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Scada Based Monitoring and Control of DC Motor

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Abstract

The Supervisory Control and Data Acquisition (SCADA) frameworks are generally embraced checking methods in control measures. This study is to execute the equipment segments for the controlling DC motor interaction and to express between field station and control unit for dealing with the data. This paper gathers the constant data acquisition remotely under supervisory control for little and huge scope distant mechanical climate. In enormous mechanical premises numerous issue go on, subsequently it is irreplaceable to screen every one of the cycles and control the variables influencing them. Adjusting an innovation like wireless SCADA the above-expressed goal can be achieved usefully, and in this way monitoring a great deal of labor. Here temperature sensors and voltage sensors are properly interfaced to the PIC 16F 877A microcontroller. Data is assembled from the temperature sensors, voltage sensors, current sensor, and MEMS accelerometer are tirelessly sent over 2.4 GHz ZIGBEE transmitter remotely to the microcontroller which is then gotten at the coordinated with 2.4 GHz ZIGBEE recipient associated with a PC. Low cut-off and high breaking point is set on the PC screen which is known as set point. Thus risky regions can be controlled with more exactness and better security utilizing SCADA. This paper basically centre on controlling and stores the data utilizing Internet of Things (IoT) based cloud data putting away framework.

Keywords: Wireless SCADA, PIC 16F 877A Microcontroller, Temperature Sensor, Voltage Sensor, Current Sensor, Mems Accelerometer, 2.4 GHZ ZIGBEE Transmitter/ Receiver

Introduction

SCADA is the innovation that agent the client to gather data from various removed offices and additionally send limited control directions to those offices. It is transcendently devised by SCADA programming to give controlling and checking of a framework. SCADA framework includes at least one far off terminal units (RTUs) or programmable rationale controllers (PLCs) associated with a few gadgets for example sensors, actuators, switches, motors, lights, and so on It grant interfacing a few convention when needed between the SCADA programming and the equipment cycle.SCADA systems have many analogy to DCS. In specific the operators are able to monitor and manage the overall functionality from a central control station with many of the computations and arbitration made by peripheral devices.In general for small scale Industry it is strenuous to implement SCADA as it is more expensive. So many problem prevails in examining the performance of motor due to lack of monitoring. SCADA depicts a vital role in monitoring and controlling of motor speed. Moreover it is automatic and it saves the manpower.

The PWM techniques to control the speed of DC motor by performing switching operation have been exploited in [1, 2]. Different voltage level is varied by increasing different levels of control system. Due to timely recognition of fault, equipment damage has been present on the run time.In Wireless SCADA approach, Zigbee technology is adopted, Temperature sensors are used and controlled by 8051 Microcontroller[3]. The functionality and features of SCADA have been explained in [4]. In this paper it mainly emphasis on PLC program with ladder diagram. SCADA control screen emerge for different operating condition of motor. Three Phase Induction motor speed is controlled and monitored using PLC programming[5]. Intrusion detection is monitored in SCADA networks[6, 7,8]. Detection of unknown attacks were easily monitored by protocol based models for characterizing Modbus TCP by applying snot rule[9]. Intrusion detection techniques were identified and two approaches were performed and presents the applications of techniques developed for monitoring critical process. Abnormalities were recognized and results were traced out [10].

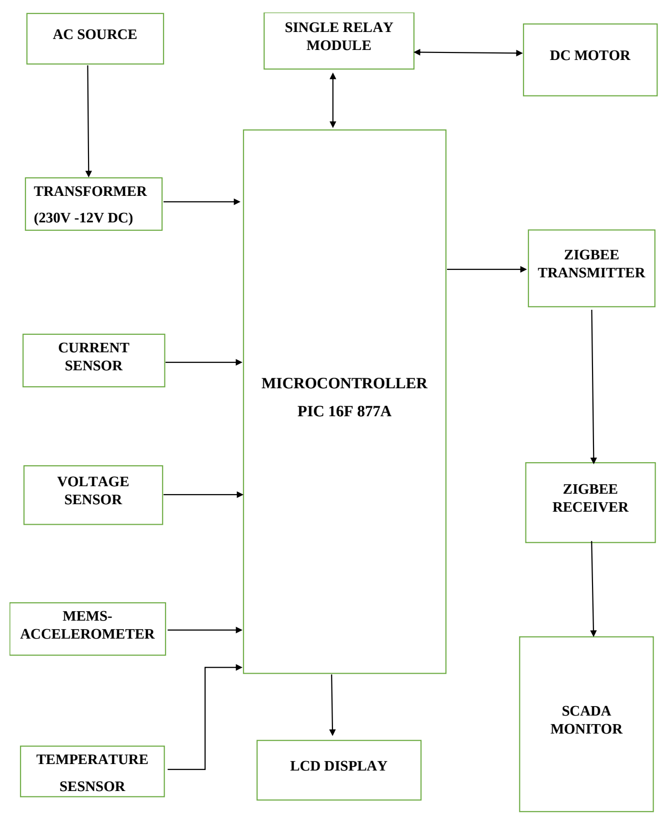
In order to procure a reliable operation of motor, overheating of motor to be excluded. Overheating causes problem such as unbalanced voltage, electrical fire hazardous, distortion in supply voltage etc. To maintain reliable operation temperature should be retained within permissible limit[11]. SCADA Architecture was outlined and various protocols are compared and best protocol requirements for secure communication was recognized. The proposed work evoke the monitoring of DC motor performance from four sensors namely Temperature, voltage, current and mems accelerometer. These sensors were interfaced with PIC 16F877A microcontroller. Data collected from these sensors are transmitted wirelessly through 2.4GHZ Zigbee Transmitter and received by the receiver of same 2.4GHZ Zigbee receiver connected by PC/LAPTOP. Hence the performance of DC motor can be viewed periodically. If the limits of temperature, voltage, current and mems accelerometer exceeds beyond the set point then the microcontroller sends the command to the relay ensuring the safe operation of motor. This paper aims

- To design SCADA interface and implement the hardware component for controlling the DC motor.
- To control and monitor the motor speeds in real-time.
- To visualize the temperature, voltage, current, mems accelerometer of DC motor and turn off the relay if any abnormalities prevails.
- To estimate the run time in IoT cloud data

2. Proposed System

The block diagram of the proposed work comprises of power supply, sensors, PIC 16F877A microcontroller, SCADA monitor, Zigbee transmitter/receiver, relay, LCD display and is shown in Figure 1. The power supply unit consists of transformer, rectifier and regulator. Initially main supply voltage is 230 V AC supply. This 230 V AC cannot be supplied directly. So it is stepped down by using step down transformer. The specified input voltage is 12 V and so the input is stepped down to 12 V supply. Rectifier converts AC voltage to DC voltage. Regulator regulates the output voltage constant. For controlling purpose PIC 16F877A microcontroller is used which is also helpful in sending commands to relay, SCADA and LCD display. Four sensors namely temperature, voltage, current, MEMS accelerometer are used and are interfaced with PIC 16F877A microcontroller. Data collected from these sensors are transmitted wirelessly through 2.4GHZ Zigbee Transmitter and received by the receiver of same 2.4GHZ Zigbee receiver connected by PC/LAPTOP. Hence the performance of DC motor can be viewed periodically. If the limits of temperature, voltage, current and mems accelerometer exceeds beyond the set point then the microcontroller sends the command to the relay ensuring the safe operation of motor. In the absence of SCADA system the whole process would be manual, tedious and it takes time. But by implementing SCADA it becomes simpler to monitor the performance of DC motor. This could possibly solved by using sensors. Hence it is automatic and saves manpower. So it is widely used in industrial process.

Figure 1 Block Diagram of SCADA based Monitoring and Control of DC Motor



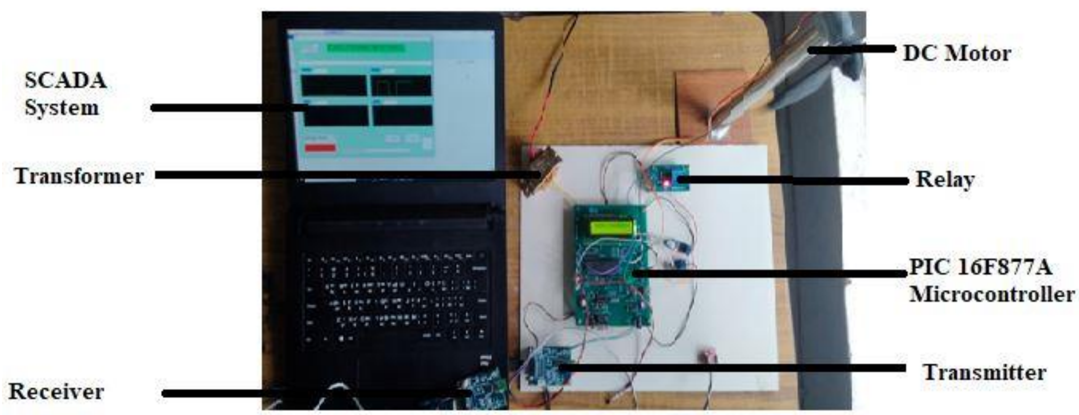
3. Results and Discussion

In this project the DC motor and its running condition have been monitored by sensing temperature, voltage and current. Then the output have been displayed in a LCD using a ZIGBEE wireless upgraded Wi-Fi module, the data have been transferred to SCADA. IoT plays a vital role in the data transmission. The same system can be implemented in a wind energy conservation system. The following sensors have been used in this work.

- Temperature sensor
- Mems Accelerometer
- Current sensor
- Voltage sensor

In IoT based SCADA monitoring system, we can analyse the outputs of temperature, current, voltage and MEMS acceleration. The hardware of proposed system is shown in Figure 2.

Figure 2 Hardware Setup of the Proposed System



3.1. Case 1: Temperature Monitoring

In this case, the motor is in working condition. The display exhibit the values of temperature waveform in the SCADA monitoring system. At Initial condition, the motor is in off mode. So, there will not be any change in the temperature. The temperature is constant and the value of 30 degree is displayed in the Figure 3. In the next stage, the motor is switched ON. It starts to rotate slowly. The temperature is also getting increased slightly. The value is mentioned as (or) displayed as 40 degree. And it has been shown in Figure 4. In the next level, the speed of the motor is still increased. So, the temperature is also increased to 90 degree. And it has been shown in Figure 5.

Figure 3 Temperature at Initial Condition

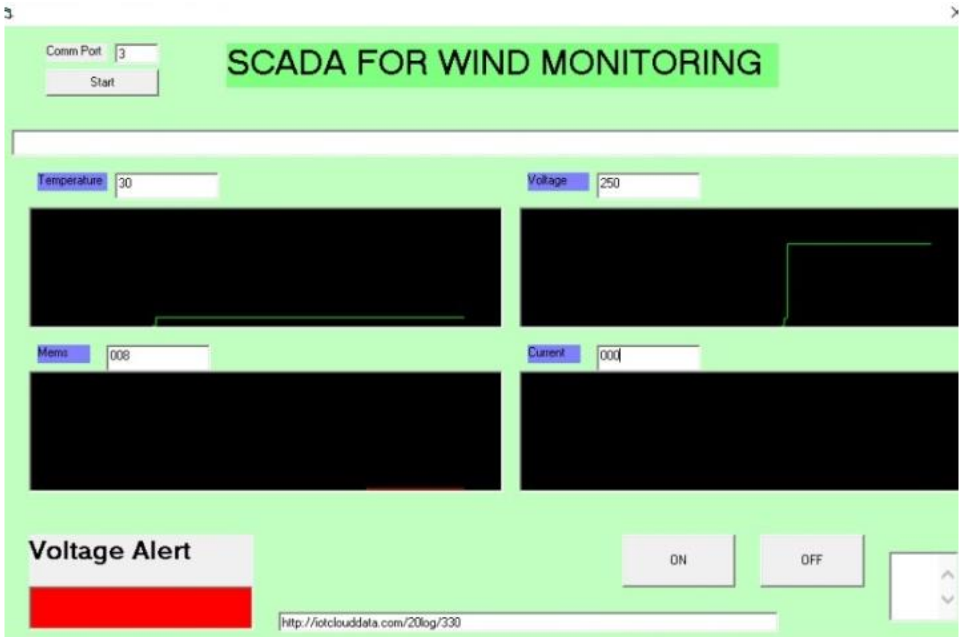
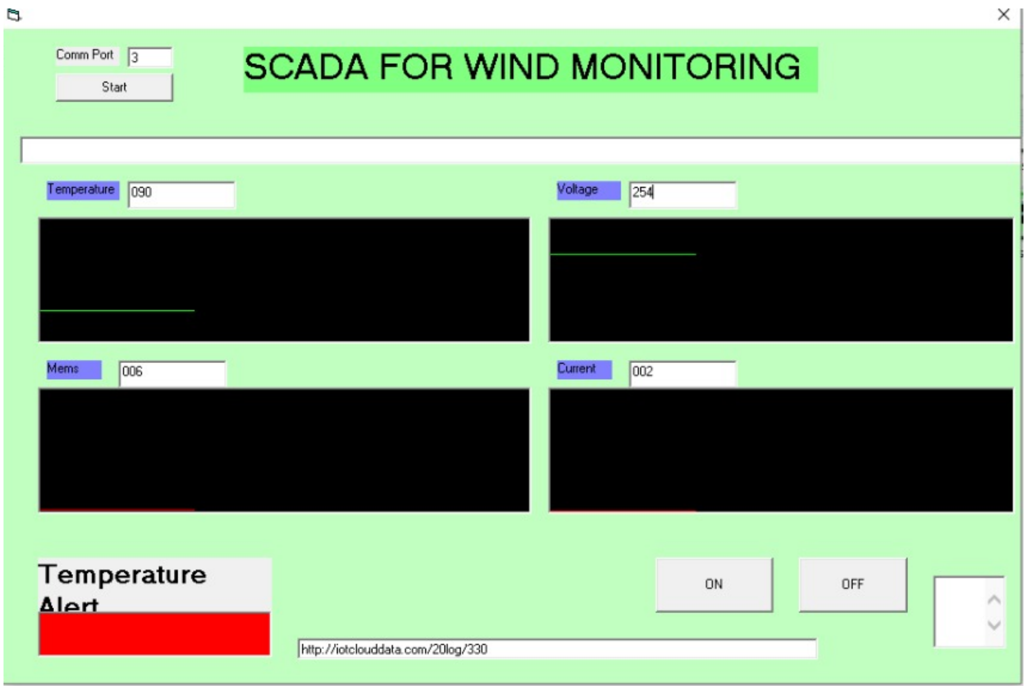


Figure 4 Temperature after Switched ON

Figure 5 Temperature Increased to 90 Degree



3.2. Case 2: Voltage Monitoring

In this case, the motor is in working condition. The displays show the values of voltages and waveform in the SCADA monitoring system. Initially the motor is in idle condition, so the waveform of the voltage has been measured as 2.54 V and it has been shown in Figure 6. Subsequently the motor is switched ON; the constant voltage of (value) has been monitored in the display as shown in Figure 7. In the next condition, the motor is switched ON. So, the voltage waveform has been getting peak from bottom to top it has been shown in Figure 8. In the next condition, the motor is switched OFF. So, the voltage waveform has been dropped from high to low. It has been shown in Figure 9.

Figure 6 Voltage at Idle Condition of Motor

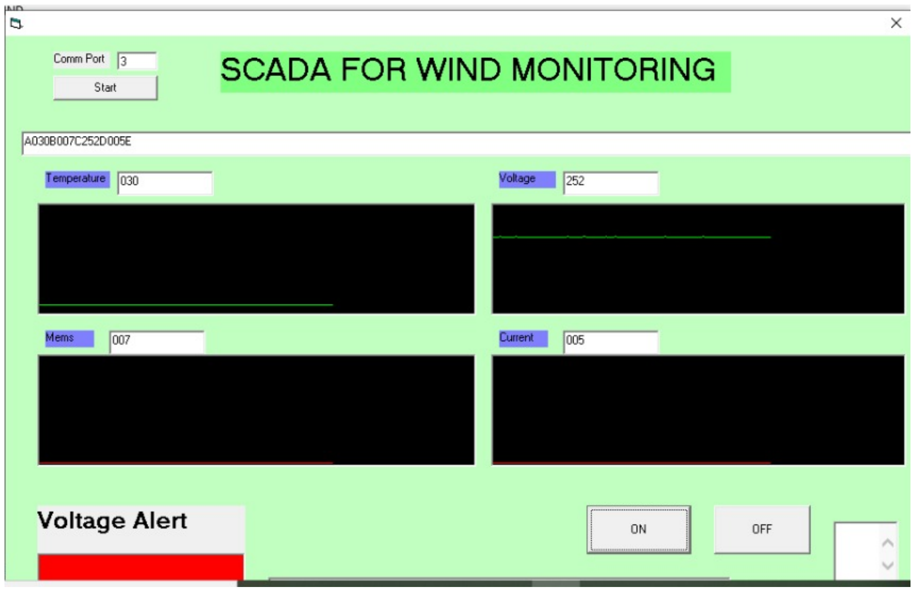


Figure 7 Voltage at Constant Level

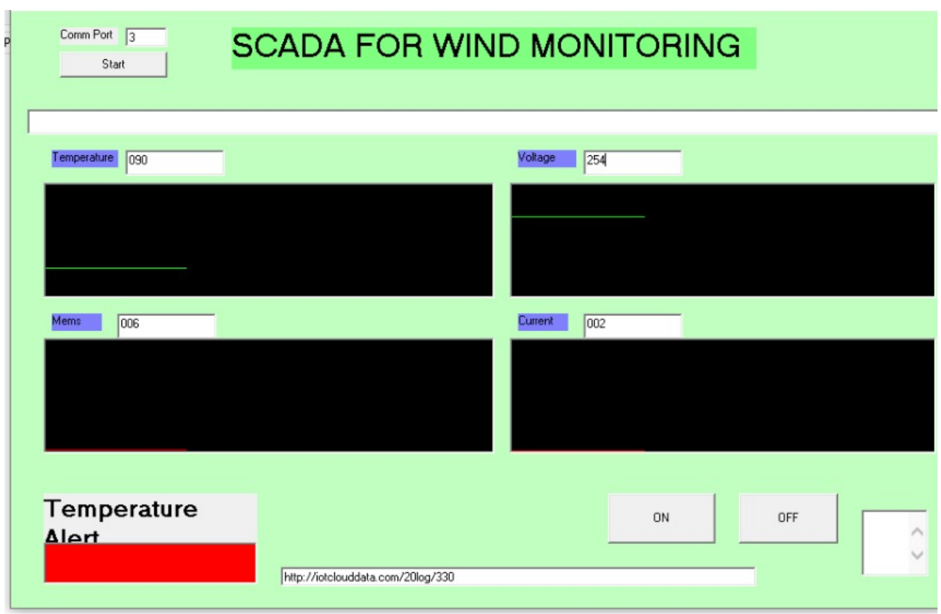


Figure 8 Voltage after Switched ON the Motor

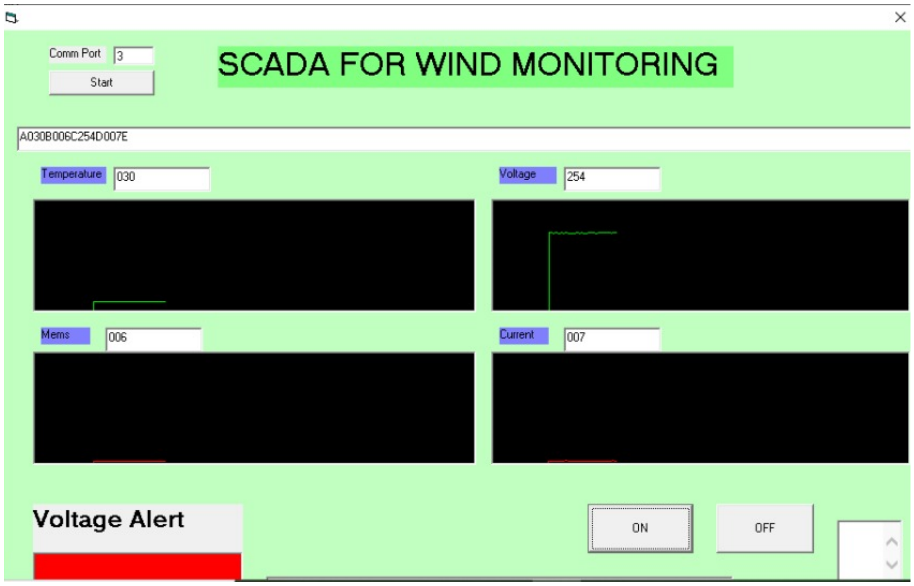
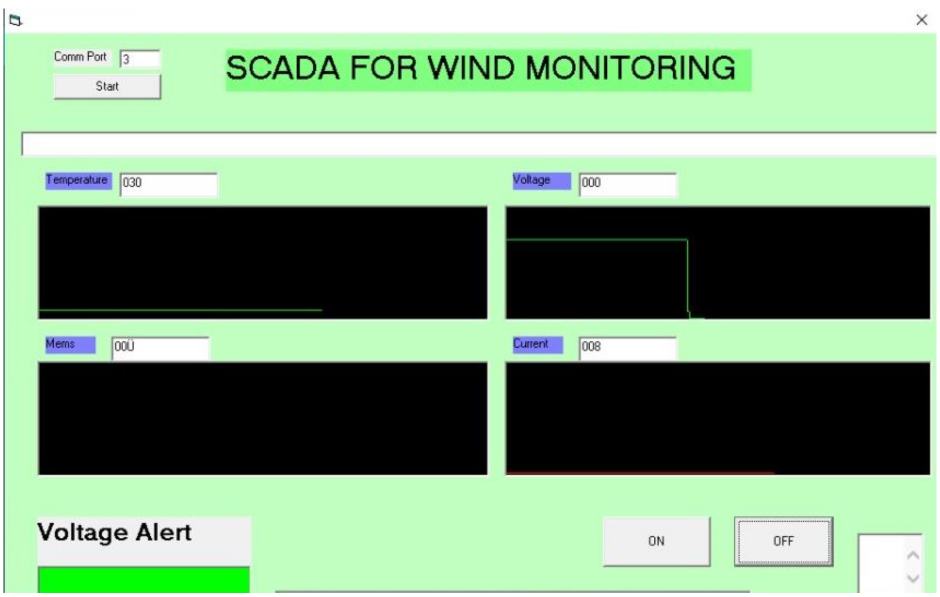


Figure 9 Voltage after Switched OFF the Motor



3.3. Case 3: Current monitoring

In the case, the motor is in working condition. The displays shows the values of current and waveform in the SCADA monitoring system. Initially the motor is in idle condition, so the waveform of the current has been measured as 0Aand it has been shown in Figure 10. Subsequently the motor is switched ON. 2A current is flowed through the motor. The waveform of the current shown in the monitor. And it has been shown in Figure 11. In the next stage, the motor is still working. The current will also increase slightly. The current has been measured as 7A. And it has been shown in Figure 12. In a next stage the current has been dropped from 7A to 5A. It has been shown in Figure 13.

Figure 10 Current at Idle Condition of Motor

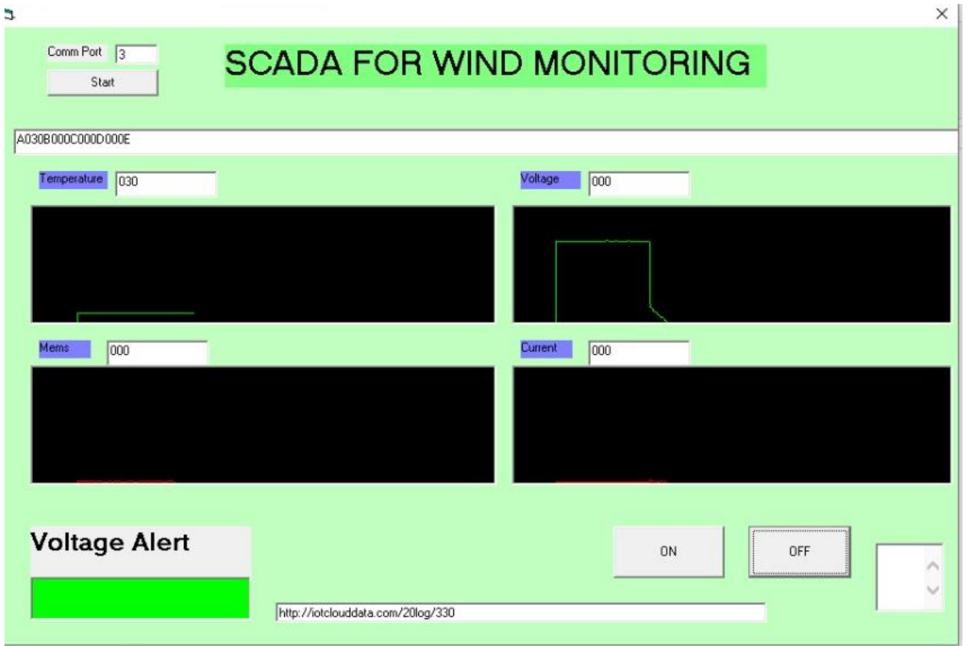


Figure 11 Current after switched ON the Motor

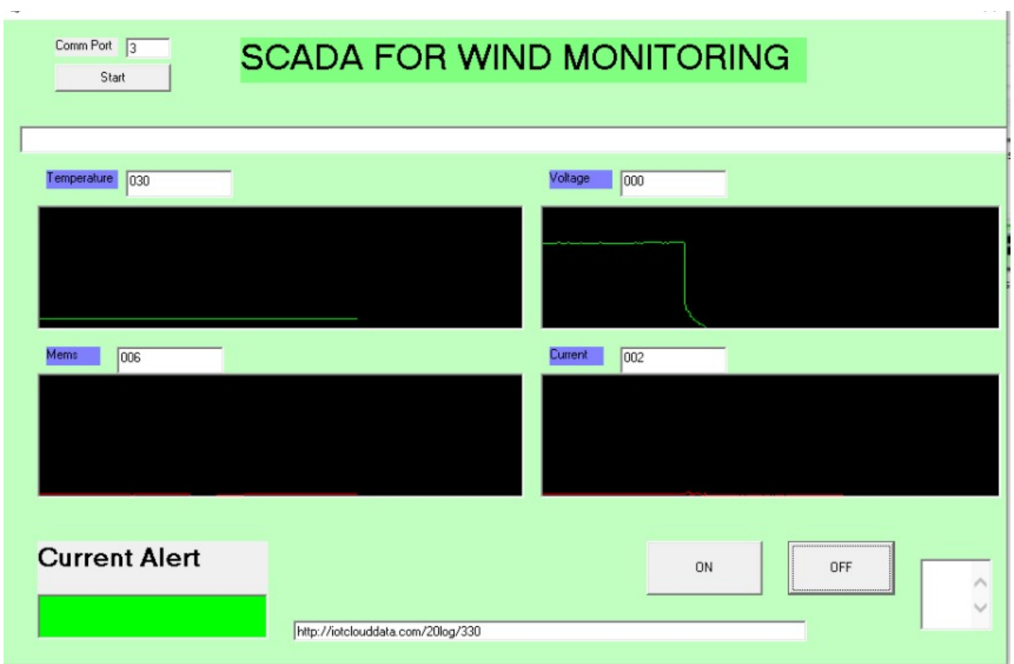


Figure 12 Current Increased to 7A

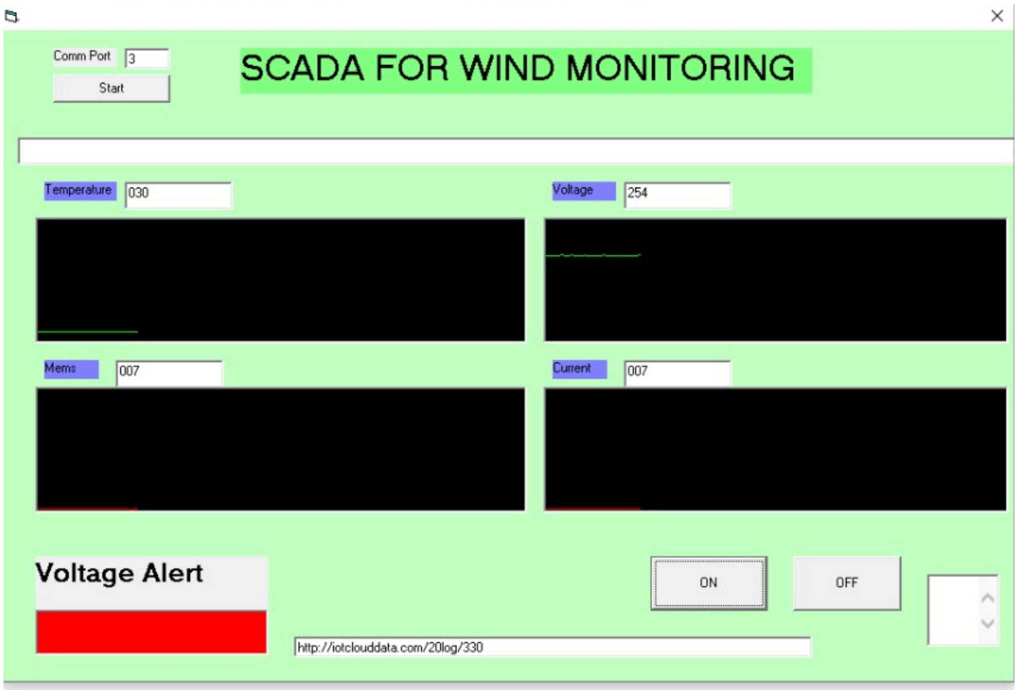
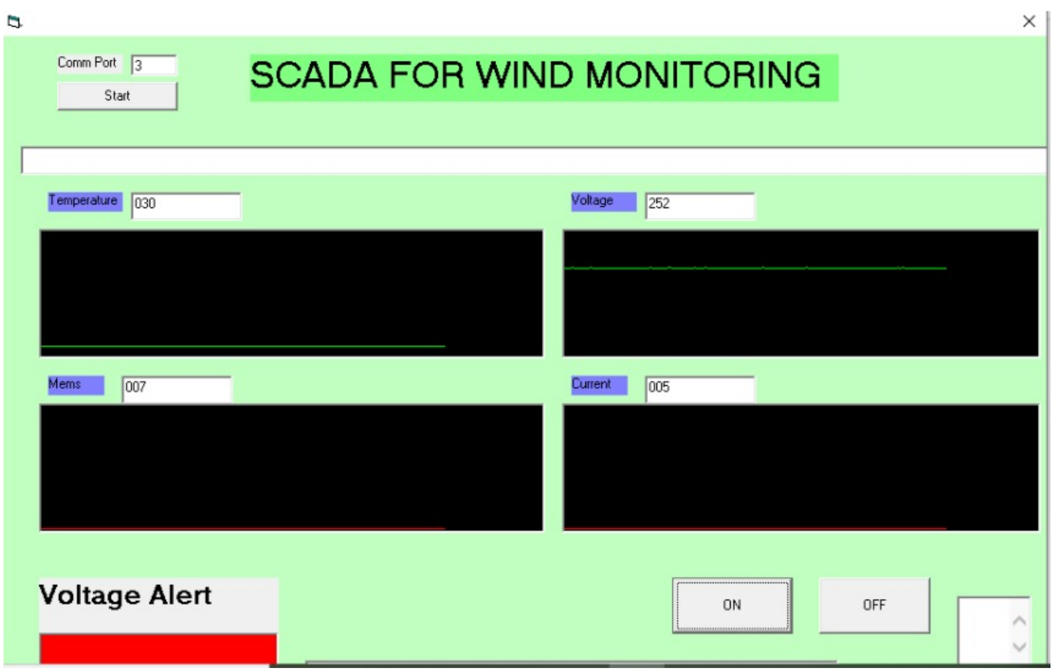


Figure 13 Current after Switched OFF the Motor



3.4. Case 4: MEMS-Acceleration Monitoring

In the case, the motor is in working condition. The displays show the values of Mems-Acceleration in the SCADA monitoring system. Initially the motor is in idle condition, so the value of the acceleration been measured as 0 Hz and it has been shown in Figure 14. Subsequently the motor is switched ON. The acceleration value has been measured as 5 Hz. And it has been shown in Figure 15. The motor is still at a running condition. The acceleration also increased slightly. The value was measured as 7 Hz. And it has been shown in Figure 16. In the next stage, the motor is running twice than the previous stage. So, the acceleration getting increased as well as the value has been measured as 8 Hz. And it has been shown in Figure 17.

Figure 14 Acceleration at Idle Condition of the Motor

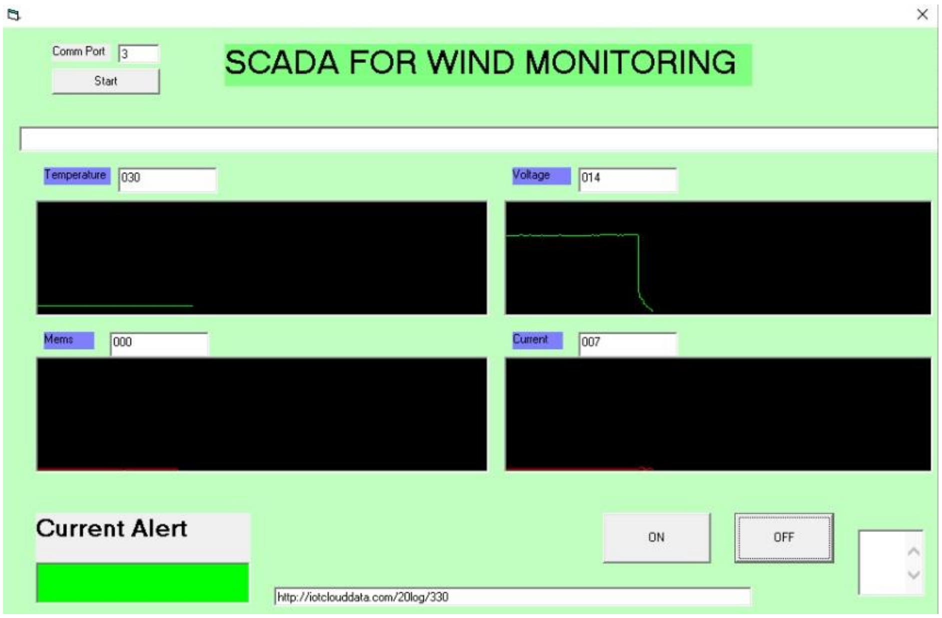


Figure 5 Acceleration after switched ON the Motor

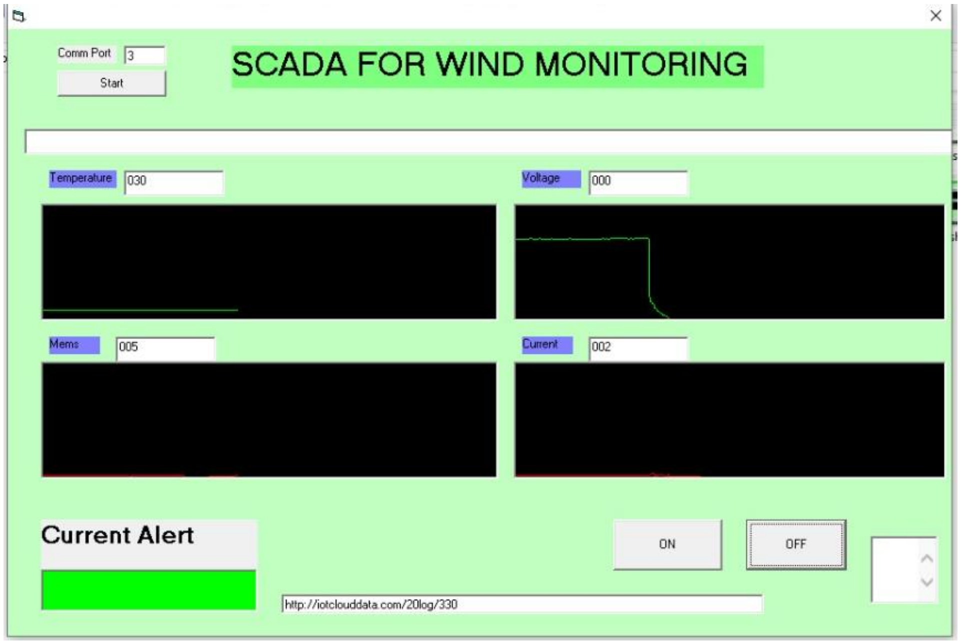


Figure 16 Acceleration at 7 Hz

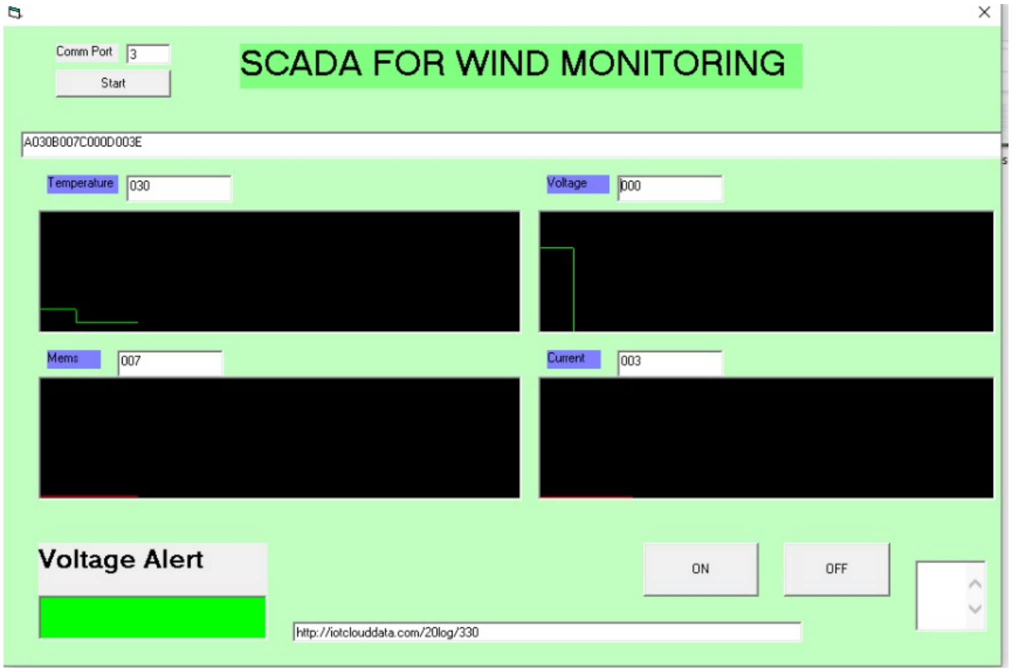
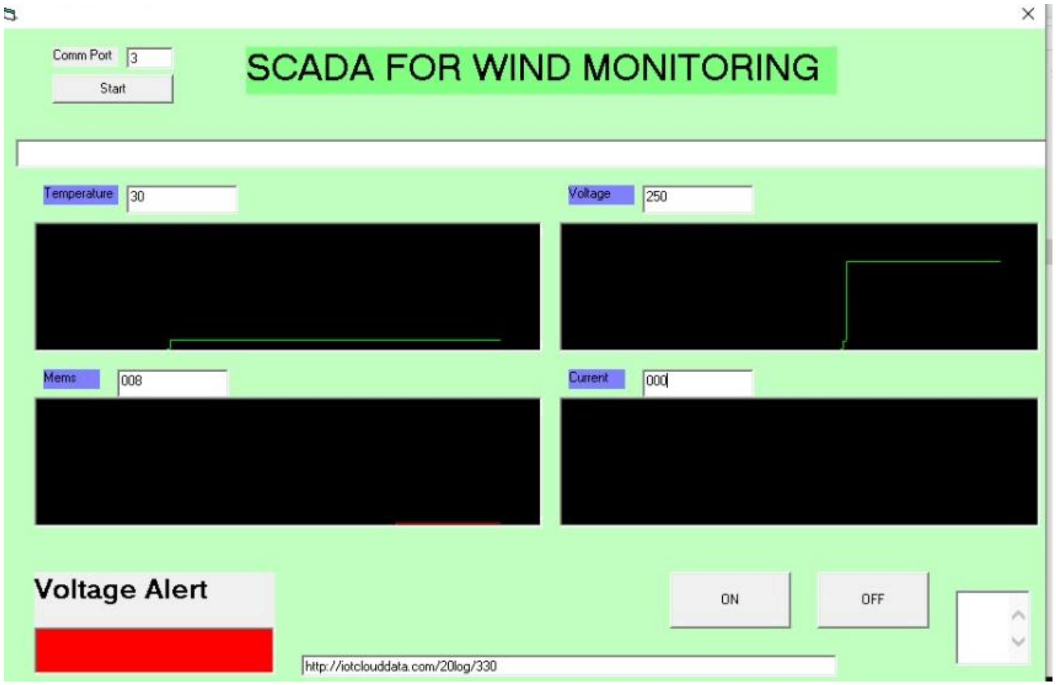


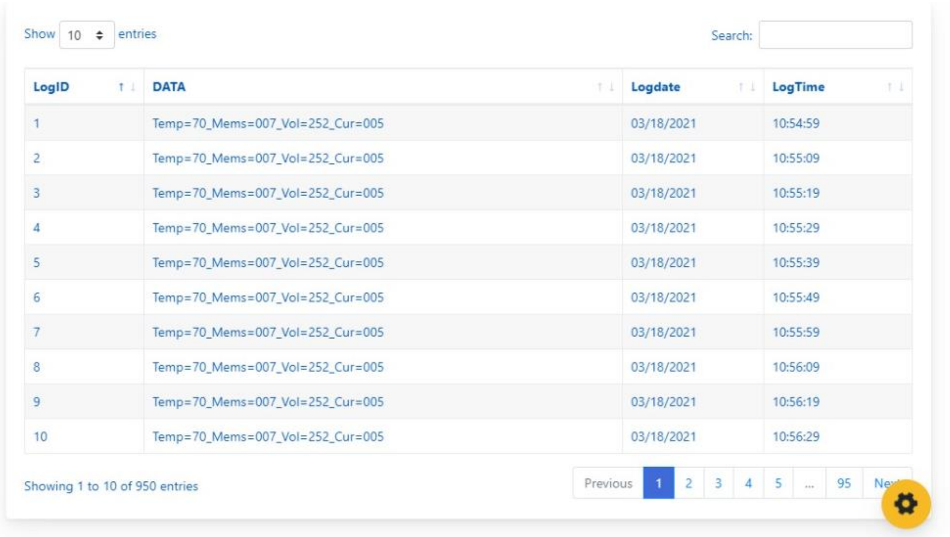
Figure 17. Acceleration at 8 Hz



3.5 Output of SCADA Data Collection

The data received from the sensors have been send to the cloud storage through ZigBee wireless module consists of transmitter and receiver. All the data received from the system have been stored in IOT cloud. And it has been shown in Figure 18.

Figure 18 SCADA Data Cloud Storage



Show 10 entries Search:

LogID	DATA	Logdate	LogTime
1	Temp=70_Mems=007_Vol=252_Cur=005	03/18/2021	10:54:59
2	Temp=70_Mems=007_Vol=252_Cur=005	03/18/2021	10:55:09
3	Temp=70_Mems=007_Vol=252_Cur=005	03/18/2021	10:55:19
4	Temp=70_Mems=007_Vol=252_Cur=005	03/18/2021	10:55:29
5	Temp=70_Mems=007_Vol=252_Cur=005	03/18/2021	10:55:39
6	Temp=70_Mems=007_Vol=252_Cur=005	03/18/2021	10:55:49
7	Temp=70_Mems=007_Vol=252_Cur=005	03/18/2021	10:55:59
8	Temp=70_Mems=007_Vol=252_Cur=005	03/18/2021	10:56:09
9	Temp=70_Mems=007_Vol=252_Cur=005	03/18/2021	10:56:19
10	Temp=70_Mems=007_Vol=252_Cur=005	03/18/2021	10:56:29

Showing 1 to 10 of 950 entries Previous 1 2 3 4 5 ... 95 Next

5. Conclusion

The objective of study is monitoring and controlling of DC motor by building efficient SCADA based wireless technology. It focuses on different sensors such as temperature, voltage, current, mems acceleration. The results are traced out for every periodic situation. For every motor working condition the temperature, voltage and current acceleration are noted. Any abnormalities also can be detected and it can be controlled by sending commands to relay to turn off therefore ensuring the safe operation. SCADA can be used to manage any kind of equipment. Typically, SCADA systems are used to automate complex industrial processes where human control is impractical systems involving more control factors, and more fast-moving control factors. Thus, the project fulfils the needs of the user to control the whole system and store the data then check out the user favorite times. The main advantage of this project is to track and control the data.

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