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Real Time PID Control of Multiprocess System

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ABSTRACT: Process control is one of the significantchallenges in today industries.In many industrial environments tightlevel, temperature, pressure and flow regulation is needed.Increasingly PID controllers are all now broadly acceptedin wide range of sectors. Thekeyaim of this study is to examinehow well theconventional PID controller effectivelyhandle diverse process variables which includes level, flow, pressure and temperature.The PID controller's performance is tested through real time SCADA software.The results indicates that the PID control scheme deliver good outcomes for multiple types of parameters.

Keywords: Level Process, Flow process, Pressure Process, Temperature Process, PID controller, SCADA

I. INTRODUCTION

The most important part of any control engineering and operational industry is designing a controller and turning it into an automatic control. The purpose of this work is to device a new PID controller for a multi-process (Level, Flow, Pressure, and Temperature). In many processes plant, all of the process variables are vital. In all industrial systems, regulating and holding the Process Parameters at a desired condition (set point) is an important and usual task. The output (process variable) is continuously determined with theaid of a sensing device and manipulated with the help of a controller to hold at a desired target value in closed loop control.Multi Process Control System was establishedto explore various control loops. Since it is a highly versatile and flexible technology, this may be utilized in wide industrial processes like flow, level, temperature and pressure[1]. Thus, it is basically used for elaborating the study of process parameters relative to flow, level, temperature and pressure. The system is equipped with transducers, actuators, PID and computerized control with DAQ Controller Software [2].

II. DESCRIPTION FOR MULTI PROCESS CONTROL

Arrangement depicted in Fig 1is developed to assist extensive controlmechanismapplied in variety of industrial operation.This system is composed of multi process control Trainer, pump, hand valves, rotameter and one reservoir tank[3,4]. The pumps are used to draw water from reservoir tanks and distribute it to process tanks and control output of controller. A rotameter is used to monitor the flow rate of intake water to process tanks. The level in a process tank is sensed detects the level in the process tank. The Temperature in the process tank is sensed using a Temperature sensor and the Pressure sensor detects the pressure in the pipeline.The necessary front panel diagram seen in Fig2 has been installed is mounted on hold-alone style of arrangement. This set-up is linked to PCvia COM 3 port with SCADA software for measuring and control ofthe conventional controller.[5].

Feedback control is a control strategy that manipulates a variable utilisingthe data from evaluations to get the desired outcome. The parameter being controlled is measured and compared to a target value in feedback control.

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Fig 1 Setup of Multiprocess Trainer

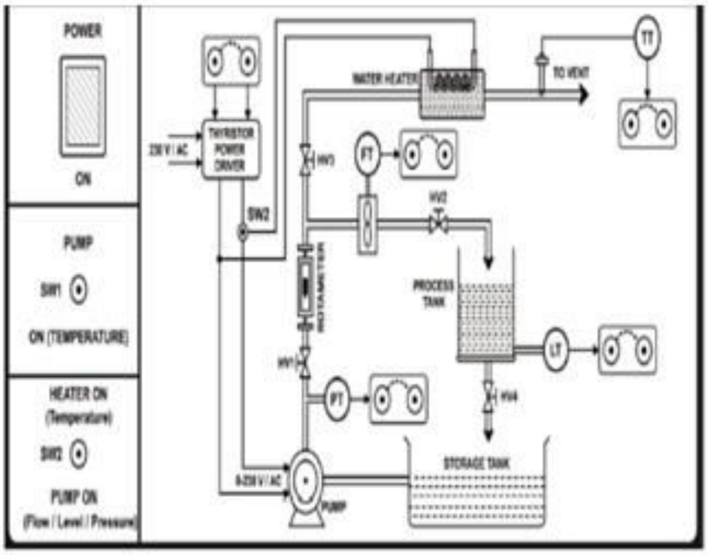

Fig 2 Front panel diagram of Multi ProcessEquipment

III.MULTI PROCESS TRAINER TUNING

The open loop Process Reaction Curve Method is used to estimate the transfer function of the multi-process system The transfer function and PID controller parameters are obtained using a two-point tuning methodology [13].The level, flow, Pressure and Temperature process transfer function can be calculated from Fig 3,4,5,6.$T_2$and T_1 is 63.2% of final output and 28.3% of finaloutput.Equations (1), (2) and (3) can be utilized to derive theparameters Process gain (K_p), dead time (t_d), time constant (τ).

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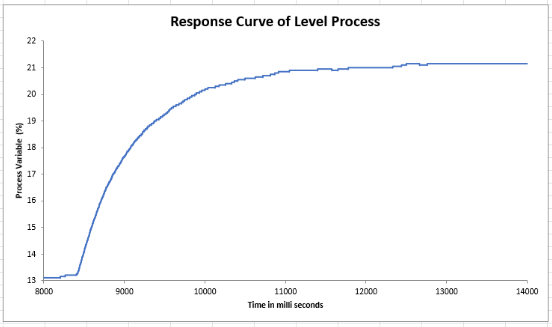

Fig 3 OL curve of level process

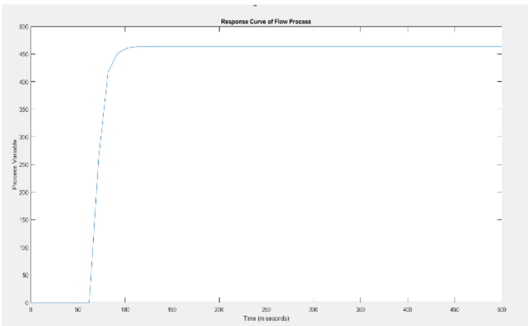

Fig4 OL curve of flow process

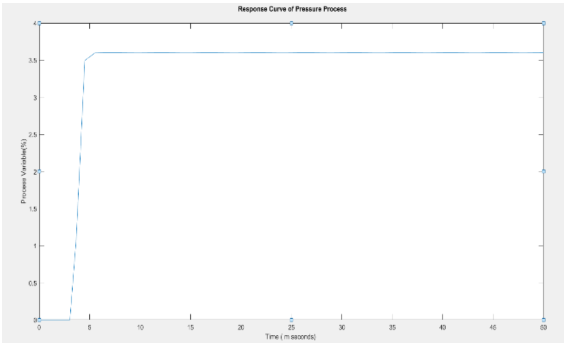

Fig 5 OL curve of pressure process

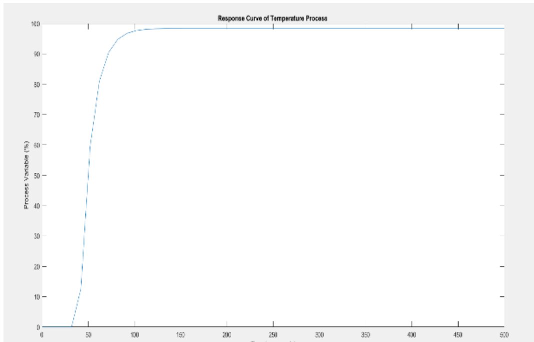

Fig 6OL curve of temperature process

$$K=\frac{Change\ in\ output}{Change\ in\ input} \quad (1)$$

$$\tau= 1.5(t_2-t_1) \quad (2)$$

$$T_d= (t_2- \tau) \quad (3)$$

The transfer function for level process = $\frac{1.63\, e^{-13.9s}}{1.22s+1}$ (4)

The transfer function for flow process = $\frac{1.16\, e^{-65.04s}}{6.91s+1}$ (5)

The transfer function for Pressure process = $\frac{1.2\, e^{-2.55s}}{0.26s+1}$ (6)

The transfer function for temperature process = $\frac{1.64\, e^{-39.6s}}{12.5s+1}$ (7)

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Intended Variables of PID Controller

Process	K_P	K_i	K_d
Level	0.048	46.28	0.00103
Flow	0.082	216.58	0.0038
Pressure	0.078	8.505	0.0090
Temperature	0.174	131.88	0.0001

IV. ASSESSMENT TECHNIQUE& HARDWARE PARTICULARS

The PID controlmechanism is carry out to explore how to keep the level, flow, Pressure and temperature at the right number. The PID controller more accurately fix the set point values. The featuresoffered in the PID controller accessible by Supervisory Control and Data Acquisition (SCADA) software are shown in Fig.7 & 8. Fig 9 shows the screen shot of values while the process is running.

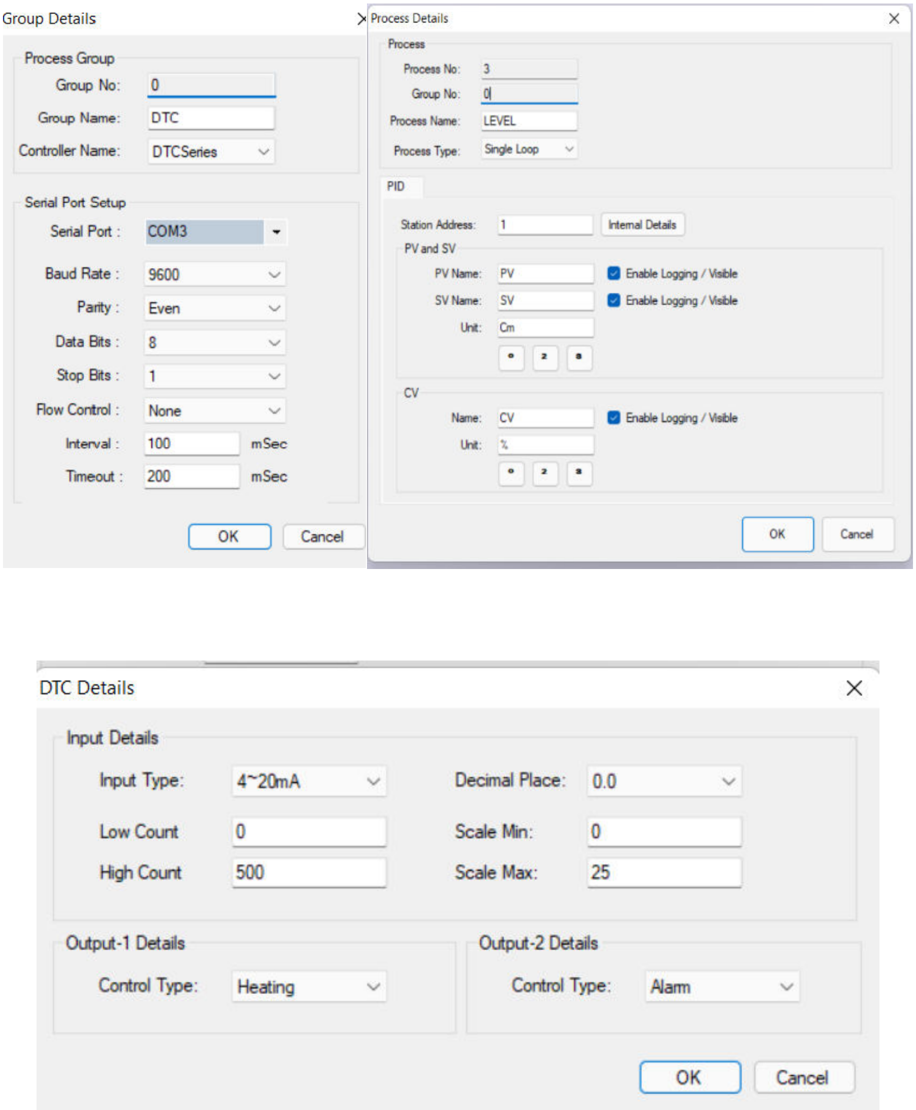

Fig 7 Properties available with SCADA software

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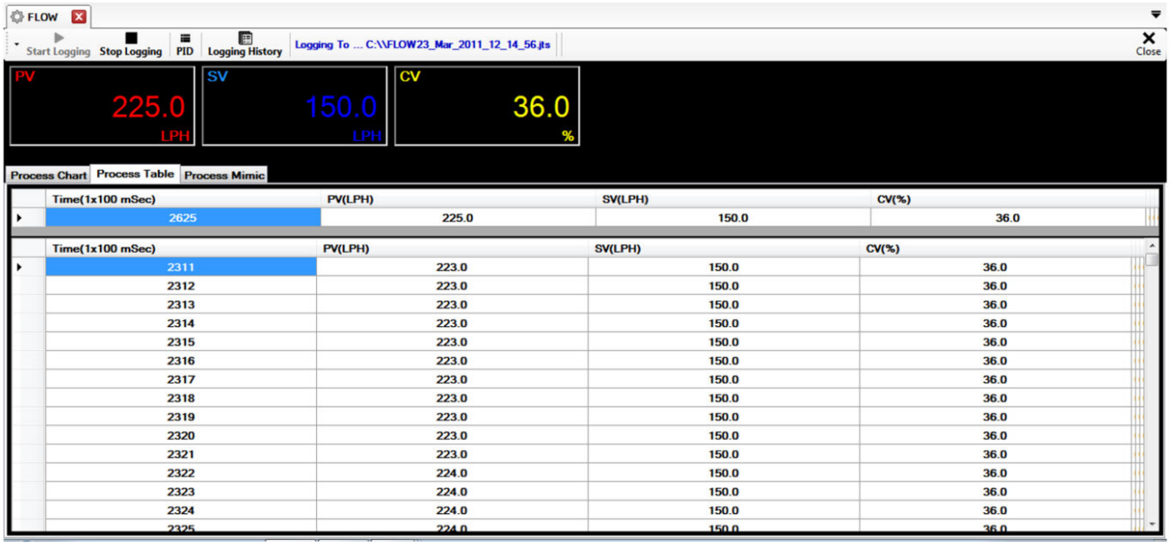

Time(1x100 mSec)	PV(LPH)	SV(LPH)	CV(%)
2625	225.0	150.0	36.0

Time(1x100 mSec)	PV(LPH)	SV(LPH)	CV(%)
2311	223.0	150.0	36.0
2312	223.0	150.0	36.0
2313	223.0	150.0	36.0
2314	223.0	150.0	36.0
2315	223.0	150.0	36.0
2316	223.0	150.0	36.0
2317	223.0	150.0	36.0
2318	223.0	150.0	36.0
2319	223.0	150.0	36.0
2320	223.0	150.0	36.0
2321	223.0	150.0	36.0
2322	224.0	150.0	36.0
2323	224.0	150.0	36.0
2324	224.0	150.0	36.0
2325	224.0	150.0	36.0

Fig 8 Screen Shot of Values while Process is running

Table 1 Level Transmitter Characterization

Input Voltage	24 Volt DC
Output scaling	4 to20 mA
Range	0 to25 cm
Type	RF Capacitance

Table 2 Flow Transmitter Characterization

Input Voltage	24 Volt DC
Output scaling	4 to20 mA
Range	(0-500) LPH
Type	Turbine

Table 3: Pressure Transmitter Characterization

Input Voltage	24 Volt DC
Output scaling	4 to20 mA
Range	0 to 5bar / (0-1000) mmwc
Type	RF Capacitance

Table 4: Temperature Transmitter Characterization

Input Voltage	24 Volt DC
Output scaling	4 to20 mA
Range	0 to 100
Type	RTD (PT 100)

V. REAL TIME RESULTS AND DISCUSSIONS

The responses of Individual processes including level, flow, pressure, and the temperature process system deliver good outcomes.To authenticate the steady Proportional-Integral-Derivative controller, a real time test was done on level, flow, pressure, and temperatureprocess. We assessed the set point of 15 cm for level process, 350 LPH for flow, 2.5 bar for pressure and 3deg for temperature and the plot is shown in fig 9a,9b,9c, &9d. The controller has produced good settling for all the process. In future the transfer function may be put up in MATLAB Simulink software using various controllers and the performance can be evaluated.

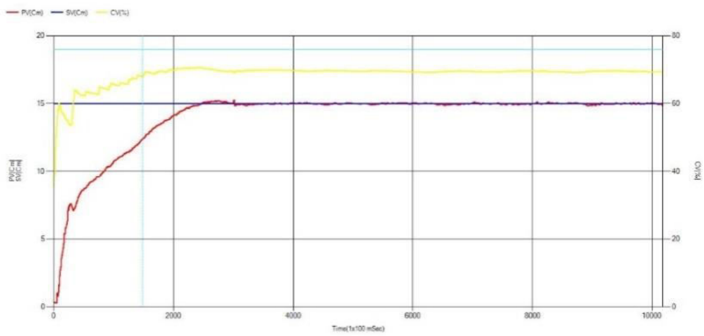

Fig 9a Response for level with SV=15 CM

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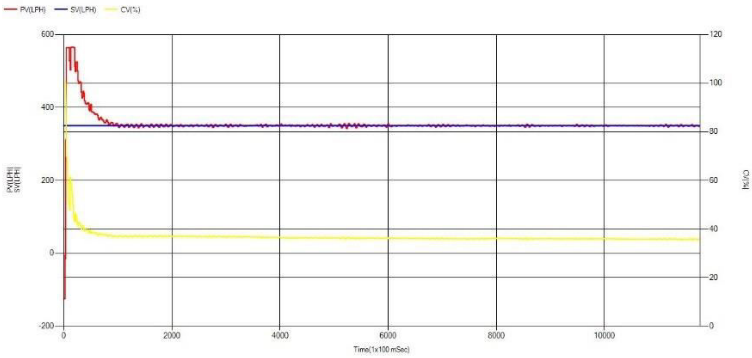

Fig 9b Response for flow with SV= 350 LPH

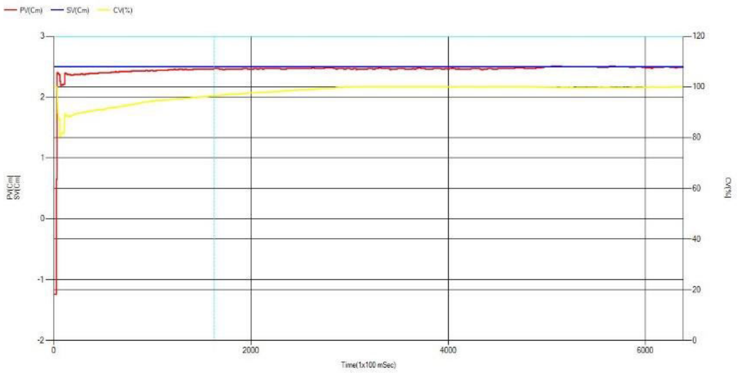

Fig 9cActual Response for Pressure with SV=2.5 bar

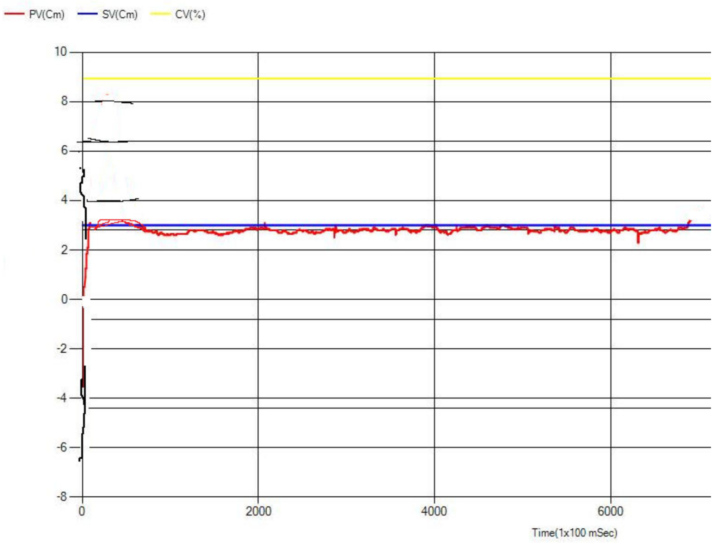

Fig 9d Actual Response for Temperature with SV= 3 deg

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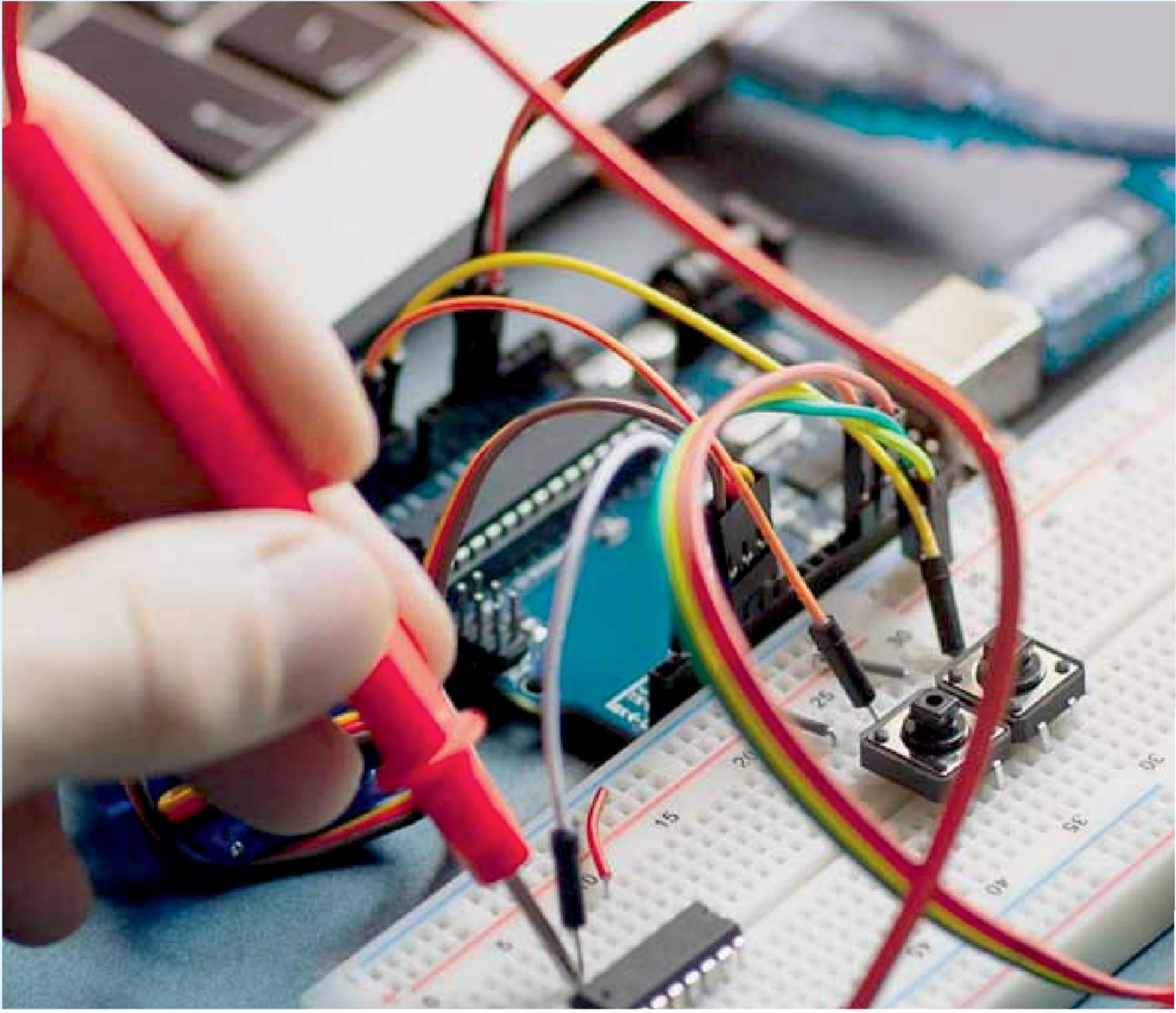

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