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Weather Data logger using ARM Processor

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Abstract: *Weather Data logger periodically measures various real-time meteorological parameters and stores for future use. The ARM Processor based weather Data Logger is designed that it can automatically operate unattended for a long period upto few years. The system has its own automatic power maintenance and storage feature to achieve the uninterrupted operation. The proposed set up consists of three sensors used to monitor the four parameters like Air Temperature, Relative Humidity, Soil Moisture and Leaf Wetness. In addition weather data logger using ARM processor having capability to measure the operating voltage of entire System. The analog sensors can be interfaced with a 32-bit micro controller. The developed system is tested and the results are discussed.*

Keywords- *Data logger, Data Acquisition System (DAQ), synchronous serial protocol (SSP), Sensors, Universal Asynchronous receiver and transmitter (UART).*

I.INTRODUCTION

Data acquisition is gathering of information about a system or process. It is the process of collecting data in automated fashion from analog or digital measurement sources such as sensors and devices under test. Before the computer age, most data was recorded either manually or on strip chart recorders. With the advancement of technology, the processes are becoming more and more complex increasing the number of parameters for data acquisition. Many new generation data acquisition products have been developed due to emergence of microcontroller that enables real-time data gathering, analysis, logging and viewing of data.

1.1 OVERVIEW

A Weather data logger measures various real-time meteorological parameters and logs for future reference. In this paper, the development of an efficient and weather data logger is discussed. The system is designed and developed to measure the parameters Air Temperature, Relative Humidity, Soil Moisture and Leaf Wetness with the help of sensors and the results are stored in the on board memory for post process analysis. Based on requirement external memory module can be interfaced with the system. The Weather data logger is arranged to automatically operate unattended for prolong period up to few years. The system necessarily has its automatic power from battery backup for maintenance and storage system.

II. DETAILS OF PROPOSED SCHEME

The sensors employed are Rm young for Air Temperature & Relative Humidity, Delta_T for Soil Moisture and Davis for Leaf Wetness. The ADC is interfaced to the controller along with external signal conditioner. Signal conditioner is of pi type low pass filter. Twenty four bit resolution type ADC is used and it is operated at 6.144 MHZ clock cycle. The LPC2478 is a 32bit microcontroller with RISC architecture and consist of ARM7TDMI-S CPU core with real-time debug interfaces that include both JTAG and embedded Trace. It has 512 KB of on-chip high-speed Flash memory. This Flash memory includes a special 128-bit wide memory interface and accelerator architecture that enables the CPU to execute sequential instructions from Flash memory at the maximum 72 MHz system clock rate.

SSP protocol is used to interface with the external peripherals like ADC and memory module. SSP protocol is used for serial communication and it is also called as four wire communication. Both the modules are

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synchronized with processor at a clock frequency of 1.2 MHZ.

UART is one type of serial communication technique. Asynchronous transmission allows data to be transmitted without the sender having to send a clock signal to the receiver. Instead, the sender and receiver must agree on timing parameters in advance and special bits are added to each word which are used to synchronize the sending and receiving units. UART can be used to dump the HEX file into target board.

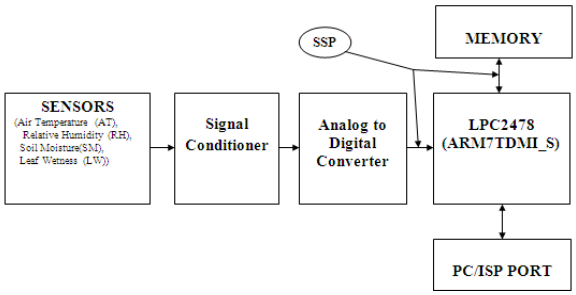

Fig1: Block Diagram of Weather Data logger

To prepare the PCB board for the data logger OrCAD Capture CIS software tool is used for circuit schematic capture. It is part of the OrCAD circuit design suite. Capture CIS is nearly identical to the similar OrCAD tool, Capture.

Component information system is the main difference between the two tools. The CIS links component information, such as board package footprint data or simulation behavior data, with the circuit symbol in the schematic. When exported to other tools in the OrCAD design suite, the data stored in the CIS is also transferred to the other tool. Thus, when a design engineer exports a schematic to the circuit board layout utility, the majority of the circuit elements have footprints linked to them. This saves time for the design engineer.

After designing the schematics we have to create the net list file for the schematics. Using the net list file we generate the layout for board. For designing layout we use LAYOUT PLUS tool. Before creating the net list file we have to create the foot prints for the components using the library manager. After creating the net list file, open the file using tool LAYOUT PLUS. OrCAD Layout is a powerful printed circuit board layout tool that is a part of a full line of design and simulation tools available from OrCAD. OrCAD Layout makes it easy to place, route and prepare printed circuit boards for fabrication.

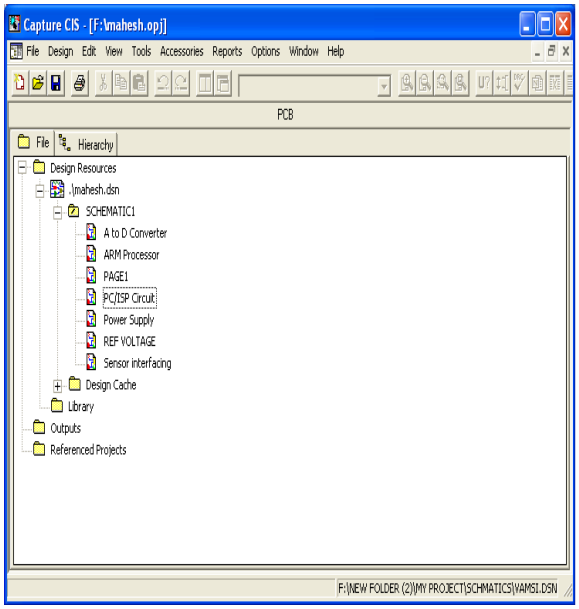

Fig. 2a: Screen shot of CAPTURE CIS

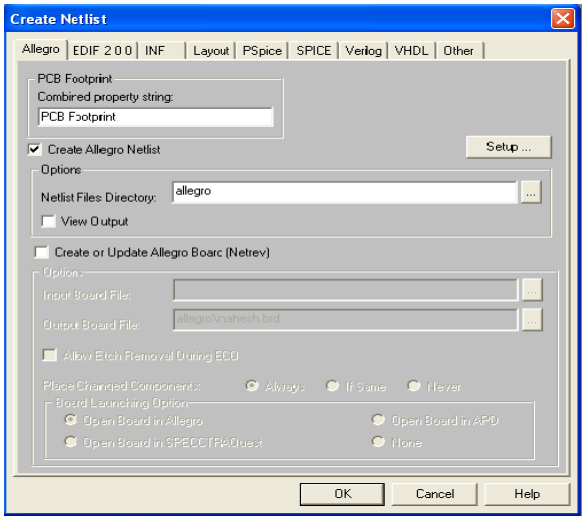

Fig. 2b: Screen shot of how to generate net list

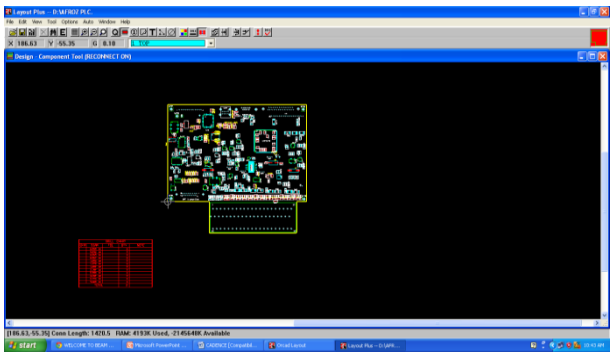

Fig. 2c: fig for LAYOUT PLUS

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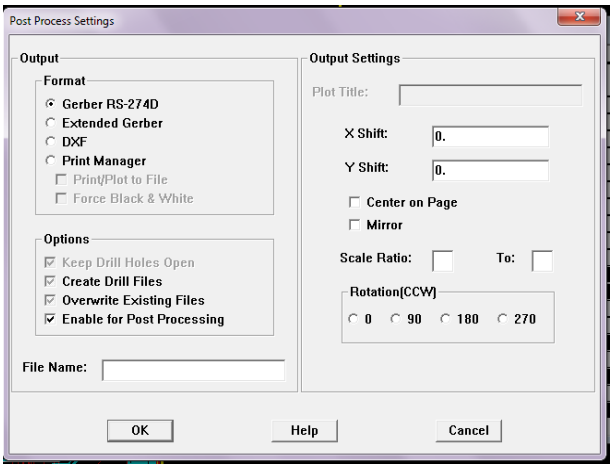

Fig. 3: Gerber films generation file

After finishing placement and routing the Gerber films for the design are generated, and given to PCB manufacture. These stages are shown in figures 2a-2c and 3. The final PCB board of data logger is shown in fig 4.

The IDE used for code writing is Ecplice and Embedded C language is used to write code. Flash magic is used to dump on the target board and the setup is shown in figure 5. SPI interface is used in the weather data logger.

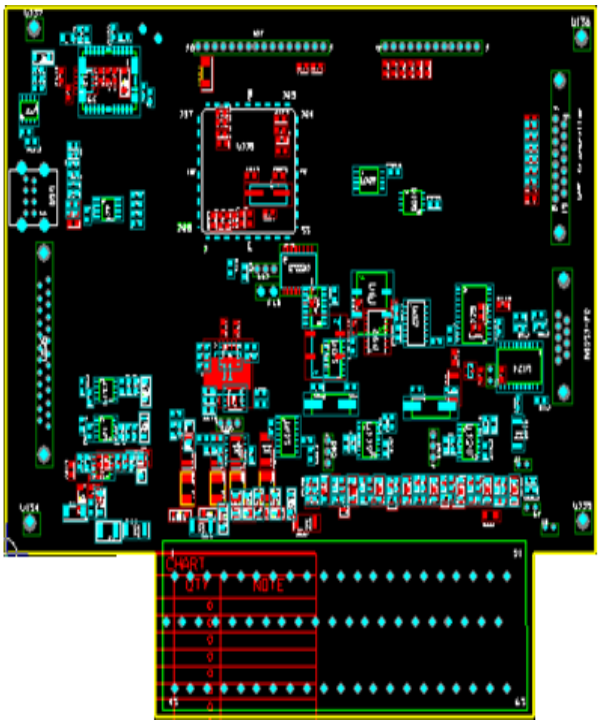

Fig. 4: Final PCB board of data logger

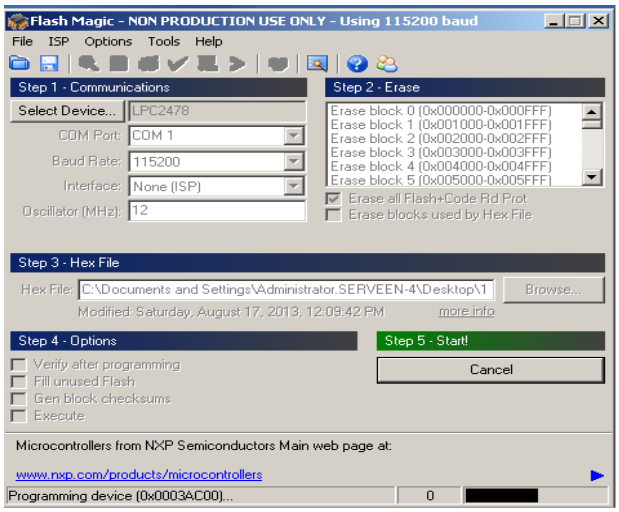

Fig.5 Open Flash Magic and set it up.

III. RESULTS

The data logger has been developed and tested to measure the parameters Air Temperature, Relative Humidity, Soil Moisture and Leaf Wetness and the results are shown in fig 6.

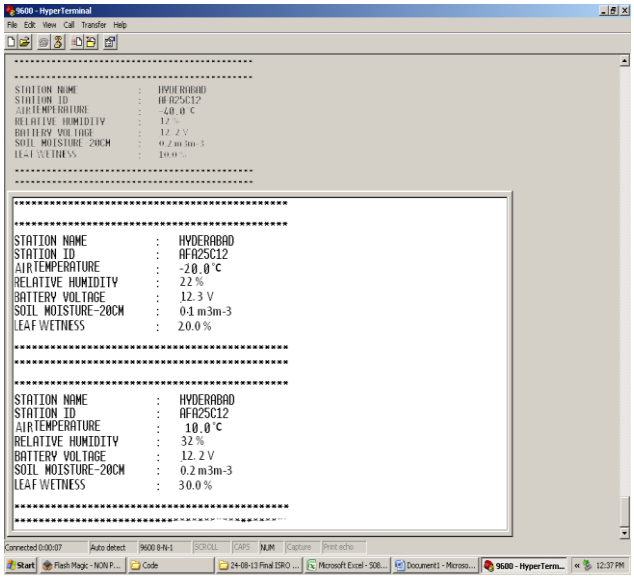

Fig 6: Display of desktop based monitoring system for Weather Data logger

IV. CONCLUSION

Data Logger using ARM Processor is successfully designed and programmed to measure the meteorological parameters periodically. The sensors can be integrated with the Data logger externally and entire setup will be tested in two ways one is at room conditions

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other one is at outdoor environment. Weather data logger readings at room conditions and outdoor environment is satisfactory with theoretical results as well as practical results. The parameters measured by weather data logger are Air Temperature, Relative Humidity, Soil moisture, Leaf wetness and Battery Voltage through sensors. We can monitor the Sensor outputs periodically through the Hyper terminal on PC monitor. The present readingS of the Weather data logger can be validate with the actual report given by Weather stations.

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