

# Intelligent System for Three Phase Submersible Motor Protection Using Arduino Microcontroller

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**Abstract**— Arduino Microcontroller based three phase Submersible Motor Protection system is control to prevent over load, dry run, fault conditions like voltage or current variation, in any phase of three phase ac supply and over temperature using current sensor module, phase control circuit, LM35 temperature sensor and GSM900 Module for network communication. Generally there are two types of faults that occur in ac motors i.e. mechanical fault and electrical fault. Mechanical fault occurs due [9] [9] to bearing jam and electrical fault occurs due to over current, over voltage, over temperature, undercurrent, under voltage, dry running etc. This project deals with GSM network to monitor and control the submersible motor for irrigation purpose. Arduino microcontroller is used for controlling the motor. It senses the current status of the motor and the corresponding person get the information transmitted through GSM network. The user having GSM mobile phone can use message or miss call to on and off the motor. S/he can also receive the faults in the motor through message service.

**Keywords**—Arduino-Microcontroller, Current, GSM900A, Motor, Voltage

## I. INTRODUCTION

India Being an agricultural country, most of its resources depend on agricultural output. Most of agriculture is rained in India. In areas where rainfall is insufficient, it becomes important to use water wisely. Optimum utilization of water is possible only through systematic irrigation system which involves collecting excess water during rainfall and releasing it to crop when needed. For distribution of stored water suitable distribution system like submersible motors are used by farmers.

Here for real time application sensors like LM35, Moisture sensor, ACS712 current sensor and voltage sensing circuit are used for temperature measurement, dry running condition, over current measurement and voltage measurement respectively. LAB VIEW software is used to create user friendly GUI interface. The software receives the all required information and sends it to the user via message. This help user to take decision based on gathered information.

LAB VIEW software system means Supervisory Control and Data Acquisition system. It gathers the information and send back to the central part of the system.

## II. PROPOSED METHODOLOGY

Transmitter is located near the motor for transmission of fault occurred such as over load, dry run, current or voltage variation, in any phase of three phase ac supply and over temperature. Analog output of LM35 is directly interfaced with Arduino Microcontroller and converted to and transmitted via GSM900A to the farmer if any other fault is occurred.

Receiver is located globally anywhere in the world. Receiver receives all the information or fault of three phase submersible Motor on his mobile.

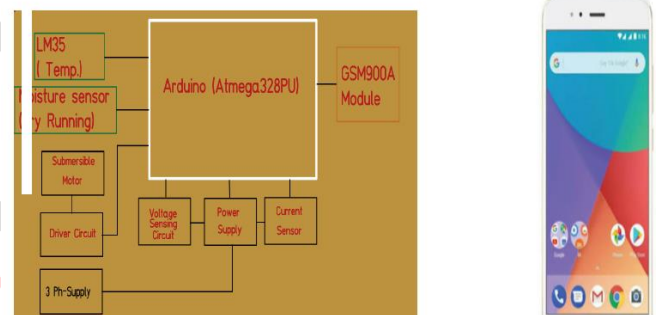


Fig. 1. Block Diagram of System

## III. PROTECTION SYSTEM OF THREE PHASE SUBMERSIBLE MOTOR

In figure 1, a block diagram of the protection system is illustrated. It consists of the measurement of current, voltage, dry running and the winding temperature. The protection system proposed can be analyzed in three categories as the hardware, the instrumentation and the software which will be discussed in following sections.

### A. Hardware

For protection system we have used 3 HP or 2.2 KW/1440 rpm 3 phase submersible motor, three voltage transformer with transformation ratio of 230/5 volt, three current sensor ASC712 for current sensing, a temperature each 1 Deg. C increasing temperature, and an moisture sensor as a dry running sensor [3]. The photograph of the proposed system is demonstrated in fig 3.

### B. Instrumentation

The use of a current sensor and three voltage transformers is for measurement of current and voltage of the motor in the protection system. Outputs of the measured values are to be applied to the digital pins of the Arduino microcontroller. The moisture sensor is used as a dry running sensor. The motor

temperature is measured by the LM-35 sensor. LM-35 sensor is linear device which generates  $10\text{mV} / ^\circ\text{C}$ . [4].

### C. Software

In order to achieve protection of three phase submersible motor easily, Arduino program was developed in Arduino IDE. We use C programming method. The first program is written in software IDE and as it can be stored in RAM or erasable programmable memory (EPROM). Algorithm of the program is given below. Data is achieved from the IDE. These data are three phase voltages ( $V_1, V_2, V_3$ ), three phase currents ( $I_1, I_2, I_3$ ), Dry condition (DrC), temperature (T) of the submersible motor.

- Algorithm:
  - a) User send message or missed call on the system.
  - b) System Detect the user message and switch on the motor.
  - c) System verifies the voltage level, current level, Temp. and Dry condition.
  - d) If the condition are full-filled then system run motor continuously.
  - e) If any fault occurs then motor turn off and send perticular message to the use.
  - f) Program repets from step c continuously.
  - g) If user send message or missed call to the system the system switch off the motor.

### IV. WORKING SYSTEM

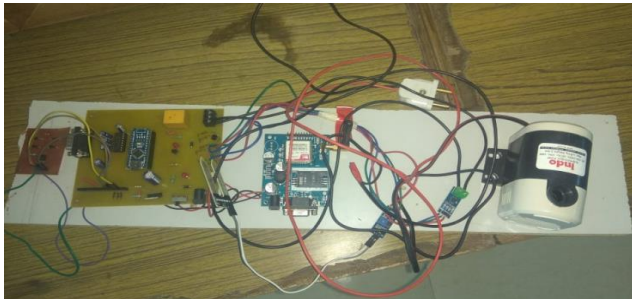


Fig. 2. Project with hardware.

The main hardware consists of a small low power wireless communication board GSM900A and processor board Arduino microcontroller Atmega328PU and sensor module which provide the electrical quantity to the processor unit.

Arduino microcontroller system will convert data acquired from the sensors and send it to GSM900A module. In case there is problem with motor GSM send this information to user through message. This is very useful facility to inform appropriate person and protect the motor from further fault.

AT command are used to control GSM900A module. This module can access following information and services:

- a) configuration to mobile device
- b) SMS services
- c) MMS services
- d) Fax services
- e) Data and voice link over mobile network.

Commonly used commands are AT, AT+CMGF, AT+CMGW, ATD etc. This commands help to GSM module communicate with the user.

### V. CONCLUSION

In this paper, a protection system for three phase submersible motor has been introduced. A 2KW three phase motor has been connected for the protection system through the measuring component. The system is successfully implemented and tested. In this overvoltage, over current, over temperature and dry running faults are detected. If any problem observed during motor operation, warning message send to the user, then the motor stops.

In this project the software LAB VIEW has been successfully used for Data Acquisition system with the use of Arduino microcontroller ATMEGA328PU. This control system is more reliable. All mobile phone can be used for communication so that the system improves its adaptability to use. Low operating cost using messages and missed calls are the major attractions of this system.

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