WIRELESS MOTOR CONTROL USING GSM TECHNOLOGY FOR INDUSTRIAL APPLICATION

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Abstract— In modern world, wireless technologies such as GSM, have been of great use in various sectors including industries which are dealing with the energy automation products. The wireless technologies give great flexibility in the operation and control of devices across a certain range depending on the technology that is being used. Addition of wireless technologies can help in serviceability and maintainability of the devices when installed in remote stations. It is significant to evaluate the GSM technology and to recommend its applicability with respect to the Industrial Applications.

Keywords— Motor control, Switchgear, GSM technology.

I. INTRODUCTION

A motor controller might include a manual or automatic means for starting and stopping the motor, forward or reverse direction, selecting and regulating the speed, regulating or limiting the torque, and protect against overloads and faults. Small motors may have built-in overload devices to automate open circuit on overload. Larger motors have a protective overload relay or temperature sensing relay including in the controller and fuses or circuit breaker for over current protection. A motor controller is connected to a power source such as a battery(dc) or power supply, and control circuitry in the form of analog or digital input signals. Switchgears are important electronic components that perform a wide range of functions. They distribute the power, provide protection and monitor, control and regulate, make connections for communication processes. Switchgear is also used to enhance system availability by allowing more than one source to feed a load. Switchgear incorporates switches, circuit breakers, disconnects and fuses used to route the power and in the case of a fault, isolate parts of an electric circuit. The switchgear unit of the motor starter has three functions for protecting the motor. The first function is switching of the motor during operation, and is performed by dedicated standard unit, usually a called contactor.

The contactor is designed to repeatedly switch high currents on-off, during the operation. Furthermore, in a switchgear unit, the functions of short circuit protection and the overload protection are integrated in one standard unit referred to power breaker. The power breaker separates the load from the power supply system when a short circuit happens and also when the currents are too high. The two standard units are arranged next to one another on a common carrier and form the switchgear unit. The project deals with replacing the contactor used for switching by a wireless electronic circuit called the motor control unit.

II. GSM TECHNOLOGY

GSM (Global System for Mobile) is a digital mobile telephone system that is widely used all over. GSM uses the variation of Time Division Multiple Access (TDMA). GSM digitizes and compresses the data, then sends it to the channel with two other stream of user data each in the own time slot. It operates at either 900MHz or 1800MHz frequency Band.

The two parts of the mobile state allow a distinct difference between the actual equipment and the subscriber who will be using it. The IMSI identifies the subscriber within the GSM network while the MS ISDN is the actual telephone number a caller (possibly in another network) uses to reach that person.

III. APPLICATION WORKING/METHOD USED

Generally switchgears are designed to operate the switch manually. However in order to achieve automated operation locally or through remote, motorised mechanism is implemented.

One of the methods to implement motorised mechanism of three position switch is by using motor control unit.
Wireless Motor Control Using GSM Technology For Industrial Application

Where V1 and V2 are the load break switch on and off commands respectively. S1 and S2 are the feedback commands from the auxiliary switch in the ring main unit of the power distribution panel in the industry. The motorised mechanism depends on the inputs v1, v2, s1, s2 and power. These signals are given to the gsm module and the wifi module on the motor control unit. And the energy required by both is calculated and compared.

GSM: GSM measurements quantify the: 1) Ramp energy: energy required to switch to the high-power state, 2) Transmission energy, and 3) Tail energy: energy spent in high-power state after the completion of the transfer. We conduct measurements for data transfers of different sizes (1 to 1000 KB) with varying intervals (1 to 20 seconds) between successive transfers.

IV. GRAPHS AND SIMULATION

The performance of motor with respect to current, voltage, power, torque, efficiency and power transfer characteristics are as follows

GSM Measurements:

Figure 6(a) shows the average energy consumption in GSM networks as a proportionate of the Tail energy. Ramp energy and transfer energy for a 50 K download. The Ramp energy in GSM is less compared to the Tail energy and the transfer energy. I observed that the tail time is 6 seconds and GSM incorporates a small maintenance energy between 2-3 J/minute (not shown). Due to the small tail time in GSM, data sizes dominates energy consumption rather than the inter-transfer times.

Figure 6(b) shows the avg. energy consumed when varying the time between successive transfers in GSM networks. The average energy does not vary with increase in inter-transfer intervals. For example, for data transfers of size 100 KB, the average energy consumption is between 19 to 21 Joules even as the time between successive transfers varies accordingly.

(a) GSM: Energy components

(b) GSM: Varying inter-transfer times

Figure 5: GSM Measurements: (a) Avg. ramp, transfer and tail energy consumed to download 50K data. The lower portion of the stacked column show the proportion of energy spent on each activity compared to the total energy .. (b) Avgy energy consumed for downloading data of different sizes against the inter transfer time.
CONCLUSIONS

The paper was focused on the study of wireless motor control using GSM to be used in industrial areas for wireless transmission of the data for the maintenance and servicing of the power distribution panels by reliable data updates with the help of spectrums and its comparison with the simulated model. The paper also proves that GSM hence can be used specifically for replacing the wired cable transmission with wireless approach. GSM technology helps to eliminate wired links thereby avoiding chaos in substations and helps in establishing wireless links for data transmission. All these features make the technology, market attractive and future proof which makes it inevitable for any vendor to implement the technology in its protection devices. The GSM communication between 2 devices was successfully established and both the devices were able to respond each other to the messages via its respectable wireless Links.

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