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A LabView based Instrumentation System for a Wind-Solar Hybrid Power Station

Pavithra A C[1], Veronika A[2], Shilpa shree S[2] , Nithyashree S K[2]

[1]Assistant Professor, Department of Department of ECE, ATMECE, Mysuru
[2]Student, ATMECE, Mysuru

Abstract— Range of renewable energy technologies are from the well-established, such as hydropower, to the emergent, such as a wind-solar hybrid system. To measure and control system variables each technology has its own individual instrumentation a requirement. The LabView data acquisition hardware and software module has become one of the most widely used tools to capture, view, and process controls, instrumentation, and power system data both in academia and the industry (Franz, 2003, and Travis, 2002) from National Instruments. A LabView based real time data acquisition and instrumentation of a 1.5 kW wind-solar hybrid renewable energy system. The addition of the new LabView module to the system provides the much-needed real time information on the system variables, such as wind speed, wind direction, dc power, ac power, ac/dc voltages and currents. To provide a hands-on laboratory experience related to electrical, electronics, and instrumentation this real-time data acquisition system is being used extensively. This paper discusses many aspects of data acquisition, instrumentation, interfacing, and programming based on an existing 1.5 kW wind-solar hybrid power station.

Keywords- LabView, anemometer, Solar photovoltaic panels and Charge controller and inverter

1. Introduction

Data acquisition can be accomplished manually using paper and pencil, recording readings from a multimeter or any other instrument at the simplest level. Data acquisition of this form may be adequate for some applications. However, data recording applications that require large number of data readings which requires very frequent recordings are must include instruments or microcontrollers to acquire and record data precisely (Rigby and Dalby, 1995). Laboratory Virtual Instrument Engineering Workbench (LabView) is a powerful and flexible instrumentation and analysis software application tool which was developed in 1986 by the National Instruments (National Instruments, 2002). LabView has become a vital tool in today's emerging technologies and widely adopted throughout academia, industry, and government laboratories as the standard for data acquisition, instrument control and analysis software. An existing 1.5 kW rated wind-solar hybrid power station. The renewable energy-based power system's design and construction was reported earlier (Pecen, et al., 2000. Particularly some components in the renewable energy plants such as batteries and dc-to-ac power inverters can lead to power quality and grid stability problems when wind-solar power systems are connected to fossil-fuel based turbine and generators (Patel, 1999). Due to the vast dynamics differences involved in wind turbines and steam turbines these interactions will happen mostly. The hybrid wind-solar power station operates in parallel, and charges a 12 V battery bank which includes six deep cycle lead acid batteries. The solar panels are installed on a frame which tracks the sun light during the day from an initial position of 0 degree to 320 degree. Also 1.5 kVA rated dc-to-ac power inverter based on solid-state devices, protection equipment such as ac and dc circuit breakers, fuses, surge arrester, a set of linear and non-linear loads, connecting cables, and junction boxes are included in the system. Students are introduced to the studies of steady state voltage and currents in the system, due to small linear and nonlinear load effects (Pecen and Timmerman, 1999) illustrating power quality problems may occur. As a part of the undergraduate electrical power and machinery laboratory content as well as a demonstration unit for visiting high school and community college students (Pecen, et al., 2003) the wind-solar hybrid power station has been used.

2. METHODOLOGY

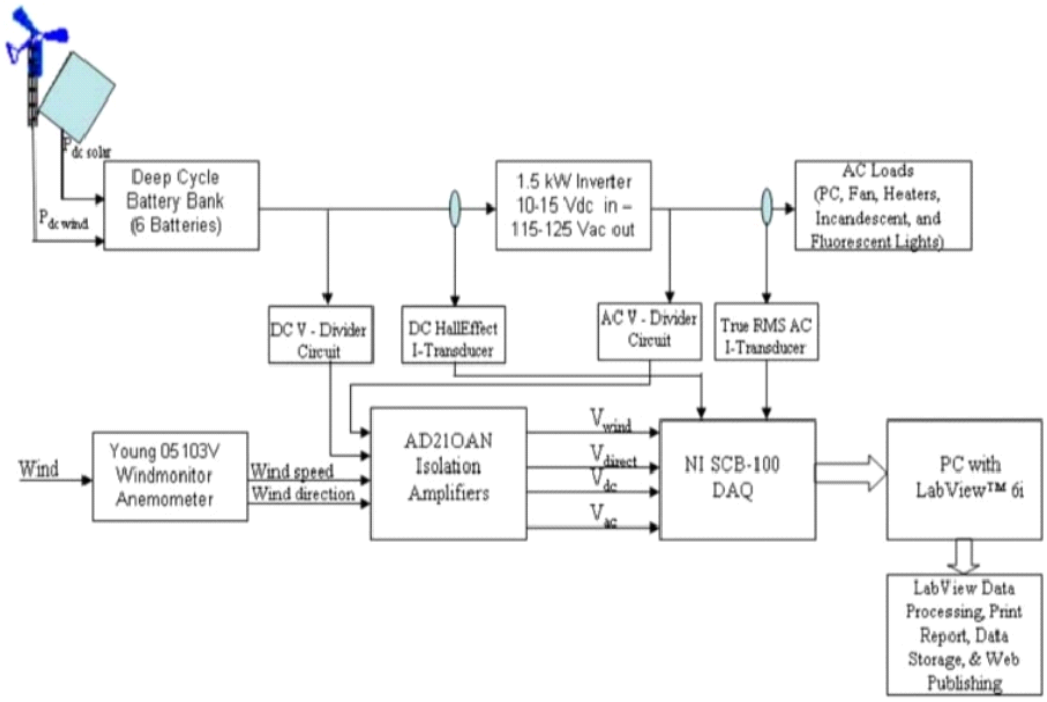

FIG 1 Functional block diagram of the overall instrumentation system

The block diagram of wheel chair system is shown in Fig 1. The Bluetooth module is responsible for sensing the direction of the android smartphone app. This would be more reaction by connected and coded. Arduino allows a control scenario via the connected relay control pins which are linked to the motor to control wheelchair movements as directed. Bluetooth module again senses the power controlling direction that android application and repeats the sensible procedure from the code for controlling the home appliances.

The details of the different components used are shown below.

Arduino kit: By using an external power source, the voltage input to the Arduino board. Arduino may be a open-source stage utilized for fabricating hardware tasks. Arduino comprises from claiming both a physical programmable circuit (often alluded on similarly as an microcontroller) also a bit for software, or IDE (Integrated improvement Environment) that runs on computer, used to compose and transfer workstation code of the physical table.

The Arduino stage need to be very much mainstream with people just beginning out for electronics. Dissimilar to practically past programmable circuit boards, the Arduino doesn't require a separate bit for equipment (called a programmer) so as will load new code onto those table -it might basically utilize an USB link. Additionally, that Arduino IDE utilization are rearranged adaptation for C++, making it less demanding will take to system. Finally, Arduino gives a standard manifestation component that breaks the crazy works of the micro-controller under a greater amount open one bundle.

Power supply: The controlled power supply used on the board for controlling the microcontroller and other components. The one is either supplied from V_{IN} through an on-board regulator, or by USB or other controlled 5V supply.

Serial Pin: 0 (RX) to I (TX). Used for receiving (RX) and transmitting serial TTL (TX) data.

A serial port may be a serial correspondence interface through which majority of the data transfers done sequentially one bit at a time. This is in contrast to a parallel port which communicates multiple bits simultaneously in parallel. The history of personal computers, information might have been exchanged through serial ports to units for example, such that modems, terminals, Furthermore Different peripherals.

While such interfaces as Ethernet, FireWire and USB send information similarly as a serial stream, the haul serial port normally identifies equipment consistent of the RS-232 standard alternately comparable Furthermore expected with interface with a modem alternately with a comparative correspondence gadget.

Reset: Bring this LOW line to the microcontroller for reset.

Relay: An electrically activated switch will categorize such a relay into a normally open or closed form. Such a relay as 5 terminal pins consisting of a pair of coil pins, a common pin, a normally open pin (NO) and a regular closed pin (NC) pin.

Motor: The most common engine type is a DC motor. Normally a DC motor has only 2 lids, one positive and one negative. When 2 lids are attached directly to a battery then the engine can rotate. A DC motor is any of a class of rotary electrical motors that converts direct current 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.

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. The universal motor can operate on direct current but is a lightweight brushed motor used for portable power tools and appliances. Larger DC motors are currently used in propulsion of electric vehicles, elevator and hoists, and in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

3. RESULTS

The results of the intelligent wheelchair system are depicted below. Figure 2 and figure3 shows the Hardware Prototype-Intelligent wheel chair

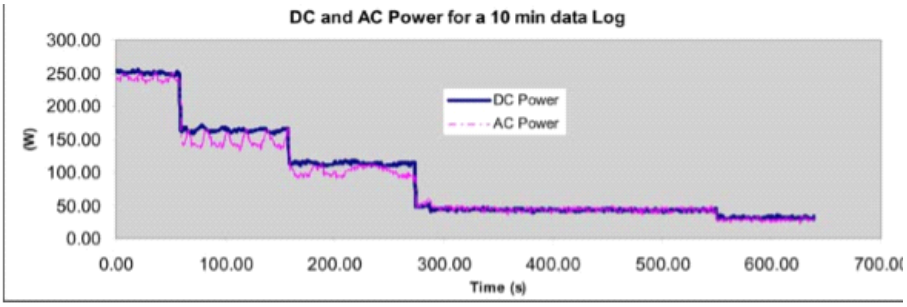

FIG 2 Wind speed W_{speed} monitoring for a 10 min time period

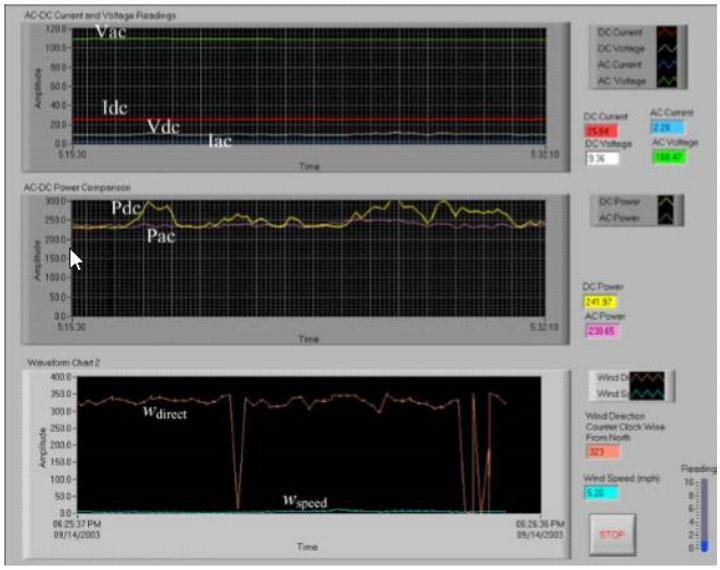

FIG 3 Front panel of the data acquisition system

FIG 2 Intelligent wheel chair (Front and back view)

The above figure shows the prototype of the Intelligent wheel chair system of front and back view. The DC motors are fixed at the back end of the wheel chair to rotate the wheel of the chair. When the switches are pressed using the Bluetooth applications it moves front, back right and left.

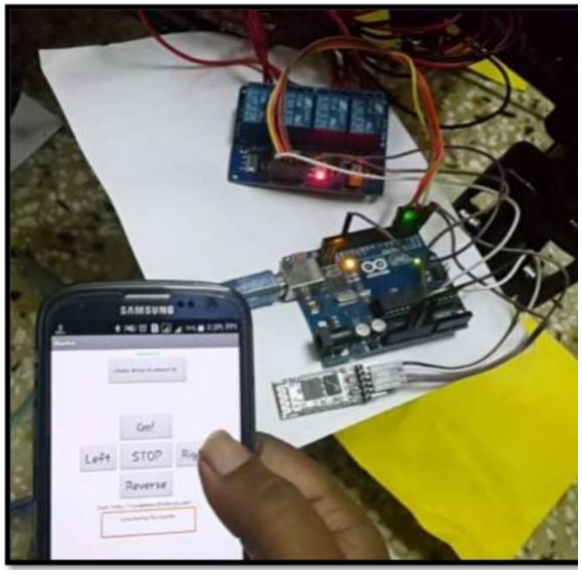

FIG 3 Wheelchair working the forward pin by relay

Figure 3 shows the working of the forward pin by relay. By using the keys provided in the application the wheelchair can be directed to move front, back, left and right.

4. CONCLUSION AND FUTURE ENHANCEMENT

Development of an instrumentation and data acquisition of a wind-solar hybrid power station is implemented. LabView based instrumentation is presented as per the student interests in both traditional and renewable energy as observed in the classes as well as in the laboratories. Student with minimum experience in LabView also prepares technology students for careers in the manufacturing industry where a number of similar graphical instrumentation tools which played a significant role in the data acquisition area. LabView based instruction at UNI Industrial Technology Department has received very positive responses from its local industrial partners such as Deere and Company, Rockwell-Collins Inc., and Waterloo Industries. It also provides an incredible opportunity for the research students to undertake practice oriented real-world laboratory projects. Most importantly, it is a valuable concept to lab instruction, research, demonstration, and recruitment. The authors conclude that even though virtual instruments are steadily replacing their free-standing counterparts in the industrial and technology laboratories due to the rising costs of laboratory trainer and instruments, for many valid reasons such as exposing students to conventional hardware instruments, many faculty members have been unwilling to completely give up the real laboratory experiences where a number of hardware and connecting wires are used.

In summary what needs to be held in mind and addressed first is the end user's need to have the most appropriate wheelchair model that suits their unique needs. A good outcome for this project will be the implementation of the potential solutions outlined in the study. These have the potential for a wheelchair user living with a disability in remote and rural Aboriginal communities to significantly enhance mobility and functional independence.

References

[1] The BMEiCON-2018 “Voice Controlled Automatic wheelchair” Sumet Umchid, Pitchaya Limhaprasert, Sitthichai Chumsoongnern, Tanun Petthong and Theera Leeudomwong. Dept. of Industrial Physics and Medical Instrumentation, Faculty of Applied Science King Mongkut’s University of Technology North Bangkok, 10800 Thailand.
[2] “Touch Screen Based Wireless Multifunctional Wheelchair Using ARM and PIC Microcontroller” Prof. Anuradha G. Tandon and Soniya D. Makwana. Dept. of Instrumentation and Control Institute of Technology, Nirma University Ahmedabad, India.
[3] The BMEiCON-2016 “Smart Wheelchair Based on Eye Tracking” Nutthanan wanluk, Aniwat Juhong, Sarinporn\ Visitattapongse and C. Pintavirooj. Biomedical Engineering Program, Faculty of Engineering King Mougkut’s Institute of Technology Ladkrabang Bangkok, Thailand.
[4] 2017 ICIIECS “Solar Powered Touch Screen Wheelchair” S.H. Shete, Shruti R. Kamble, Aishwarya V. Patil, Swapnali R. Gurav, Shweta P. Patil and Sharvari S. Desai. EED-AMGOI-Vathar Kolhapur-Maharashtra.
[5] ICACCS-2017, Coimbatore, INDIA “Wireless Gesture Controlled Wheelchair” Rajesh Kannan Megalingam, Sarath Sreekanth, Govardhan A, Chinta Ravi Teja and Akhil Raj Dept. of Electronics and Communication Engineering, Amrita Vishwa Vidyapeetham, Amrita University, India.
[6] Beekman C, Miller-Porter L & Schoneberger M (1999) Energy cost propulsion in Standard and ultralight wheelchairs in people with spinal cord injuries. Physical therapy journal, volume 79, No 2.Retrieved March 23, 2006
[7] Bourke-Taylor, H. & Hudson, D. (2005). Cultural differences: the experience of establishing an occupational therapy service in a developing community. Australian Occupational Therapy Journal. 52,188-198
[8] A review of the literature on disability services for Aboriginal and Torres Strait Islander people. (2004) Margaret O’Neil, Ellie Kirov, Neil Thomson. December 2004, Australian Indigenous HealthInfoNet Perth. Australian Indigenous Health Bulletin Vol 4 No4 October – December2004