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# LabVIEW Based System for SMALL SCALE PLANT

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**ABSTRACT**

*Gas Filling Plants are used to fill, count & deliver Gas Cylinder ensuring an automated & efficient batch production. Different types of devices are used but the theme by introducing Supervisory and Data Acquisition System which overcomes human intervention and increases the overall efficiency and safety of the Gas Filling Station. Data acquisition is the process by which physical phenomena from the real world are transformed into electrical signals that are measured and converted into a digital format for processing, analysis, and storage by a computer. In a large majority of applications, the data acquisition (DAQ) system is designed not only to acquire data, but to act on it as well. In defining DAQ systems, it is therefore useful to extend this definition to include the control aspects of the total system. As Data Acquisition software Lab VIEW is used .It is a graphical development environment with built-in functionality for simulation, data acquisition, instrument control, measurement analysis, and data presentation. Lab VIEW gives one the flexibility of a powerful programming language without the complexity of traditional development environments. Lab VIEW delivers extensive acquisition, analysis, and presentation capabilities in a single environment, so one can seamlessly develop a complete solution on the platform of your choice.*

***Keywords:* *DAS, Sensors, ULTRA 2001,* Tedea-Huntleigh, *analog***

## I. INTRODUCTION

Gas Filling Plants are used to fill, count & deliver Gas Cylinder ensuring an automated & efficient batch production. Different types of devices are used but the theme here is to increase the efficiency by introducing Supervisory and Data Acquisition System which overcomes human intervention and increases the overall efficiency and safety of the Gas Filling Station Data acquisition is the process by which physical phenomena from the real world are transformed into electrical signals that are measured and converted into a digital format for processing, analysis, and storage by a computer.

LabVIEW is a graphical development environment with built-in functionality for simulation, data acquisition, instrument control, measurement analysis, and data presentation. Lab VIEW gives one the flexibility of a powerful programming language without the complexity of traditional development environments. Lab VIEW delivers extensive acquisition, analysis, and presentation capabilities in a single environment, so one can seamlessly develop a complete solution on the platform of your choice

## II. OVERVIEW OF AN PLANT STRUCTURE

### 2.1 Introduction

A supervisory & data acquisition system for any filling plant is to be developed should covered following points

1. Automatic counting of empty and filled cylinder is to be done for measuring performance of plant
2. Weight of every cylinder is to be taken for detection of error in filling
3. Air to LPG ration to be monitored regularly
4. An alarm to be indicated at operator room at LPG to air ration increase at 60% at any part of plant so that safety measure can be taken
5. An hooter alarm operate if LPG/air ration increases at 80% indicating to manually shut down plant and workers should be evacuated at safe places
6. Smoke detector should be placed at every sensitive

### 2.2 Designing process

1. To design a service oriented architecture few points should be taken in account
2. System should be least complicated and user friendly
3. Accuracy level should be high
4. System should be cost effective and space for future add ups. To meet the system requirement in this specified case a supervisory & data acquisition system output control signal can be suggested as flows:
5. Alarm to be raised at error in weight of cylinder
6. Security alarms at different condition 60% and 80% LPG to air ratio
7. Smoke detection alarm
8. Level control of water tank
9. All control signals are relay output to actuate a coil

### 2.3 Input signals to the data acquisition system from the sensor are:

1. Output from LPG sensor (0 to 5 V)
2. Output from smoke detector (relay output 5V)
3. Ultrasonic sensor output calibrated npn or pnp output.
4. Load cell output calibrated at 27±0.5 kg relay output.

Now we divide plant in small distributed system to reduce the cable traffic in the plant. Each group should have an DAS mounted in field in which outputs from each sensor can be give and having RS-232 communication system than RS-232 to RS-485 converter is there to transmit the signal to operator room. The operator room has RS-485 to RS-232 convertor and PC with lab view on which all controlling is done. The plant layout containing the field wiring and positioning of sensor is as shown.

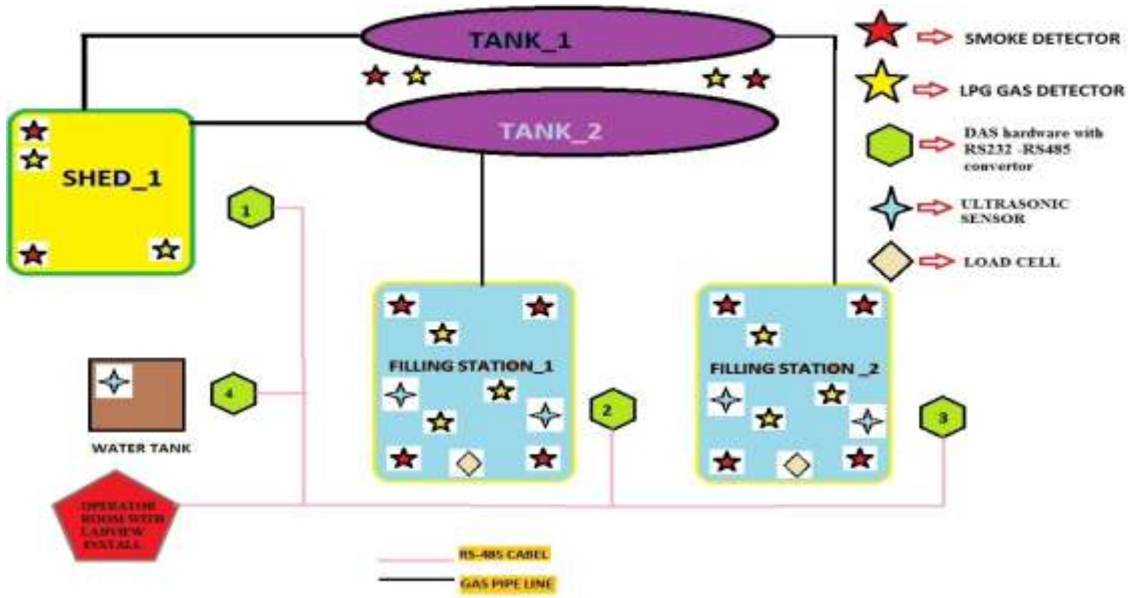


**Fig 1. Gas filling plant layout**

## III. DATA ACQUISITION SYSTEM

A data acquisition and control system, built around the power and flexibility of the PC, may consist of a wide variety of diverse hardware building blocks from different equipment manufacturers. It is the task of the system integrator to bring together these individual components into a complete working system.

The basic elements of a data acquisition system are as follows:

- **A)** Sensors and transducers
- **B)** Field wiring
- **C)** Data acquisition hardware
- **D)** PC (operating system)
- **E)** Data acquisition software (lab view)

## IV. TRANSDUCERS AND SENSORS

Transducers and sensors provide the actual interface between the real world and the data acquisition system by converting physical phenomena into electrical signals that the signal conditioning and/or data acquisition hardware can accept. Transducers available can perform almost any physical measurement and provide a corresponding electrical output. For example, thermocouples, resistive temperature detectors (RTDs), thermistors and IC sensors convert temperature into an analog signal, while flow meters produce digital pulse trains whose frequency depends on the speed of flow. Strain gauges and pressure transducers measure force and pressure respectively, while other types of transducers are available to measure linear and angular displacement, velocity and acceleration, light, chemical properties (e.g. CO concentration, pH), voltages, currents, resistances or pulses. In each case, the electrical signals produced are proportional to the physical quantity being measured according to some defined relationship.

**4.1 LPG detector**: There are many sensor which detect the LPG contain in air for example Hanwei sensor model MQ-06. Its main features are : Application They are used in gas leakage detecting equipments in family and industry, are suitable for detecting of LPG, iso-butane, propane, LNG, avoid the noise of alcohol and cooking fumes and cigarette smoke.

1. Semiconductor type gas sensor
2. Typical detection ranges: propane, butane, liquefied petroleum gas,
3. 300ppm to 10,000ppm
4. Standard circuit conditions
5. Circuit voltage: 3V to 15V, DC
6. Out put voltage : 0 to 5V , DC
7. Heater power consumption: 750mW

**FIG 2. Hanwei sensor model MQ-06**

**4.2 Photo electric smoke detector** (Simplex make 4098 smoke detectors )

These devices operate on a light scattering principle. The smoke sensing chamber contains an infrared LED source with a peak spectral emission of 880nanometers. This source is placed at an angle from a spectrally matched photodiode receiver. During a NO SMOKE condition, only light reflected from the chamber walls enters the receiver and shows up as a small photocurrent. As smoke particles enter the sensing chamber and cross the light beam of the LED, more light reaches the receiver due to scattering. The receiver circuitry converts this photocurrent into a signal voltage. In a detector, when this voltage reaches a preset level, an alarm is produced. In a sensor, this signal voltage goes into an 8-bit, A to D (analog to digital) converter. A digital representation of this signal voltage is then transmitted to the fire alarm panel for further processing.

**FIG 3. Simplex make 4098 smoke detectors**

**4.3 Ultrasonic sensor** Features:

1. Parameterisation interface for the application- specific adjustment of the sensor setting via the service program ULTRA 2001
2. 2 switch outputs freely adjustable
3. Hysteresis mode selectable
4. Window function can be selected
5. Synchronisation options

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6. Adjustable acoustic power and sensitivity
7. Temperature compensation

**FIG 4.P&F make ultrasonic sensor**

**4.4 Tedea-Huntleigh make load cell model no :** 1042 , Single Point Load Cells Models 1042 is a low profile, two -beam single point load cell designed for direct mounting of low cost weighing platforms, ideally suited for retail, bench and counting scales.

Features

Capacities: 1 - 100 kg (2.20 - 220.46 lbs) ,

Anodized aluminium construction ,

6 wire (sense) circuit

Single point 16 inch x 16 inch platform

IP66 PROTECTION

**FIG 5. Tedea-Huntleigh make load cell**

## V. FIELD WIRING AND COMMUNICATIONS CABLING

Field wiring represents the physical connection from the transducers and sensors to the signal conditioning hardware and/or data acquisition hardware. When the signal conditioning and/or data acquisition hardware is remotely located from the PC, then the field wiring provides the physical link between these hardware elements and the host computer. If this physical link is an RS-232 or RS-485 communications interface, then this component of the field wiring is often referred to as communications cabling. Since field wiring and communications cabling often physically represents the largest component of the total system, it is most susceptible to the effects of external noise, especially in harsh industrial environments. The correct earthing and shielding of field wires and communications cabling is of paramount importance in reducing the effects of noise. This passive component of the data acquisition and control system is often overlooked as an important integral component, resulting in an otherwise reliable system becoming inaccurate or unreliable due to incorrect wiring techniques.

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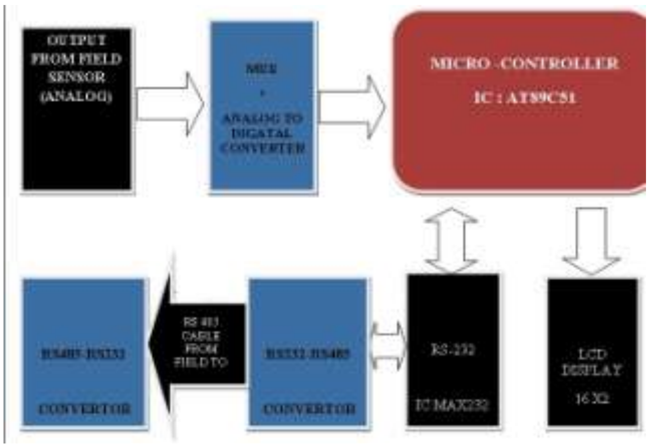
## VI. RS-485 COMMUNICATION PROTOCOL

RS485 or EIA (Electronic Industries Association) RS485 is a balanced line, half-duplex transmission system allowing transmission distances of up to 1.2 km. The following table summarizes the RS-485 Standard:

| Parameter | |
|---|---|
| Mode of drivers | Differential |
| Maximum cable length | 1200 meters |
| Number of drivers and receivers | 32 driver and 32 receiver |
| Maximum common mode voltage | 12 to -7 volts |
| Receiver sensitivity | +/-200mv |

Connection diagram: A Belden 9841 (Single pair) or 9842 (Two pair) cable with a characteristic impedance of 120 ohms is recommended, the cable should be terminated at each end with a 120 ohm, quarter watt (or greater) resistor. There must be no more than two wires connected to each terminal, this ensures that a "Daisy Chain or "straight line" configuration is used. A "Star" or a network with "Stubs (Tees)" is not recommended as reflections within the cable may result in data corruption.

## VII. DATA ACQUISITION HARDWARE DESIGN




## VIII. LAB VIEW INTRODUCTION

Lab VIEW (Laboratory Virtual Instrumentation Engineering Workbench) is a graphical development environment with built-in functionality for simulation, data acquisition, instrument control, measurement analysis, and data presentation. Lab VIEW gives one the flexibility of a powerful programming language without the complexity of traditional development environments. Lab VIEW delivers extensive acquisition, analysis, and presentation capabilities in a single environment, so one can seamlessly develop a complete solution on the platform of your choice.

### 8.1 Front Panel

1. User Interface (UI)

2. Controls = Inputs
3. Indicators = Outputs

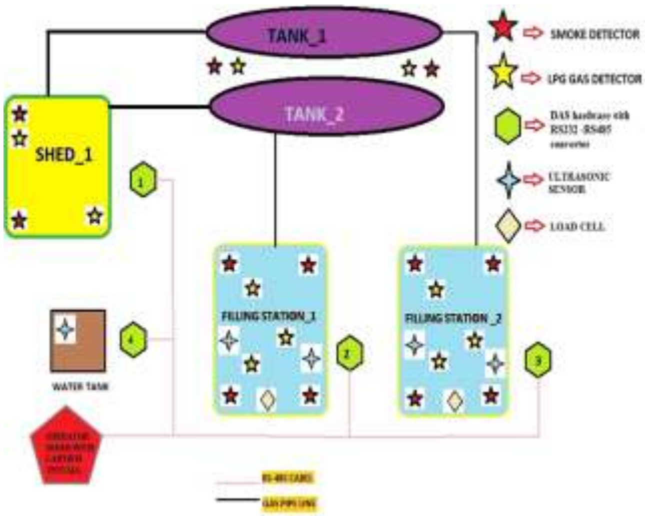



**Fig 6.Gas filling plant layout**

**8.2 Block Diagram**

1. Graphical Code
2. Data travels on wires from controls through functions to indicators
3. Blocks execute by Dataflow

## IX. LAB VIEW AND VC MIX PROGRAMMING

### 9.1 Introduction

In the method the DLL functions are compiled with VC++, and call the DLL function in Lab VIEW. The serial port communication is realized in Lab VIEW environment by the mix programming between Lab View and VC++.

Lab VIEW is a kind of chart programming soft. It uses the chart editor to replace traditional the text editor programming language, and it is widespread used in control system, such as signal process, motion control. Lab VIEW has its own insufficiency as the chart editor programming development environment in hardware firmware writing, and massive complex data process. This requires it combine to use with other language.

### 9.2 Function Block Design on COM Port Application

The functions in DLL : Open the com port the port Initialization Include to opens the com port and configures the serial port. The com port is processing as a file, and must open before the use. It is opened by API Create file function, which returns a sentence handle for operation. The open API function is:Bvoid Createfile (int port_num) Configure the com port com port is configured before data communication and the configure data format is DCB data structure block, which includes baud rate, data bits, stops bits, parity check, transmission buffer size, and receive buffer size. In the data format, it should consider whether select the ASCII code or the binary code The initial function is: int initcom(int port_num,long baud,int bit,int paritybit,int stopbit); Writing string function in serial port after the COM port configure, you can do read or write operation. The program calls Writefile () function to complete writing string operation in Win32 API function. The writing API function is: int writecom (int port_num,char string]); Reading string function in serial port reads operation can be inquiry, and event drive method. The program uses Readfile () function tocatch the port information . The read function is:

```
char *readcom(int port_num)
{
char *string;
char *a,*b;
a="1";
b="2";
string=buffer;
HANDLE hcom;
if(port_num==0)
hcom=hcom1;
else
hcom=hcom2; osReader.hEvent =
CreateEvent(NULL,
TRUE, FALSE, NULL);
if (osReader.hEvent == NULL)
        return a;
if(!fWaitingOnRead) {
if (!ReadFile(hcom, buffer, num,&Num_read,
NULL))
{
if (GetLastError() != ERROR_IO_PENDING)
return b;
else
{
fWaitingOnRead = TRUE;
}
return string;
}
```

Closing serial port function When the serial port is not using, the port need close and release system resources. Otherwise the port will be at opens condition, other application procedures are unable to open or to use it. The close function is:

```
void closecom(int port_num)
```

```
{
switch(port_num)
{
case 0:
CloseHandle(hcom1);
case 1:
CloseHandle(hcom2);
default: break;
}
}
```

### 9.3 Create DLL files

Create a DLL project in VC environment In VC environment chose Win32 Dynamic X Link Library and input DLL file name, such as tx.DLL

Design communication source functions code in tx.cpp.

```
int initcom// // initial port function
int wtitecom // // writing function
char *readcom // // read function
void closecom; // close function
```

**9.4 Create define function**, tx.def file //build tx.dll; TT.def : Declares the module parameters for the DLL

```
LIBRARY "tx"
DESCRIPTION 'tx Windows Dynamic Link Library'
EXPORTS ; Explicit exports can go here
initcom
writecom
closecom
readcom
```

**9.5 Debugging the code, and after compiling constructed DLL document.**

Connect DLL Function in Lab VIEW The method is connected DLL function by Call Library Function Node in Lab VIEW. The fig shows the connect process in Lab VIEW.

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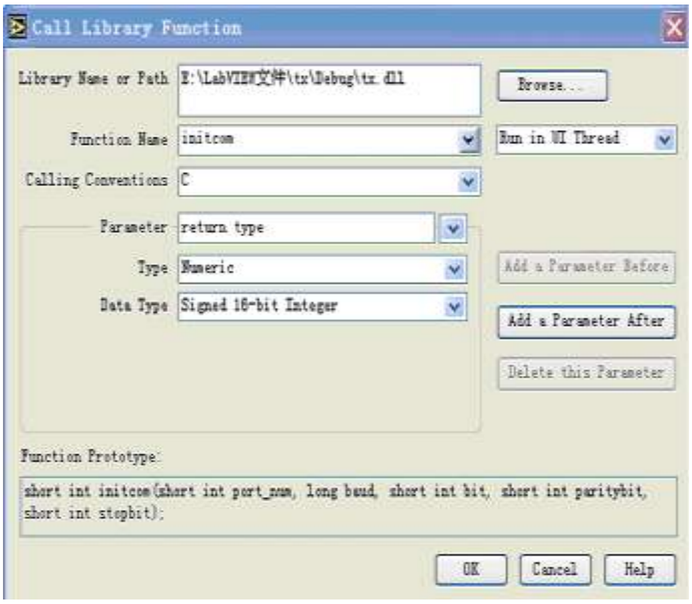


**Fig 7. Call library function**

## X. CONCLUSION

The model presented is a first step towards providing a better method to analyze applications created in Lab VIEW to determine if deadlines can be met. While performing the measurements, a relationship between the context switch time and size of data structure was noticed. Further exploration of this relationship needs to be done. The next phase of this research is to validate the model to ensure that it will accurately predict if a set of tasks is schedulable. Longer-term goals are to add to this model by relaxing more of the underlying assumptions. We have designed a data acquisition system using ATMEL89c51 microcontroller and ADC0804LCN analog to digital transformer. The designed model was programmed in assembly level language for single analog input and was tested under proper condition.

## XI. FUTURE SCOPE

In stage two of this project we test the created, .dll files for interfacing and built the lab view control programming. Also search the possibilities of report generation and use interfacing of das with pc to make it more users friendly.

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