Original Research Article

DISPLAY UNIT FOR DATA ACQUISITION AND DATA LOGGING SYSTEM WITH USB INTERFACE

Shraddha Ghatol, Rupali Jadhav, Priyanka Khot

Jadhav mala,Mohamadwadi,opposite Vignaharta garden
Hadapsar,Pune -411 060,Maharashtra,India

Abstract
This paper presents the designing of display unit for Data acquisition and data logging system. Designing of this display unit is based on seven segment display and is specific to application in data acquisition system which will display the real time physical parameter. This paper describes the method of displaying the solar panel data like voltage, current, temperature and power. System is developed with USB interface which will be acting as input to Display unit. Application of design is very specific to solar panel data display application. It can extend with LCD display unit.

Keywords- Display unit, seven segment display, solar panel display, USB interface, Data acquisition display unit.

Introduction
The purpose of this paper is to explain how to display the parameters of the solar panel on the display module. This paper describes the project which is a part of the Data Acquisition System based on Wireless Sensor Network. In this solar panels are placed and the data of solar panels like temperature, voltage and current is acquired by the Wireless Sensor Network. This data is sent to the server PC where this data is stored. Now a display unit is designed in which this data is processed and displayed on the display module. The data of the solar panels which is displayed on the module:

- Temperature (0°C to 60°C).
- Voltage (0 to 50V).
- Current (0 to 20 Ampere).
- Power.

The data is taken from the server PC through the USB cable. This data is sent to the microcontroller where the data is processed and stored in the controller's memory. Then the data from controller's memory is displayed on the display module. The design

A proceeding of
National Conference for Students in Electrical And Electronics Engineering (NCSEEE 2014)
www.johronline.com   **112** | P a g e

of the display unit is able to display the data of one panel at a time. Display module is made by cascading the seven segment displays on which data from microcontroller is displayed.

While thinking of design there are various options for microcontroller which is heart of whole design. Selection criterion for microcontroller is its speed, memory, number of ports available. So, after comparing different controllers like ARM, PIC, 8051, 8951, AVR it is found that it will be efficient to used PIC controller [1]. It is also require that controller must have USB support also.

Basically today's display units are becoming less power consumption and with more performance but their cost is high. Selection of any type of display for application includes various parameter to be take care of such as size, distance for which it is visible, cost, power consumption. In electronics design there is trade-off between design requirements. So, for this application specific display unit design in same way it was important to compromise between requirements.

Requirement was it has to big in size with low cost. And data is only numeric so, seven segment display was good choice and its drivers are easily available.

Now for actual process of displaying data is can done using various methodologies. It includes driving display with latches, using parallel to serial or vice-versa, shift registers, BCD to &-segment display drivers and so on[10]. But while testing of this different methodologies it found that there are problems regarding flickering of display and multiplexing so, instead of using any latch or shift register it is always best to used specific seven segment driver IC which will take care of flickering and multiplexing. MAX7219 is one of option in display driver. It drives eight seven segment display at a time with internal multiplexing so avoiding flickering. Also this

driver uses only three pins of controller (one or serial input one for serial clock and chip select) with SPI protocol bus.

This display driver has its inbuilt registers which controls the eight digits connected to it. Through programming we can configure it according to our requirements.

USB protocol is used to transfer data from the server PC to the microcontroller [6]. USB version 1.1 supported two speeds, a full speed mode of 12Mbits/s and a low speed mode of 1.5Mbits/s. The 1.5Mbits/s mode is slower and less susceptible to EMI, thus reducing the cost of ferrite beads and quality components. The Universal Serial Bus is host controlled. The USB host is responsible for undertaking all transactions and scheduling bandwidth. Data can be sent by various transaction methods using a token-based protocol [15]. USB as its name would suggest is a serial bus. It uses 4 shielded wires of which two are power (+5v & GND). The remaining two are twisted pair differential data signals. USB supports plug n play with dynamically loadable and unloadable drivers.

The data is send through USB HID terminal from the host. What we are building with the microcontrollers are human interface devices (HID) which require a specific type of descriptor. USB interface is one of feature of this design as incoming data is from USB so, it can take data from any computer which has USB support.

Block Diagram and Methods:

In this system data will be taken from the server PC through USB interface with microcontroller. This data from server PC will be saved in controller's memory in the form which can be display on seven segment display module. According to requirement of display it has to display the parameter of solar panel (voltage, current and temperature) along with its Row and panel number.
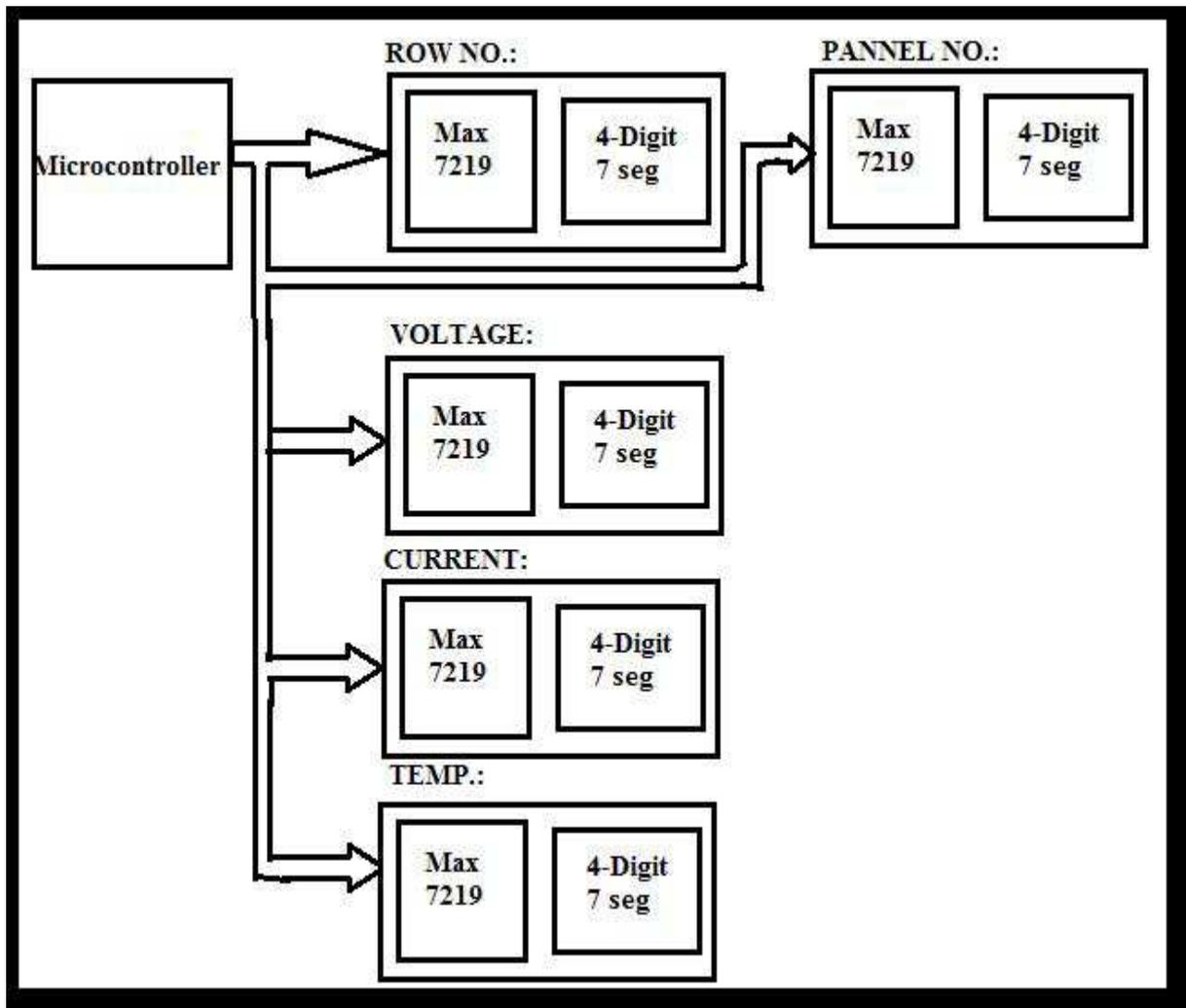
A proceeding of
National Conference for Students in Electrical And Electronics Engineering (NCSEEE 2014)
www.johronline.com **113** | P a g e

Figure.1.Block Diagram of Display unit

This design make use of MAX7219 eight digit seven segment display driver with serial SPI interface. Each parameter is display on four digit seven segment display and is driven by MAX7219 seven segment driver connected in cascaded manner. Data is real time and updated after every 15 minutes. Controller is heart of system whose job is to take data from server PC through HID terminal. After taking data from interface controller will save the updated data in its memory.

Data which is received from USB cable is obviously not in format which can display directly on seven segment display.

After saving data in appropriate manner next step is to send this data to seven segment display. As MAX7219 has cascade feature, so in this design to display each parameter on four digit seven segment display module it is driven by separate MAX7219 driver. And all of them are cascaded together.

Result and Discussion

While finalising the type of display for this display design there are several option like LCD display, GLCD,TFT display etc. But as data will be only in numeric form and font size should be greater also cost effective, comparing all this option seven segment is good option because though LCD display

A proceeding of
National Conference for Students in Electrical And Electronics Engineering (NCSEEE 2014)
www.johronline.com   **114** | P a g e

required low power but it has small font size and TFT are very costly. The only compromise is with power consumption of display.

There can be various Methodologies can be used to drive such large number of seven segment display in such applications, like latches, shift registers can be used. This design uses MAX7219 seven segment display driver. The selection of this driver is because it has SPI interface with controller, can drive up to eight digit at a time also good sinking capacity. At initial stages of design when comparing all possible different approaches it is found that in case of using latches for design problem of flickering occurs due to multiplexing of display. The solution for this problem was to add an extra circuitry to make flickering unnoticed.

Acknowledgement

We take pleasure in submitting our paper on "Display Unit for Data Acquisition and Data Logging System with USB Interface". We take this opportunity to thank all those who have extended their support in helping in designing this system. We express our gratitude towards Prof.R.G.Purandare and Prof.R.B.Ghongade. We thank them for their co-operation and guidance. We gratefully acknowledge their valuable assistance for which words are inadequate to express without which the work would not have been completed.

References

[1]Muhammad Ali Mazidi,Rolind D. Mckinlay and Danny Causey, "PIC Microcontroller and Embedded Systems", Pearson Publications, 2011.

[2]www.Alldatasheet.com

[3]Wikipedia.

[4]https://www.fairchildsemi.com/ds/MM/MM74HC374.pdf

[5]www.onsemi.com/pub/Collateral/**74HC374**-D.PDF

[6]www.microchip.com/**downloads**/en/devicedoc/39632c.pdf

[7]www.microchip.com/**downloads**/en/DeviceDoc/30292c.pdf

[8]www.keil.com/dd/docs/datashts/atmel/at89s51_ds.pdf

[9]http://www.kwalityindia.com/DATA%20SHEETS.HTM

[10]http://www.wayjun.com/Datasheet/Led/Segment%20Digit%20LED%20Display.pdf

[11]www.**everlight**.com/**datasheets**/F511SYGWA-S530-E2_**datasheet.pdf**

[12]http://www.avagotech.com/docs/AV02-0568EN

[13]http://www.instructables.com/file/FXIB8U6GTGCQA15

[14]http://ww1.microchip.com/downloads/en/devicedoc/39632c.pdf

[15]http://ww1.microchip.com/downloads/en/DeviceDoc/MCHPFSUSB_Setup_v1.2.exe

[16]http://datasheets.maximintegrated.com/en/ds/MAX7219-MAX7221.pdf

[17]http://ww1.microchip.com/downloads/en/devicedoc/39632c.pdf

A proceeding of
National Conference for Students in Electrical And Electronics Engineering (NCSEEE 2014)
www.johronline.com   **115** | P a g e