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Supervisory Control and Data Acquisition for Motor Operation using Arduino

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Abstract: ***SCADA (Supervisory Control & Data Acquisition) is a combination of software as well as hardware elements that allows industrial organization to control industrial processes locally or at remote location. This system allows you to continuously monitor, gather, and process real-time data. Directly interact with devices such as sensors, motor drives, microcontroller and more through human-machine interface (HMI) software i.e., SCADA. This project also allows you to record events and log into a file such as Microsoft Excel.***
Keywords: SCADA, Arduino Uno, Arduino IDE, Motor Control & Monitor

I. INTRODUCTION

Industrial processes require careful precision and coordination. Real-time data collection gives you insights to maximize efficiency, reduce overhead costs, and streamline operations. Many industrial organizations rely on a Supervisory Control and Data Acquisition (SCADA) system. It helps operators access actionable data and manage equipment. SCADA is a powerful control system that is designed to collect, analyse, and visualize data from industrial equipment. Operators can view critical measurements like temperature, vibration, power usage, and levels across industrial equipment. Using modern SCADA solutions, operators and field supervisors can access actionable data and manage hundreds of assets without visiting every field device. Our project also deals with the same thing like monitoring, controlling, & record the data. Most motors run at a high RPM (revolutions per minute), examples being computer cooling fans, or radio-controlled car wheels. The speed of motor will be controlled using SCADA software. Motor will be connected to Arduino Uno microcontroller and Arduino will be interfaced with SCADA software. The speed which will be set in SCADA will be received by microcontroller which will run the motor according to the set speed.

II. WORKING METHODOLOGY

The whole system will be controlled by SCADA. The SCADA software i.e., CX Supervisor is installed on computer. Arduino and SCADA are connected through cable which is RSMAX32. Also, Arduino OPC Server is installed on the pc which allows you to connect your Arduino with any OPC SCADA Compliant. This proposed system or project will allow you to control the speed of motor so, desired speed is set on SCADA or varied using the slider present in the SCADA which will give digital input to the Arduino Uno microcontroller. The microcontroller will run the motor according to the desired speed. The change in speed will be shown by the meter present in the SCADA. And this data can be automatically logged by the SCADA software in the Excel format. This is how we will be able to monitor, control & record data on a real time basis.

III. CIRCUIT DIAGRAM

In this project we have used some known & popular hardware such as Arduino Uno, L293d motor driver, IR or Infrared Sensor, jumper wires, 3-9V DC motor, 100pf capacitor, 12V DV Adaptor. Below fig shows the circuit diagram in which all the components are connected to the Arduino Uno using Male to Female Jumper wires.

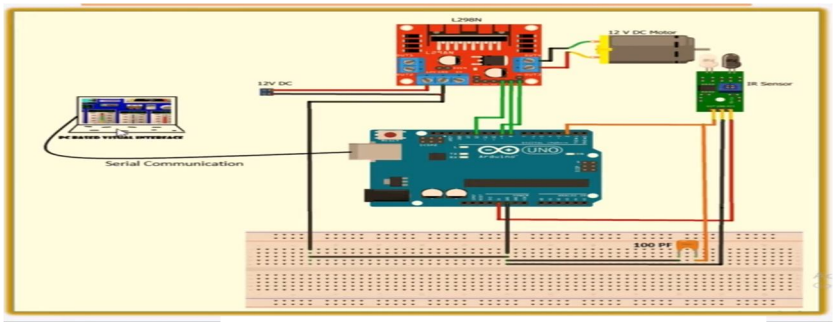

Fig. 1 Showing circuit diagram

IV. DESCRIPTION OF HARDWARE

A. Arduino Uno

Arduino Uno is a microcontroller chip dependent on the Atmega328(datasheet) with 14 computerized I/o pins, in which 6 pins can be utilized as yields, 6 pins are utilized as simple information sources. It has 16 MHz clay resonator, a USB association, a power jack and a reset button. The microcontroller has 32kB of ISP flash memory, 2kB RAM and 1kB EEPROM. The board provides serial communication capability via UART, SPI and 12C.Because of well design in the form of Arduino it is easy to understand. In Arduino we use high level of programming language like C language, C++ language etc. It is easy to understand and user-friendly language. It has much advantage like multitasking, automation, time domain etc. Arduino Uno fig4 (a) is given below.

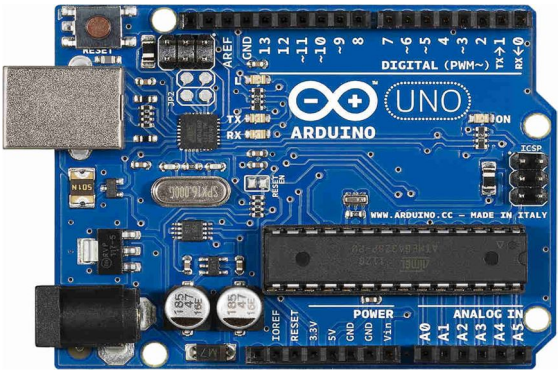

Fig. 2 Arduino Uno

B. L293d Motor Driver

Motor drivers acts as an interface between the motors and the control circuits. Motor require high amount of current whereas the controller circuit works on low circuit signals. So, the function of motor drivers is to take low-current control signal and then turn it into a higher-current signal that can drive a motor. Using this motor driver, we can use DC motors and power supplies up to 16V, that some pretty big motors and the chip can supply a maximum current of 600mA per channel, the L293D chip is also what's known as a type of H-Bridge. The H-Bridge is typically an electrical circuit

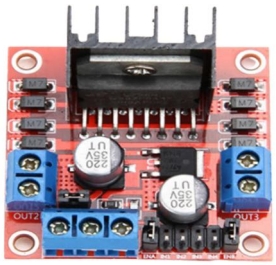

Fig. 3 L293d Motor Driver

C. IR (Infrared) Sensor

An infrared (IR) sensor is an electronic device that measures and detects infrared radiation in its surrounding environment. Infrared radiation was accidentally discovered by an astronomer named William Herschel in 1800. While measuring the temperature of each color of light (separated by a prism), he noticed that the temperature just beyond the red light was highest. IR is invisible to the human eye, as its wavelength is longer than that of visible light (though it is still on the same electromagnetic spectrum).

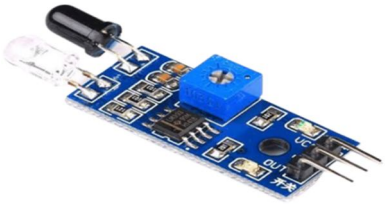

Fig. 4 IR Sensor

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D. Jumper Wires

A jump wire (also known as jumper, jumper wire, DuPont wire) is an electrical wire, or group of them in a cable, with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

Individual jump wires are fitted by inserting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

Fig. 5 Jumper Wire Male to Female

E. 3-9V DC Motor

A DC motor is any of a class of rotary electrical motors that converts direct current (DC) electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.

DC motors were the first form of motor widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances.

Fig. 6 3-9V DC Motor

F. Capacitor

A capacitor is a device that stores electrical energy in an electric field. It is a passive electronic component with two terminals.

The effect of a capacitor is known as capacitance. While some capacitance exists between any two electrical conductors in proximity in a circuit, a capacitor is a component designed to add capacitance to a circuit. The capacitor was originally known as a condenser or condensator.

Fig. 7 100pf Capacitor

V. RESULT & OUTPUT

According to the proposed plan the final outcome of this paper leads to the development of SCADA system. Through this project, an automated system has been created so that we can easily control & monitor the operation of motor. One of the objectives of this project is to design low cost SCADA for easy operation of motor. By varying the slider or setting the speed in SCADA desired speed is obtained and the change in speed can be observed in SCADA software. In the graph provided real-time variation in speed can be observed.

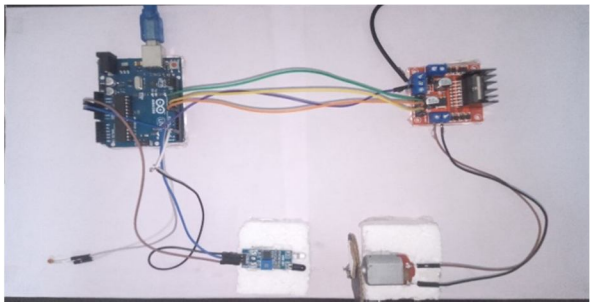
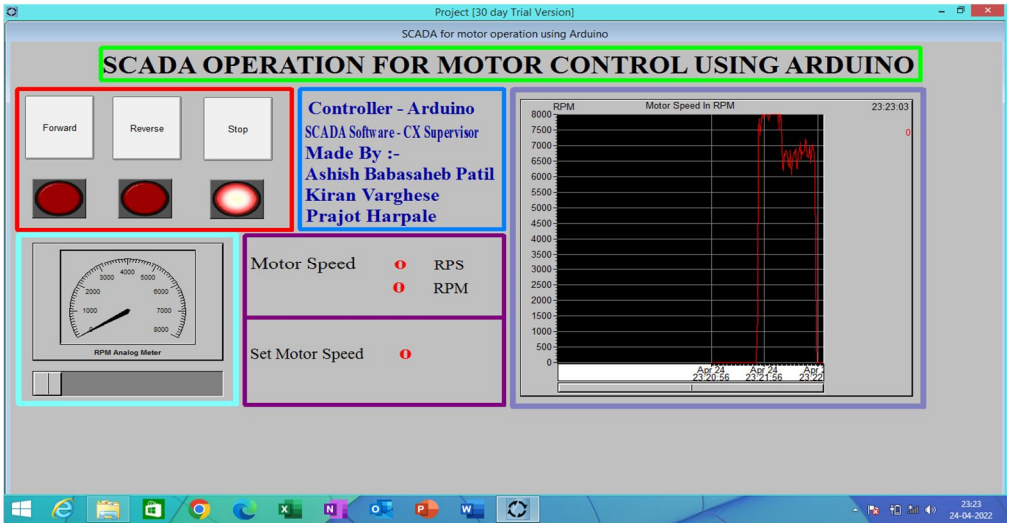


Fig. 3 Actual Image of the project



VI. CONCLUSION

The development & implementation of SCADA for controlling a DC Motor was successfully implemented using CX Supervisor and Arduino Uno Microcontroller. Speed of motor is sensed by using IR sensor which is sent to SCADA interface and shown on the screen. The method implemented can be used for various industrial application. This technique helps in maintaining the stability of system. We designed SCADA interface on CX Supervisor successfully and run it. In many industrial process SCADA is used to monitor & control the production & varies drives.

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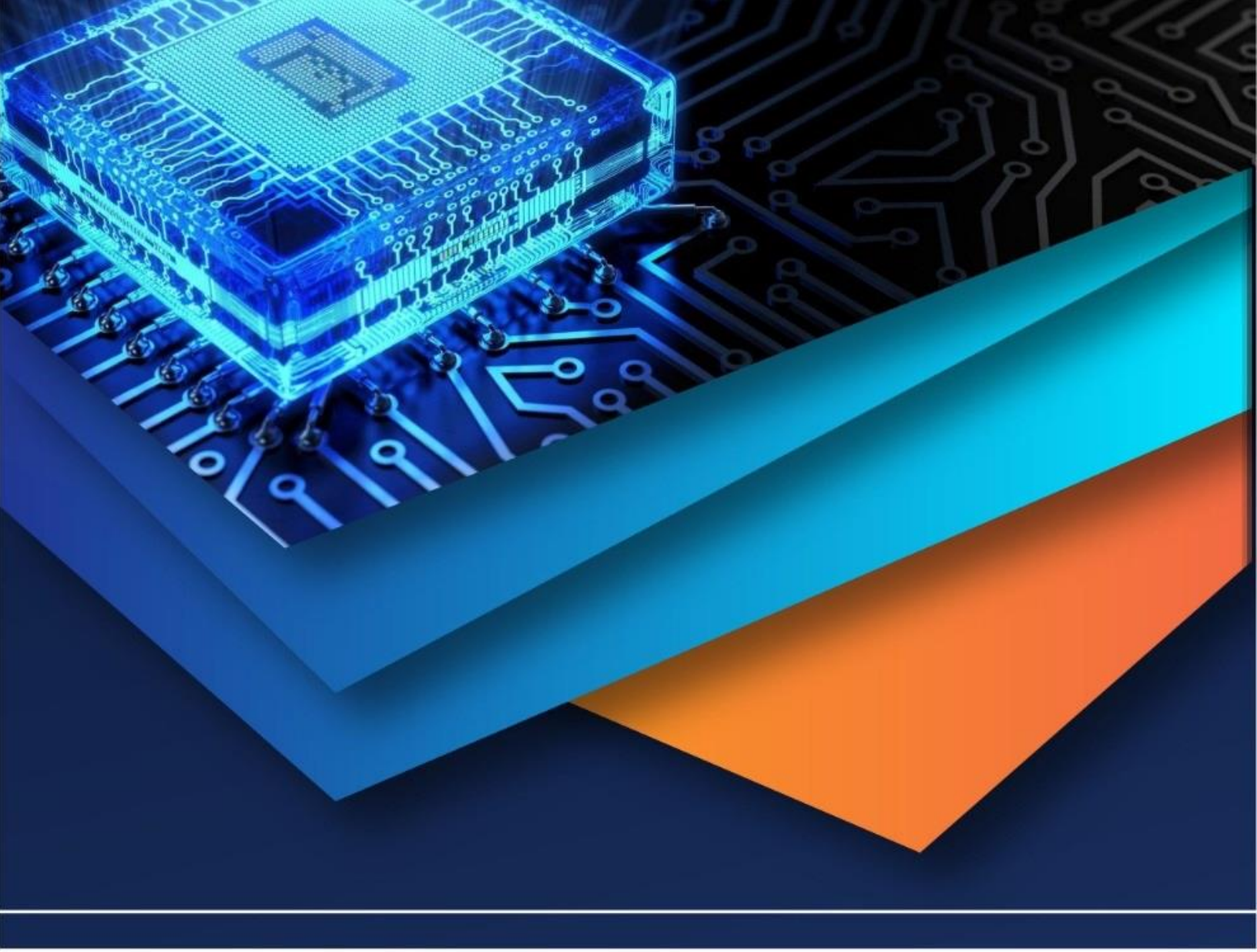

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