help for a reduction in production time, lessens human error, high accuracy.

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