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COURSE: STRUCTURED COMPUTER PROGRAMMING

INTRODUCTION

ABUAD FARM is a farm where cultivating the soil, growing crops and raising livestock occurs. It includes the preparation of plant and animal products for people to use and their distribution to markets.

DRY-SEASON farming is not profitable for crops production.This is because there are no irrigation facilities in most parts of the country. Irrigation is the process through which controlled amount of water can be supplied through artificial means such as pipes, ditches, sprinklers etc. the main objectives of irrigation systems is to help agricultural crop growth, landscape maintenance, reduce the effect of inadequate rainfall etc. Therefore, the importance of irrigation systems is very high.

CONCEPTUALIZATION

Administrative control and data collection (ACADC) is the technology that enables a user to collect data from one or more distant facilities and/or send limited control instructions to those facilities. (ACADC) systems are vital components. They control pipelines, water and transportation systems, utilities, refineries, chemical plants, a wide variety of manufacturing operations, we will work on the application of this system in irrigation for the first time in the ABUAD FARM.

ACADC provides management with real-time data on production operations, implements more efficient control paradigms, improves plant and personnel safety, and reduces costs of operation. These benefits are made possible by the use of standard hardware and software in ACADC systems combined with improved communication protocols and increased connectivity to outside networks, including the Internet. However, these benefits are acquired at the price of increased vulnerability to attacks or erroneous actions from a variety of external and internal sources.

Specific Functions associated with the components of ACADC systems.
These ACADC elements are defined as follows:

Operator: Human operator who monitors the
ACADC system and performs supervisory control functions for the remote plant operation.

Human machine interface (HMI): Presents data to the operator and provides for control inputs in a variety of formats, including graphics, schematics, windows, pull down menus, touch-screens, and so on.

Communications means: Communication method between the HMI and remote controllers. Communication can be through the Internet, wireless or wired networks, or the switched public telephone network.

Remote terminal unit (RTU): Functions as a slave in the master/slave architecture. Sends control signals to the device under control, acquires data from these devices, and transmits the data to the HMI. The data rate between the RTU and controlled device is relatively high and the control method is usually closed loop.

SPECIFICATIONS

Data Acquisition and Control

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.

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:

- Sensors and transducers
- Field wiring
- Signal conditioning
- Data acquisition hardware
- PC (operating system)
- Data acquisition software

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), thermostats, 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.

Signal conditioning

Electrical signals generated by transducers often need to be converted to a form acceptable to the data acquisition hardware, particularly the A/D converter which converts the signal data to the required digital format. In addition, many transducers require some form of excitation or bridge completion for proper and accurate operation.

Data acquisition hardware

Data acquisition and control (DAQ) hardware can be defined as that component of a complete data acquisition and control system, which performs any of the following functions:

- The input, processing and conversion to digital format, using Analog to Digital Converters (ADCs), of analog signal data measured from a system or process – the data is then transferred to a computer for display, storage and analysis
- The input of digital signals, which contain information from a system or process
- The processing, conversion to analog format, using Digital to Analog Converters (DACs), of digital signals from the computer – the analog control signals are used for controlling a system or process
- The output of digital control signals.

Data acquisition software

Data acquisition hardware does not work without software, because it is the software running on the computer that transforms the system into a complete data acquisition, analysis, display, and

control system. Application software runs on the computer under an operating system that may be single-tasking (like DOS) or multitasking (like Windows, Unix, OS2), allowing more than one application to run simultaneously. The application software can be a full screen interactive panel, a dedicated input/output control program, a data logger, a communications handler, or a combination of all of these. There are three options available, with regard to the software required, to program any system hardware:

• Program the registers of the data acquisition hardware directly.

• Utilize low-level driver software, usually provided with the hardware, to develop a software application for the specific tasks required.

• Utilize off-the-shelf application software – this can be application software, provided with the hardware itself, which performs all the tasks required for a particular application; alternatively, third party packages such as LabVIEW and Labtech Notebook provide a graphical interface for programming the tasks required of a particular item of hardware, as well as providing tools to analyze and display the data acquired.

DESIGN

B

HARDWARE FEATURES

Moisture Scale

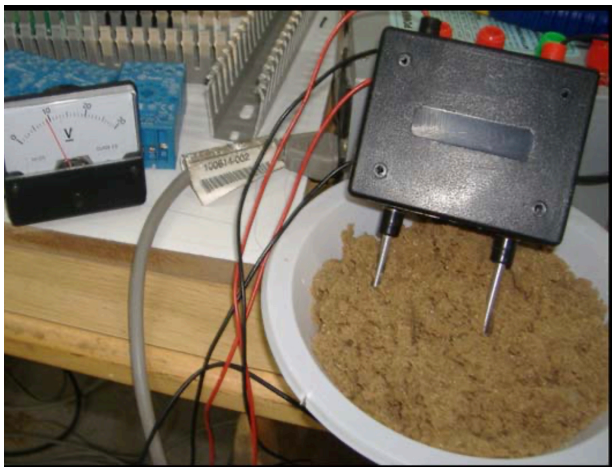
It is the device that measures the average of the soil's moisture. This device was made by us since the devices available in markets are so costly.

The idea is mainly based on the variety of the electrical conduction in soil which positively varies with the quantity of water in soil.

We consider the soil as a variable resistance.We will place two Noresta poles with a distance 8 cm. It means that the value of the variable resistance (soil) varies from 250MΩ(high moisture) to 3GΩ (Low mositure) according to the quantity of water in the soil.

If we connect a 10 VDC -voltage source- of on the constant resitance, and the variable resistance (soil) . Then, if we pour some water on this soil, we notice the variety of voltage value on voltmeter when the amount of water increases (Voltage Drop on R) On contrary, when the amount of water decreases in the soil, it leads to decrease in (Voltage Drop on R)

Testing in wet soil.



Testing in dry soil

Water Pump
• Source needed: 220V AC
• Terminals: Two terminals
• I/O: Water in, Water out
• Description: When you apply a 220V AC to the water pump terminals, it pumps the used water to outside the water tank. If you disconnect the source, the pump will stop working.
This pump is needed for transfering water from the tank to the agricultural areas according to the need of each area.

Valves

We need 5 valves – main valve – and 4 valves for each crops .

- Source needed: 220V AC.
- Terminals: Two terminals
- I/O: Water in, and Water out
- Description: The input valve will allow the input water to pass through it

when a signal is applied to its terminals. After the signal is disconnected, the valve will return to its normal operation (prevent water to pass).

Water Level Sensor

It comprises two switches including a ball and a weight that appoints Low level and high level point which witnesses the change of each switch due to the variety of water level in the tank, that brings about a change of the ball's position, and the switches' position as . Water Level Sensor.

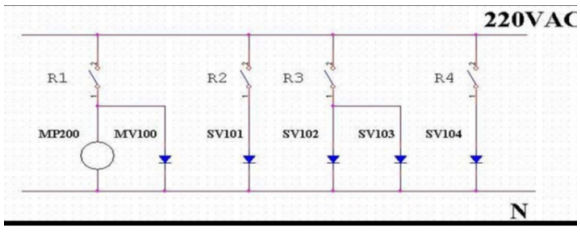
When the ball moves due to the change in the water level in the tank, the ball moves to change the switches' position.

We use water level sensor to attain a signal that indicates the level of water in the tank decreased (low level). Consequently, the main valves and the pump are stopped.

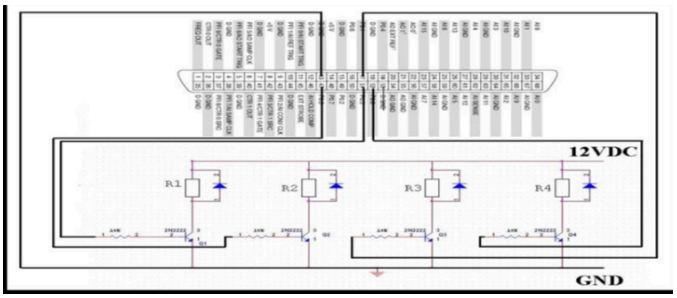
The normal position we used for water level sensor was (NC). When the water level decreases (low level) where water level sensor was calibrated, it turns to NO position. Then, the pump and the main valve are stopped.

After viewing the parts used in this model, we need means for enabling the computer to deal with such signals. We have four analog signals coming from the soil indicating to the moisture, water level sensor signal, and need five digital signals to operate the pumps and the valves.

Power Circuit: This circuit is responsible for passing current from source to load. The power circuit which we used in this model including the pump, and the valves.



Control Circuit: This circuit is responsible for passing current to driver at suitable time and way.



SOFTWARE FEATURES

Here are some of the typical ACADC software components:

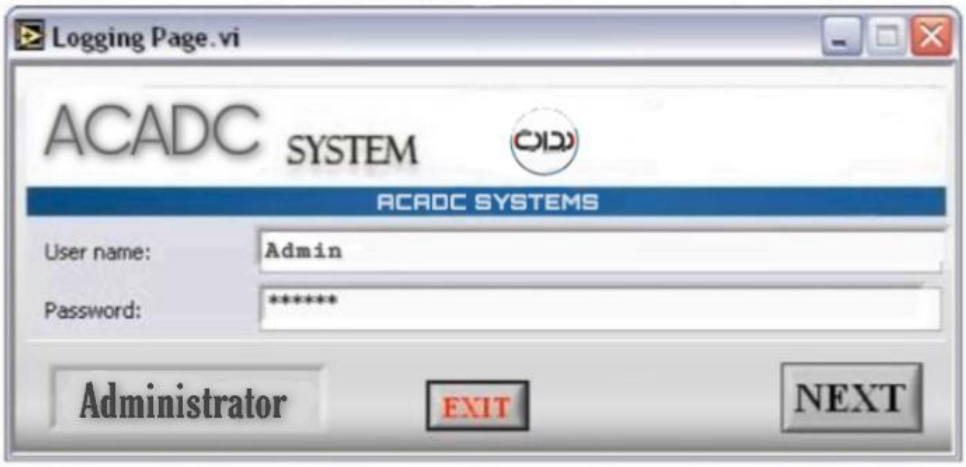
- ACADC master/client :
  - ❖ Human machine interface
  - ❖ Alarm handling
  - ❖ Event and log monitoring
  - ❖ Special application
- ACADC slave/data server
  - ❖ Database processing application
  - ❖ Real time system manager
  - ❖ Report generator
  - ❖ Alarm handling
  - ❖ Interfaces of control component
  - ❖ Charts and graph
  - ❖ Spreadsheet
  - ❖ Data logging

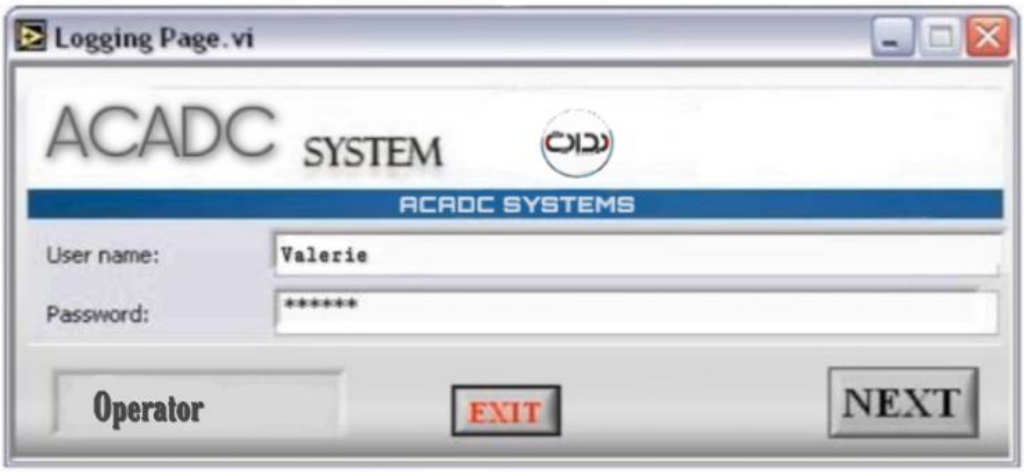
After reading the average of moisture in the soil and the level of water in the tank, we should realize if the time is suitable for irrigation or not. This is conducted though the After reading the average of moisture in the soil and the level of water in the tank, we should realize if the time is suitable for irrigation or not.

ACDAC Irrigation System:

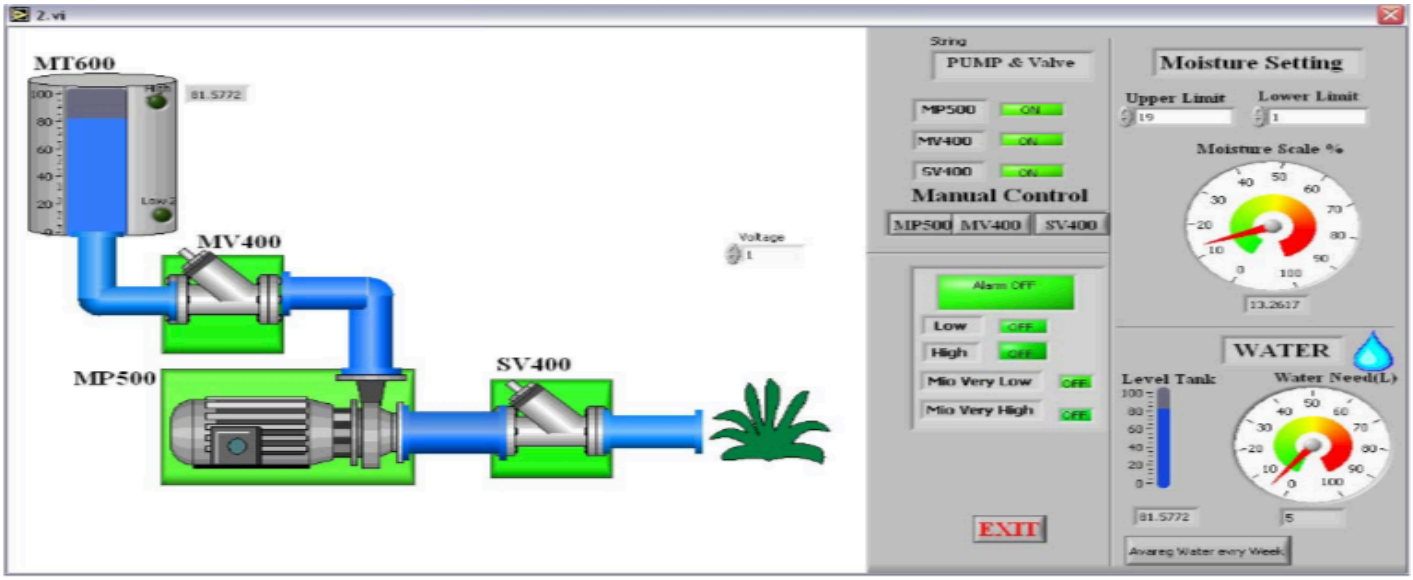
We have two accounts (Administrator and Operator), where administrator account able of monitoring and control and supervisor, but operator account only monitor the process and the system with no control.

Connect with Database, and generate Excel report and data logging.





I divided the work on this page into two areas: The left area including the Human Machine Interface with regard to the delimited area showing an image for the tank, the pump, the main valve, and the secondary valve. Meanwhile, the right area includes the needed information about HMI system.
The right side of the page which includes the needed information about HMI on the same page. In Moisture Setting, the administrator defines the saturation average by considering the maximum average of saturation at the upper limit, and the minimum average allocated by the administrator at the lower limit. The saturation average can be easily defined when the reading of (Moisture Scale %).
It starts to vary very slowly. Then we realize that the soil reaches the saturation average.



MONITORING PAGE

Here description of button and Labels:
Water Need: It is the screen that enables the administrator to know the quantity of the water irrigated in this area.

Level Tank: It is responsible for the water level in the tank.

Average water every week: Whereas the Administrator can account the water quantity spent for irrigation during the last week, and it is related to a database.

Pump and Valves: Whereas we are able to know the status of the pumps and the valves; The green color indicates the working status, while the red one indicates the stop status.

Manual Control : These buttons are concerned with the manual control process of the pumps and the valves that we can stop the work of the pumps and the valves when the soil is in need to irrigation.

Alarms: This screen enables us to know if there is alarm message or the position of such a message. (Alarm off) means there is no alarm in the system and it works appropriately. (Alarm on) indicates to alarm message represented in red, whereas we can specify the place of alarm from the lower menu. For example, if the alarm signal is red for LOW, it means the tank is empty of water, while High refers to the tank status.

Mio Very High and Low: It indicates that the moisture level in the soil reaches the maximum average (saturation), or the minimum average (drought).

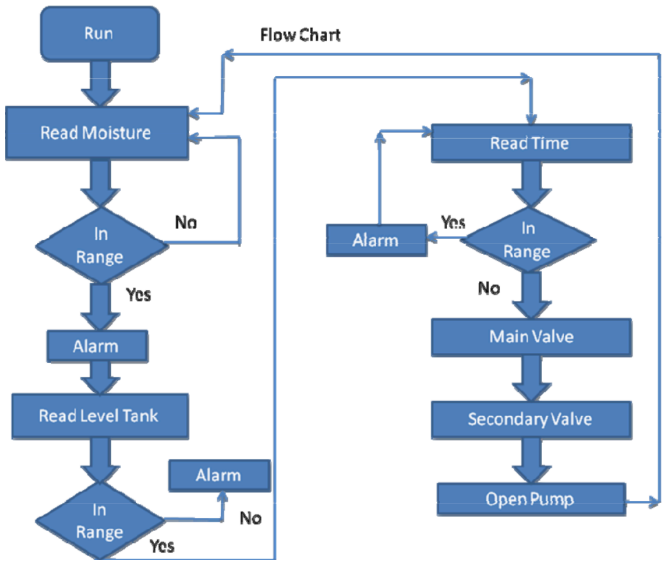
Voltage: It gives the reading of voltage from Alameer Moisture Scale.

Exit: To Exit from the page

Data logging: This page shows all process in all client area and we can print Excel Report for these data.

C

FLOWCHART



ALGORITHM

1. START,
2. REQUEST PASSWORD ,
3. IF INPUT is valid,
   READ soil temperature"ST"
   READ soil moisture "SM"
   READ water level in the tank
4. IF the tank level is greater than the minimum value let the plant be watered,
5. IF soil moisture is less than the maximum moisture and soil temperature is greater then the plant should be watered,
6. Activate a radiation system,
7. ELSE,
   trigger an alarm
8. "PRINT" water level is too low to perform a radiation .
9. PRINT "SM", "ST"
10. ELSE,
    go to step 2,
11. END.

SPECIFICATIONS

1. Windows Environment (98/2000/XP).
2.LabVIEW Runtime Engine 8.
3. SQL Server 2000.
4- Backup "test" database.

TESTING AND DEBUGGING

Both uniformity and pump/well testing should be performed on an irrigation system every 2-3 years to uncover maintenance issues that can save energy and improve the water application efficiency. Uniformity testing is a troubleshooting procedure to check that the water distributed by the irrigation system is being applied uniformly to the field within practical limitations. The test procedure only measures the amount of water applied to the soil surface and is not intended to indicate the amount of water that infiltrated the soil into the root zone. This test functions as low cost insurance to determine if the nozzles and sprinklers are applying water evenly.The test will take 1 or 2 people about 4 hours to complete depending on the size of the field. Pump testing is typically done in an open discharge method where the pump is disconnected from the irrigation system and a flow meter, pressure indicator an valve is installed on the pump output. The pump is started and the valve partially closed until the design system pressure is reached. The system is allowed to run for a period of time, generally 15 minutes, and then the valve is opened and closed to obtain enough points to draw a pressure/flow curve.

D

TOP DOWN DESIGN