IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

# Simulation for Controlling and Fault Monitoring of Home Electrical Appliances

[1]Gauri Ghadge, [2]Pragati Korde

[1] Research Scholar, Department of Electrical Engineering, G H Raisoni Institute of Engineering and Technology, Pune 412207, India

[2] Professor, Department of Electrical Engineering, G H Raisoni Institute of Engineering and Technology, Pune, 412207, India

***Abstract:*** In day to day life home appliances have important role to make easy life style of human being. Electrical home appliances continuously under use in every day, saving of electrical energy is very much essential now a day, also due to continuous use of home appliances and load power, failure rate of devices increases so it's necessary to avoid damage to the devices. This paper described the simulation for controlling and monitoring of home appliances by using Metlab software. It consists of single phase AC voltage regulator, TRIAC, controller and load. Speed can be controlled by changing firing angle, if firing angle changes from $o^0$ to $180^0$ according to that speed of device such as fan vary from maximum to minimum and speed has been controlled. Simulation also consist of programming for controller having different sensors such as Temperature, Vibration, Noise, Voltage, Current, if any value of sensor parameter exceeds the reference value, controller will cut the voltage and current supply to the load. Controller monitor the fault occurs due to increase values of sensor parameter above the set or reference value and it will cut the load, so it avoid further damage to the devices. So both speed control and fault monitoring helps the devices to operate smoothly and detect early failure of device to avoid more damage to the devices, this information important for maintenance and product support for future improvement in quality of device.

***Index Terms*** **- Controller, Speed control, Temperature, Vibration, Noise, Current, Voltage, Fault**

## I. INTRODUCTION

IoT is a big technology advancement; where, a human interacts with the machines and perform work more accurately and swiftly. As per studies, billions of the devices will be connected to internet by 2025. Interconnection of devices will create an intelligent network and will build smart devices. Thus when they are interconnected they can analyze the data in countless ways which creates better and faster products at low costs. All tasks can be performed more accurately and automatically with combination of IoT and automated devices. IoT offers us an opportunity for saving our time, money and utilizing our resources optimally. Along with IoT It is very much essential to control home appliances and monitor fault occurs because of changing the parameter associated with device such as temperature, vibration, noise voltage, current. Some devices having measure problem if not diagnosis that problem at initial level after certain period device require more maintenance and cost of maintenance increase or in certain cases device might be fail totally. Now days, the need of efficient controlling of appliances to minimize power wastage and monitor fault of appliances is essential. So, this product will help to identify or recognize unexpected situations before any serious failure which leads to a greater reliability and significant cost savings.

## II. LITERATURE SURVEY

Siddhartha Maity. [1] In this paper the simulation executed on Proteus and hardware circuitry was designed. To send the user's command to the circuit through the local cloud server connected with Arduino and Bluetooth module by using Blynk app. They have presented the procedure of smart home automation controller, using IoT home appliance can be converted into a smart and intelligent device. This system uses IoT connectivity to monitor and access of devices from anywhere, was prove to be energy efficient.

Fomin S.P. [2] they developed a simulated model for system tests of bedroom to exemplify Smart Home operations, test results provided and also shown that the automation switching saves time for turning on or off the devices.

Akhil Jose [3] For fast switching and protection of the sub circuits developed smart distribution board for low voltage residential using solid-state circuit breaker. In smart distribution board, IoT based real-time monitoring of sub-circuits was developed. Hardware system was developed having solid state relays for working IoT based automation system and by using Metlab software performance of the SSCB evaluated.

Muhammad Zeeshan Saeed. [4] In this paper, an economical, secure, fault-tolerant and easy to install/use surveillance system was developed. To detect heat signatures a couple of PIR and microwave sensors are used. They are physically connected using Arduino Mega Board. The Arduino Mega Board generates an alert notification and sends it to the 3G/GPRS Shield (SIM5215A) module, if intrusion is detected.

Jorge C. [5] for monitors the behavior of electrical magnitudes of domestic appliances in real time they developed low cost, intelligent system. The system is able to analyze the collected data, detect possible faults, and report this situation to the user .The system was contribute to old fashion domestic appliances recover through the adoption of an IoT adapter. The simple technical person is easily identifying faults that only specialized technicians can observe. With the resources available, the detected faults sent directly to the user, for repairing of the devices.

Amruta Patil [6] in this work cost effective home automation system designed and implemented. For elders and handicapped person designed system was user friendly to control appliances.

Arun Francis [7] Intelligent home automation systems and technologies was examined in this work. To control and monitor operations, smart devices was used in home automation system. They discuss IoT technology for the automation of appliances and listed the advantages and limitations.

Dhia Nadhirah Binti Azizul [8] This research include the automatic light and automatic fan controlled system based on temperature of the room and automatic opening and closing door system. They use sensor and moving motor connected to gear which will slide the door open and close, model of system was developed with Adriano.

## III. PROPOSED MODEL OF SIMULATION

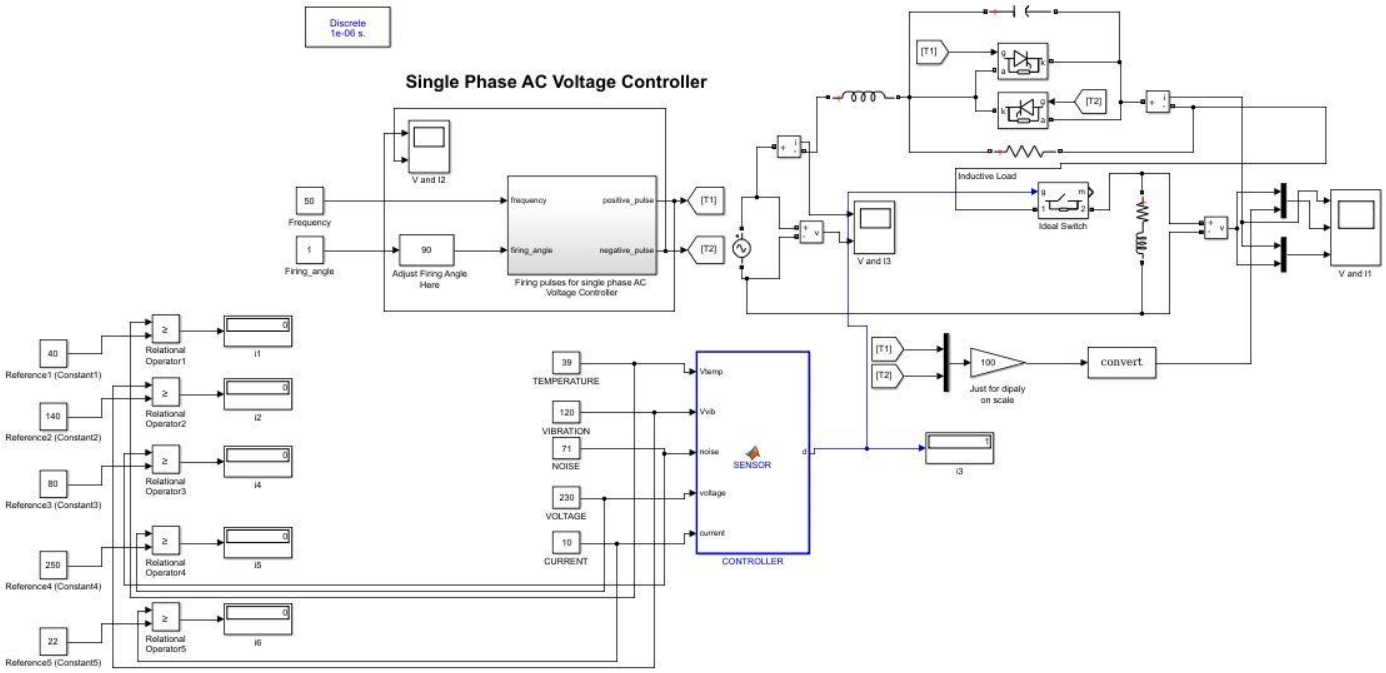


Fig.1 simulation for fault and speed control of fan

Figure 1 shows the simulation for fault and speed control of ac fan, it consist of single phase AC voltage regulator and input for that is constant frequency and adjustable firing angle, it also consist of TRIAC T1 and T2. Here load is considered as inductive load i.e. fan. Firing angle can be adjust from $0^0$ to $180^0$, according that output waveform vary and speed will be regulated, means speed of fan controlled by changing firing angle . Result for output waveform shown as V and I. Different sensors are taken here as temperature, vibration, noise, voltage and current, program is made for sensor controller, if any one value of above parameter of sensor more than the reference value (for temperature Reference value 40, for vibration reference value 140, for noise reference value 80, for voltage reference value 250 and for current reference value 22) it will cut the supply to the load and automatically fan will off.

## IV. SIMULATION RESULTS AND DISCUSSION

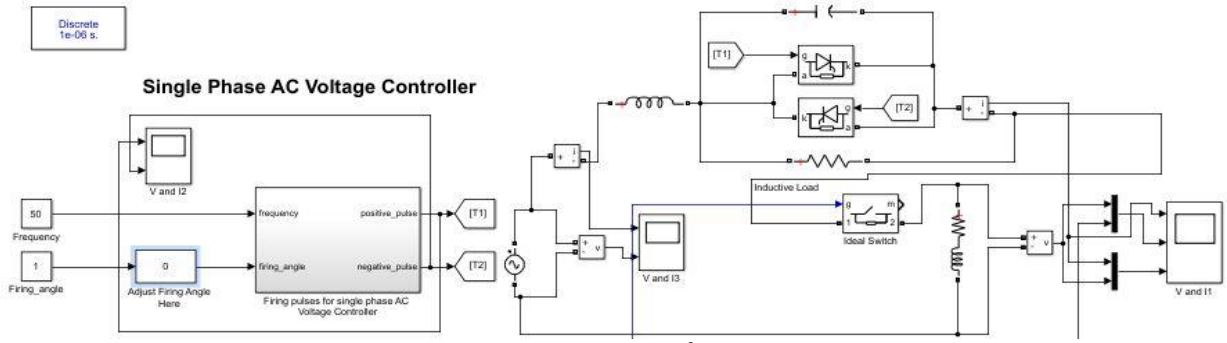


Fig.2 firing angle $0^0$

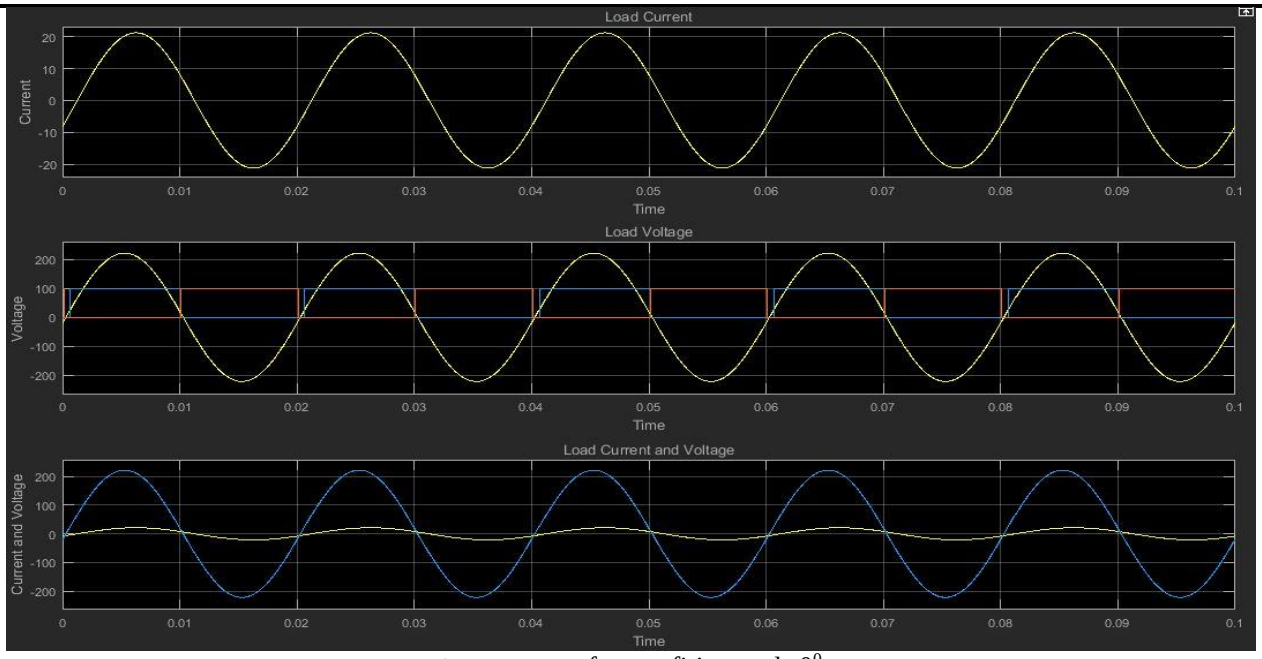


Fig. 3 output waveform at firing angle $0^0$

Figure 2 shows firing angle zero for single phase AC voltage regulator and figure 3 shows output waveform at firing angle $0^0$ at that condition fan operated at maximum speed and waveform shows results as voltage and current at firing angle $0^0$

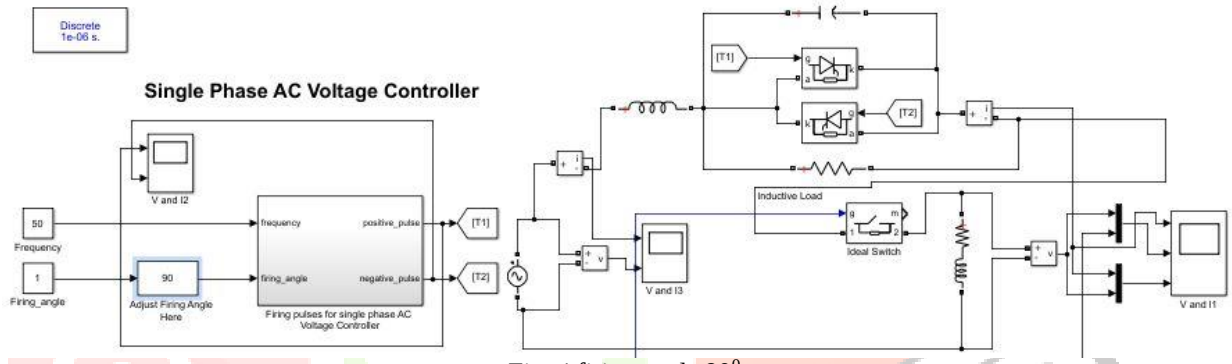


Fig. 4 firing angle $90^0$

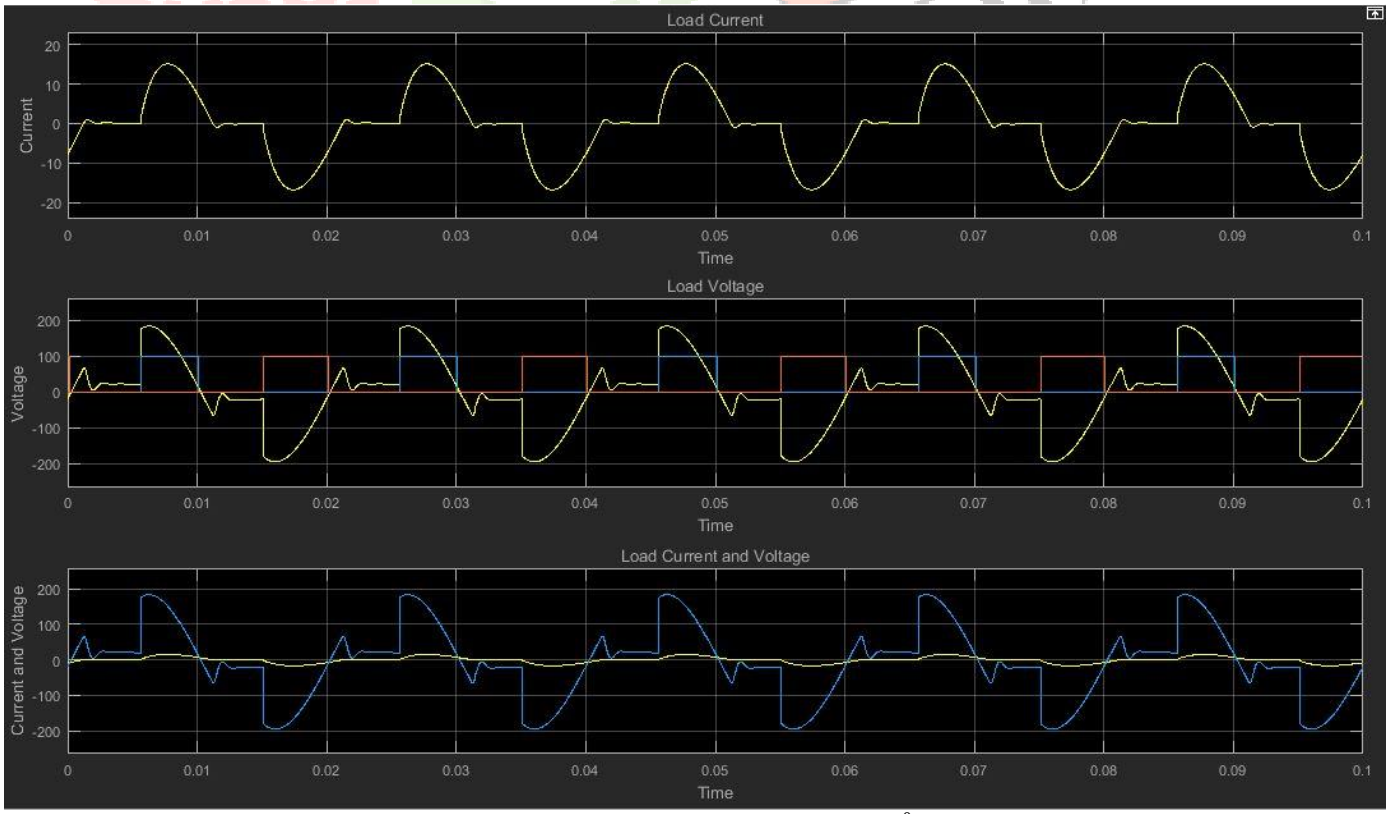


Fig. 5 output waveform at firing angle $90^0$

Figure 4 shows firing angle $90^0$ for single phase AC voltage regulator and figure 5 shows output waveform at firing angle $90^0$ at that condition fan operated at less speed as compared to fan speed when firing angle at $0^0$ because of less voltage and current supply to the fan at firing angle $90^0$ and waveform shows results as voltage and current at firing angle $90^0$.

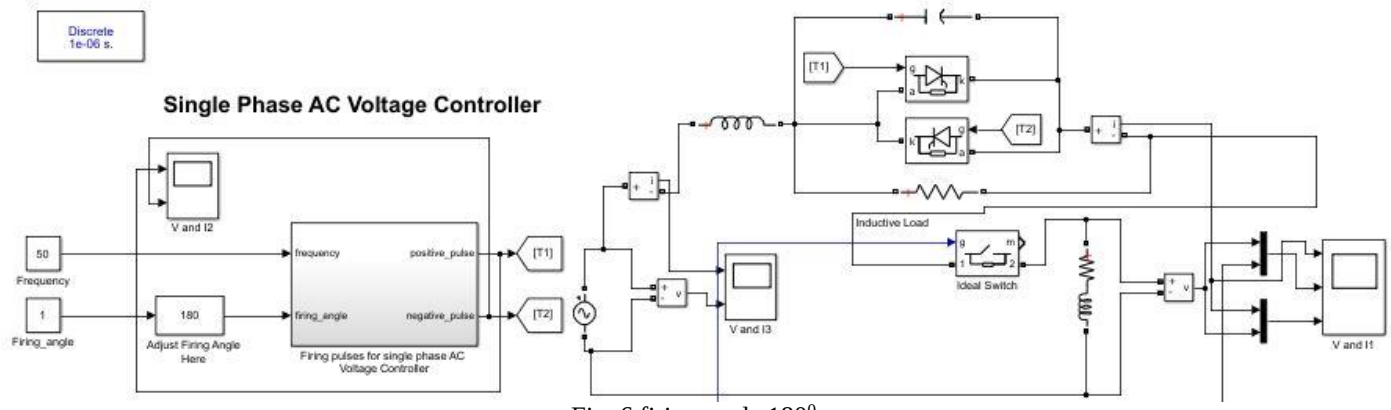


Fig. 6 firing angle $180^0$

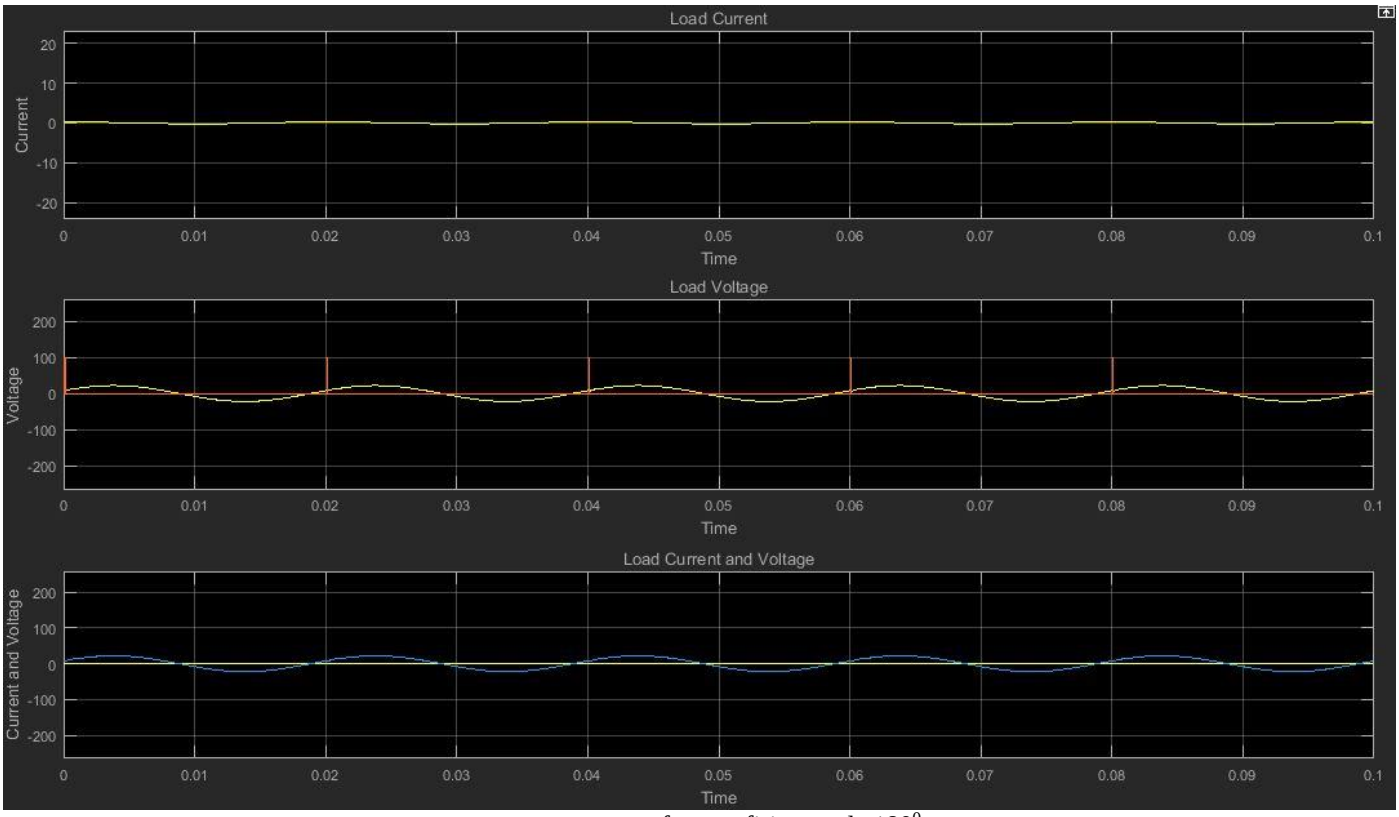


Fig. 7 output waveform at firing angle $180^0$

Figure 6 shows firing angle $180^0$ for single phase AC voltage regulator and figure 7 shows output waveform at firing angle $180^0$ at that condition fan operated at very less speed as compared to fan speed when firing angle at $90^0$ because of less voltage and current supply to the fan at firing angle $180^0$. Speed of fan is closer to zero means fan is in OFF condition, voltage and current supply to load is zero, waveform shows results as voltage and current at firing angle $180^0$.

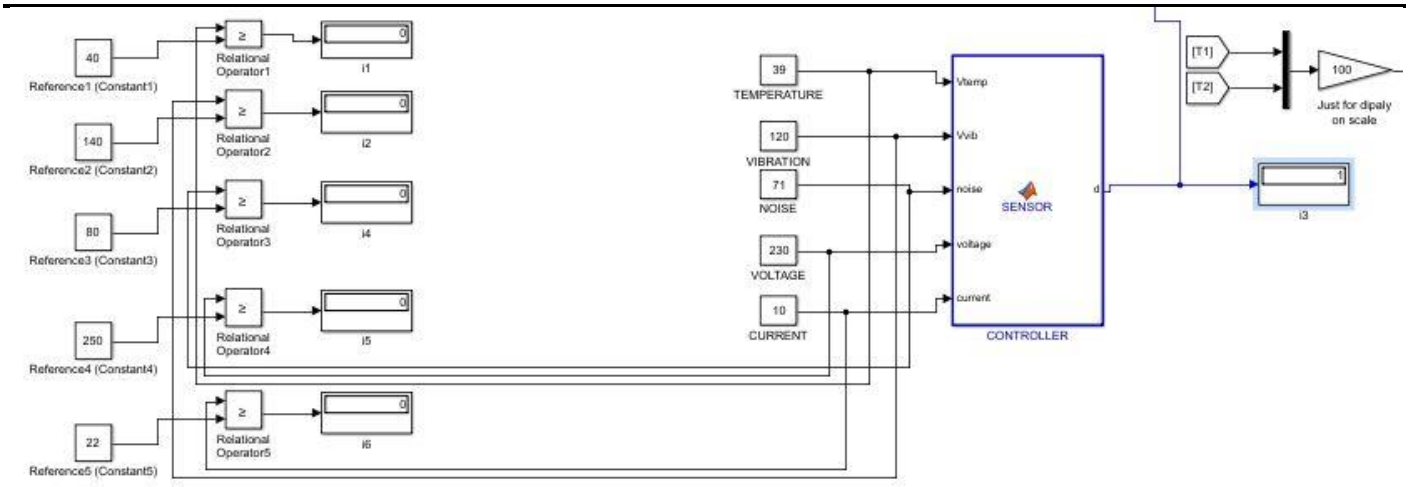


Fig. 8 Display 1 when no any fault, means the Fan is in ON Condition

Figure 8 shows Display 1 when the no any fault occurs, means the Fan is in ON condition, as all the values i.e. temperature, vibration, noise, voltage, current are less than the reference value then output at i3 is shown as 1, and at i1, i2, i4, i5, i6 it is shown as 0 means no fault occurred, controller not cut the voltage and current supply to load (fan) and due to that fan is in ON condition.

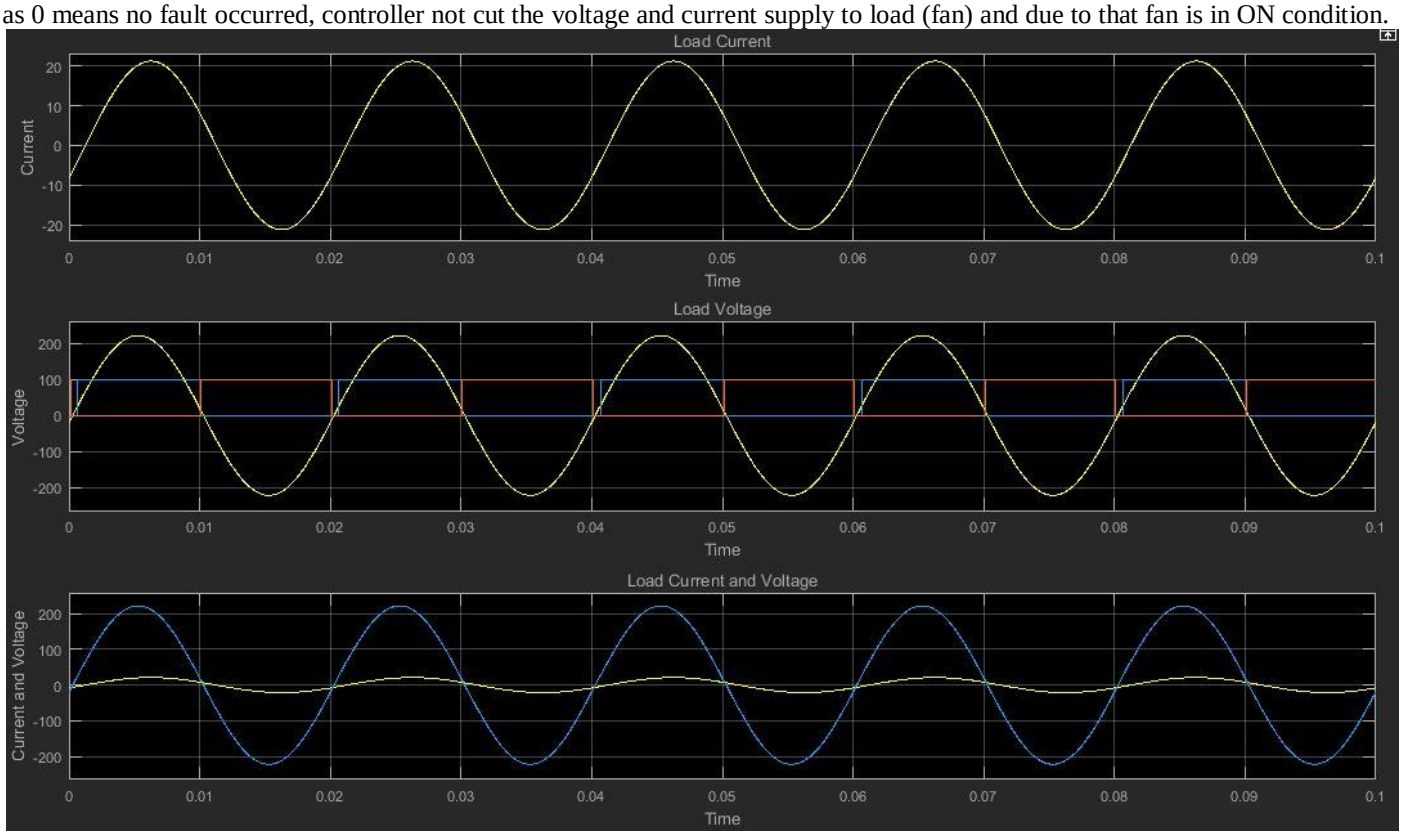


Fig. 9 output waveform when no any fault

Figure 9 shows waveform when no fault occurs at that case result shows voltage and current and fan is ON condition and running smoothly.

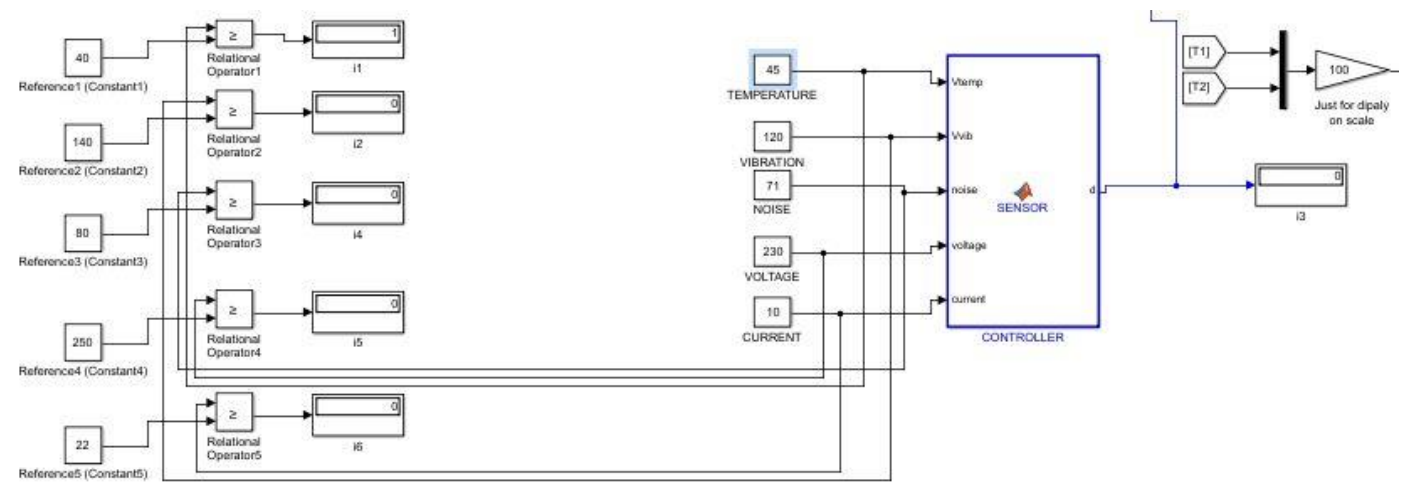


Fig. 10 Display 0 when the fault occurs due to Temperature

Figure 10 shows Display 0 when the fault occurs due to Temperature, means the Fan OFF, as reference temperature is considered as maximum vales as 40, controller campier the value with reference value and if temperature value increases beyond that reference value then output at i3 is shown as 0, and at i1 it is shown as 1 means fault occurred, controller cut the voltage and current supply to load (fan) and due to that fan is in OFF condition. similarly fig 11, fig 12, fig 13,fig 14 show that Display 0 when the fault occurs due to vibration, noise, current, voltage as values of their respective parameter increases beyond the respective reference values and in that case controller cut the voltage and current supply to load (fan) and due to that fan is in OFF condition.

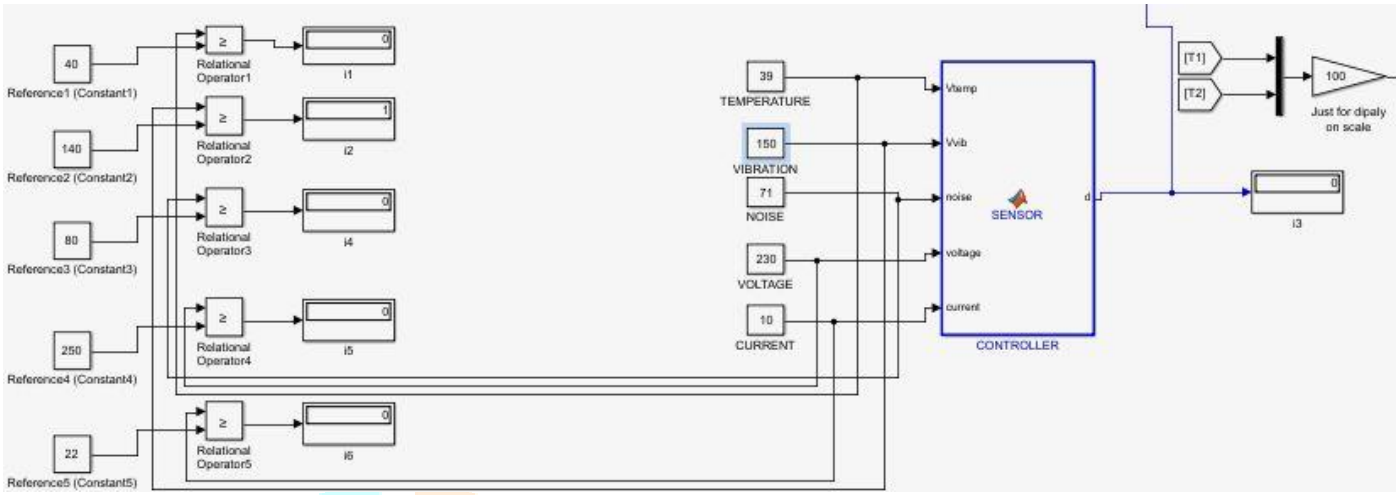


Fig. 11 Display 0 when the fault occurs due to Vibration

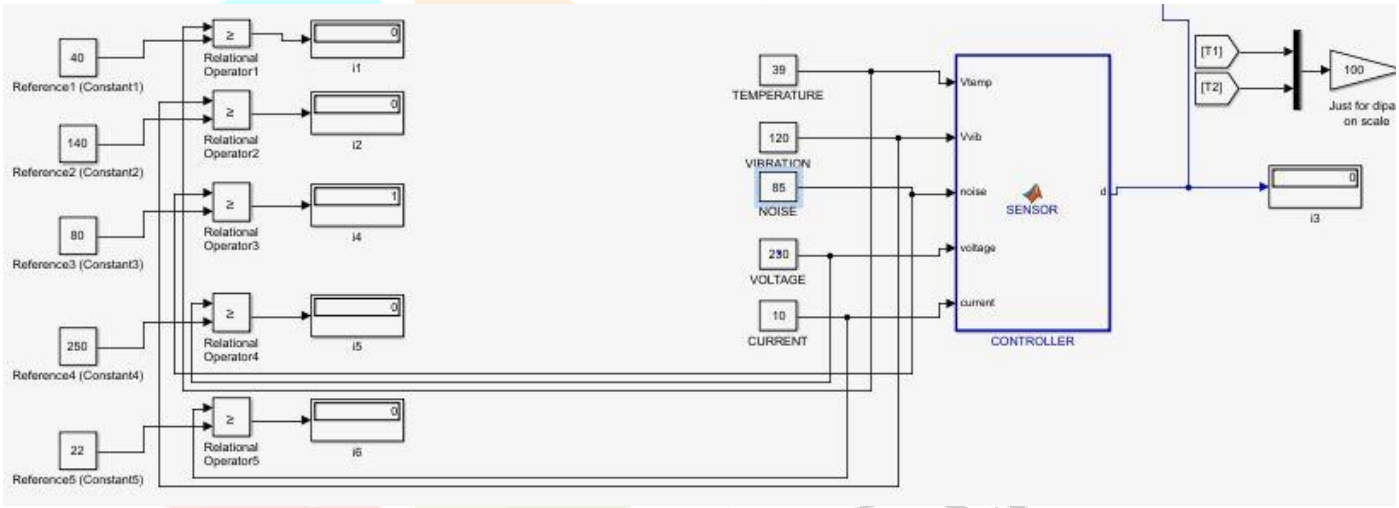


Fig. 12 Display 0 when the fault occurs due to Noise

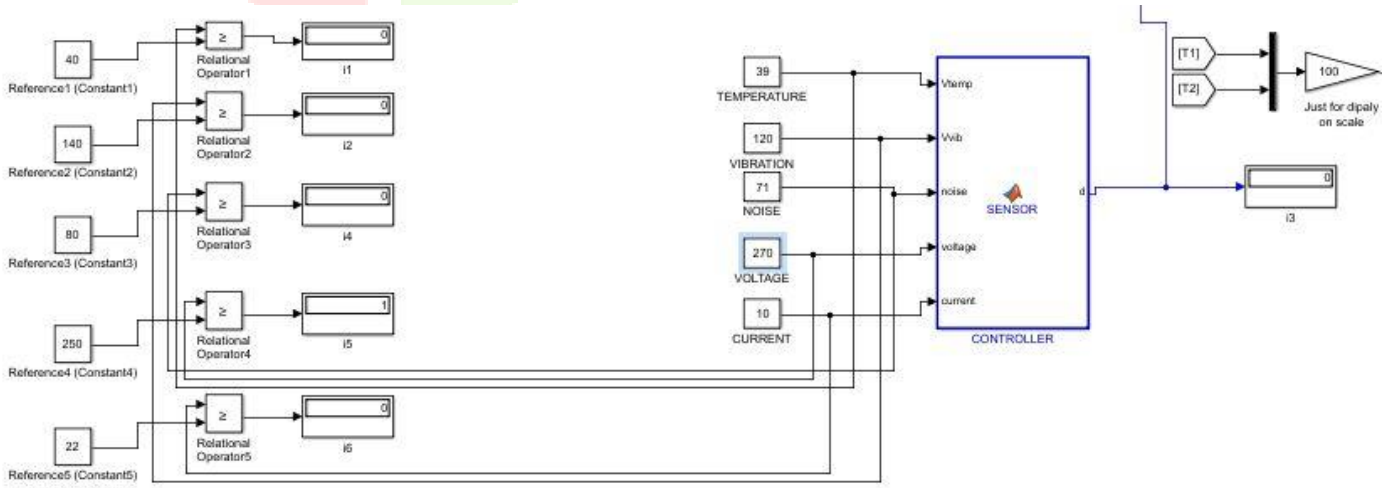


Fig. 13 Display 0 when the fault occurs due to Voltage

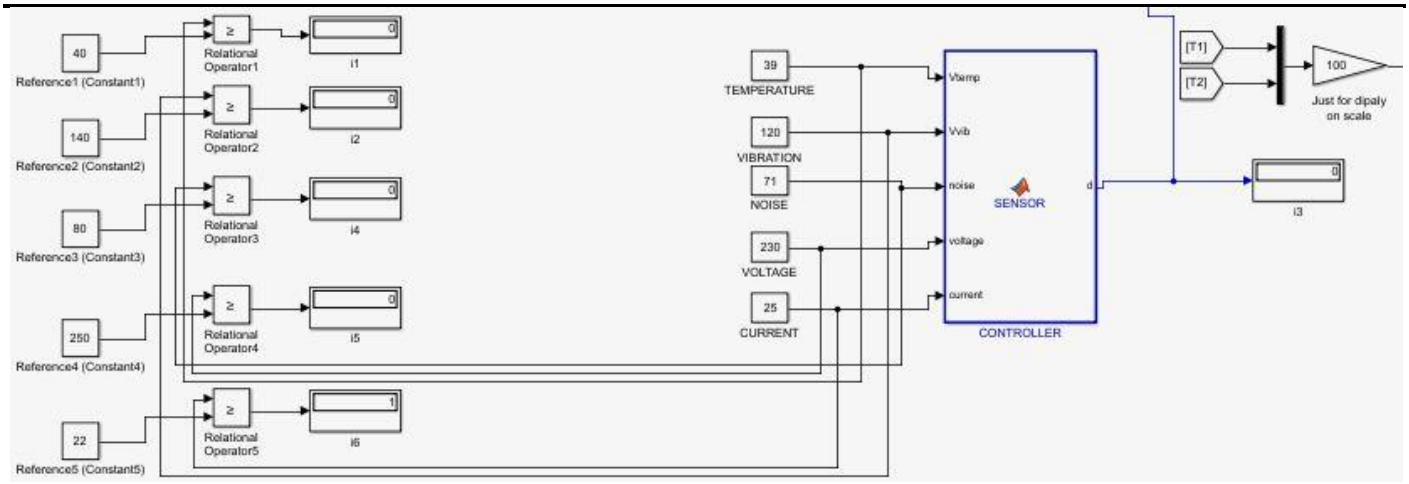


Fig. 14 Display 0 when the fault occurs due to Current

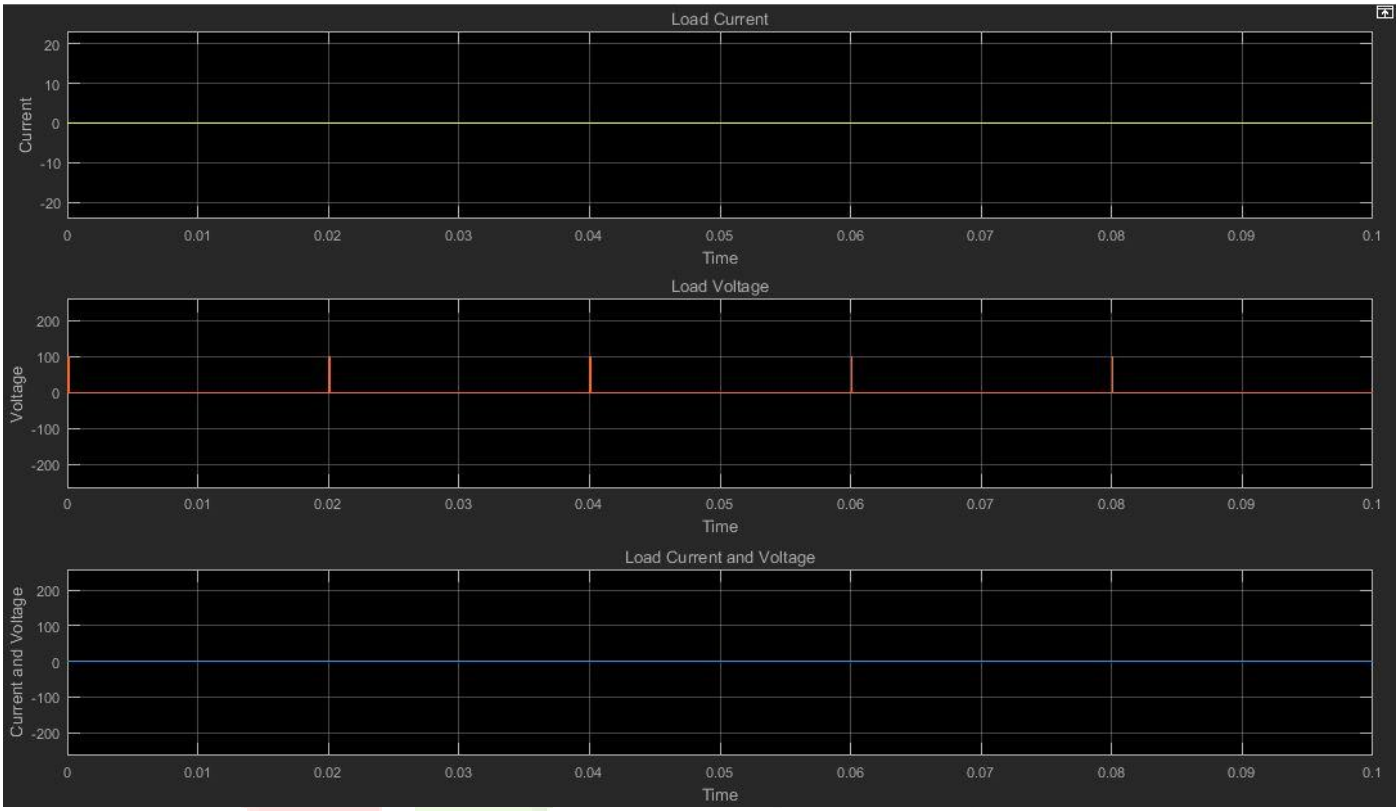


Fig. 15 Waveform when fault occurs due to temperature

Figure 15 shows waveform when fault occurs due to temperature at those case results shows voltage and current supply to load (fan) is zero, fan is in OFF condition. Similar waveform when fault occurs due to Vibration, Noise, Voltage and Current, When value of Vibration, Noise, Voltage and Current increases beyond the reference value at that condition fault occurs and voltage, current supply to load (fan) is zero and fan is in off condition.

## V. CONCLUSION

Simulation for speed control and fault monitoring of home electrical appliances are described in this paper. Speed of fan was controlled by using changing firing angle, when firing angle is $0^0$ fan operated at maximum speed , firing angle $90^0$ fan operated at medium speed and when firing angle is $180^0$ fan speed is near about zero means fan is in OFF condition. Controller monitor the fault occurs due to increase values of sensor parameter above the set or reference values and it will cut the load, it avoids further damage to the devices. So by using speed control and fault monitoring system it is easy to operate devices smoothly and detect early failure, to avoid more damage to the devices. This system helps us enhance the performance and life of electrical appliances.

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