PROTOTYPE AWS MGA-05

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Abstract

AWS has been introduced to BMG since the year of 1993. Since the equipment started to operate, many problems raised with regard to the data logger and software application, which cannot be solved by BMG technician. This caused discontinuity of data availability. Based on the above problems, BMG develops a prototype of AWS systems called AWS MGA-05. The prototype utilized the sensor of SA Environment with frequency output. The main objective to develop AWS MGA-05 is to make data logger using ATMEL microcontroller as the main component. For acquisition purposes, it is used Assembler programming and for application is used Visual Basic 6.0 and Excel programming. The result of calibration shows that the output of the system is within the range of tolerance.

I. Introduction

In order to improve the technicians capability, Meteorological and Geophysical Agency (MGA), made an Automatic Weather Station design, make use of the available sensors from Environ data. The data logger designed is based on the ATMEL micro-controller as the heart of Data Processing System. It does the basic of AWS works, i.e. data acquisition, conversion into computer-readable format, proper processing of the data in accordance with specified algorithms, temporary storage of processed data and their transmission to a PC.

The ATMEL micro-controller used is from 8-series. It is chosen because for the time being, this micro-controller is the most available in domestic market. In the future, an advance micro-controller will be chosen for more complex task being performed. The most important thing for us is to have an experience in designing, build and operate AWS by our selves. The MGA-05 is the second version in AWS design done by MGA. The first version is an interface from sensors direct to PC. Data storing and processing are done in the PC. There is a disadvantage using the system in case of power failure. The data will be lost, and there is no chance to recover it if the power returns to normal condition.

Instead of improving the interface, so called MGA-04 with the number referring to the year of development, 2004, we totally redesign the system and turn to design a new AWS. The design was completed during the year 2005, so the product identified as MGA-05. Figure 1 is a block diagram showing the design concept of the MGA-05. The uses of digital sensors give an advantage and therefore reducing the complexity of the design. Except the precipitation sensor, the other sensors' outputs are frequencies. The frequencies from the sensors are then fed into a multiplexer before it is send to the counter, while the pulse output is conditioned prior the counting. Together with the time stamp from the "Real Time Clock (RTC), the data then sent from the internal memory to the RS 232 serial port.

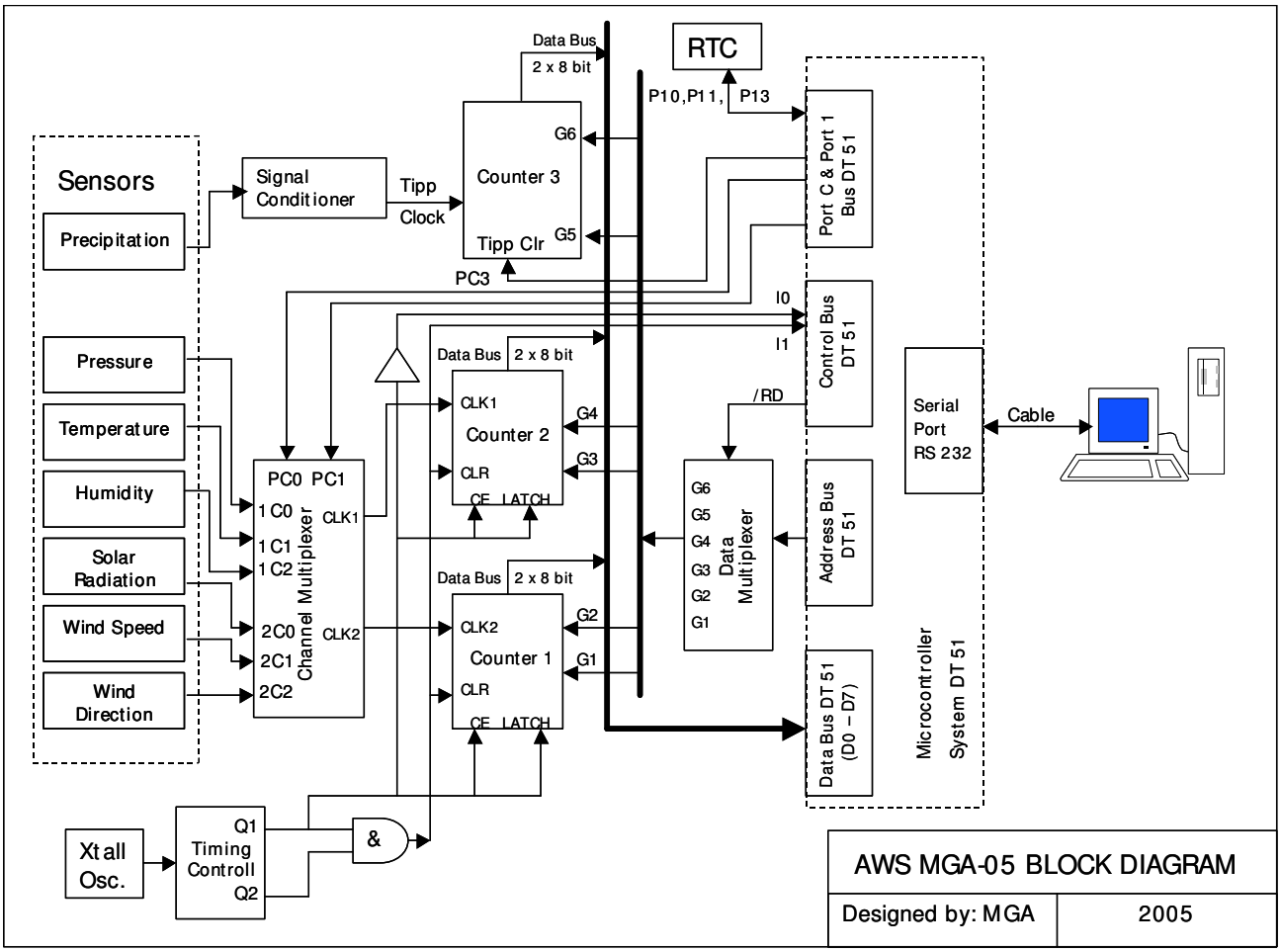

Figure 1, the block diagram of the MGA-05 AWS

II. Method and Design

It has been mentioned above that the sensors used are digital type with frequencies as the output. As the consequences the method being used is to count the frequencies received from sensors and sent it to the communication port.

The frequencies received are delivered to a channel multiplexer, or to a signal conditioner for precipitation sensor's output, prior to the counter. The data from counters are then fed to the microcontroller and store in its internal memory. Together with time stamp taken from the Real Time Clock, RTC, the processed data from the internal memory transmitted to the computer through RS 232 port in computer readable format.

The RTC is set during the initiation process in which need to be synchronized with the attached computer timing system. During the initiation process the communication parameter such as the speed of data stream, data format, parity start and stop bit are set. After the initiation, the reading of frequencies from the counter is started. All of the results are stored in the internal memory. Sending the data from the internal memory ends the cycle of process and resulting a set of data, and the process starts again to collect the next set of data. The whole process inside the logger can bee seen in the flowchart as shown in figure 3, and the command to perform the process is written in Assembler programming language.

The output from logger is a set of frequencies corresponds to the set of meteorological data being observed. Application software does conversion from frequencies into meteorological quantities, written in Visual Basic and run on MS-Windows operating system. The results are saved in an Excel program database. All of the program listings are attached to this paper.

Figure 2. Logger Test at the Workshop of
Meteorogical and Geophysical Agency

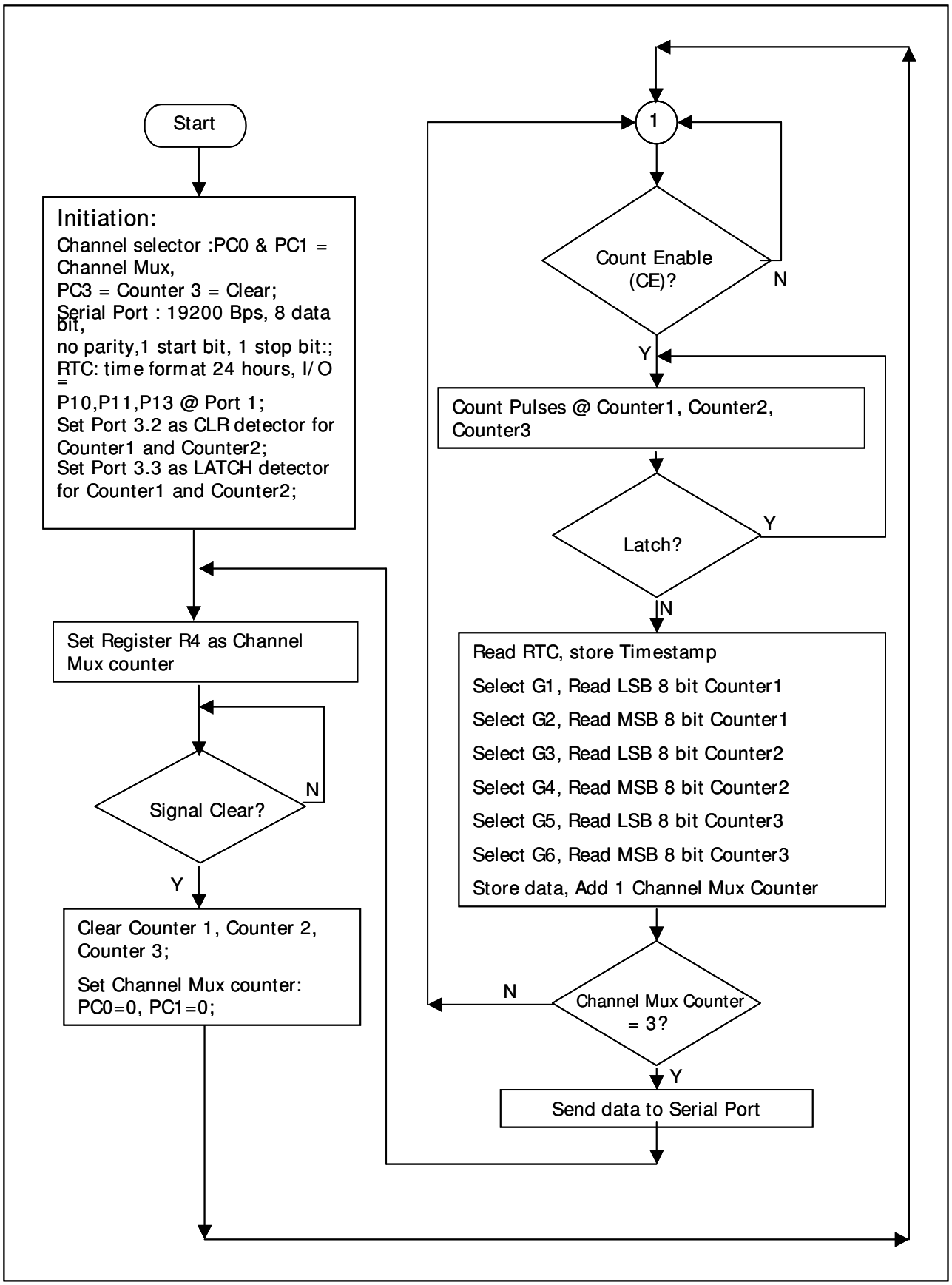

Figure 3. Flow of process inside the logger.

It is clear from the flowchart that the process cycle ends with data transmission to the PC via RS 232 serial port, and the cycle start again without performing the initiation process. These processes continue until the operation of AWS stopped by the operator.

Application software run on PC will then store the data received into a database, Excel based, and can be retrieved anytime needed. A sample of the observation product can be found in the appendix. From the data collected we can do a further processing needed.

Figure 4. The display of the recording system (PC)

Figure 5. Sensor and the Data Logger System of the AWS MGA-05

Figure 5. Pressure Sensor Calibration of AWS MGA-05
at Meteorogical and Geophysical Agency

Figure 6. Wind Speed Sensor Calibration of AWS MGA-05
at Meteorogical and Geophysical Agency

Figure 7. Field Test of AWS MGA-05

III. Future Improvement

The microcontroller used in the development of AWS is from ATMEL, AT 89S51. It has a small internal memory and used as the only memory in the prototype. In the future development, instead of AT 89Sxx we will use the AT 90Sxx. The reason is that the later has a feature that make us easier to be program. Programming can be done directly from a PC.

Other improvement that we plan is to increase the memory capacity, at least up to 2 Mbytes. The memory improvement can now be done easier, while the AT 90Sxx series also has an internal flash memory. With the memory improvement we expect that the logger will capable to store more data, and the connection to a PC can be done only when it is needed, or, in other words, we can download the data only when we need it to be done, weekly or monthly. Figure 5 is a block diagram showing the design concept of the MGA-06.

Another application program will be developed, run on the same PC, performing synoptic and climate coding in accordance with WMO format. The operator should enter the other meteorological parameters that cannot be observed automatically manually. Performing these tasks at the same time, the PC acting as an editing terminal.

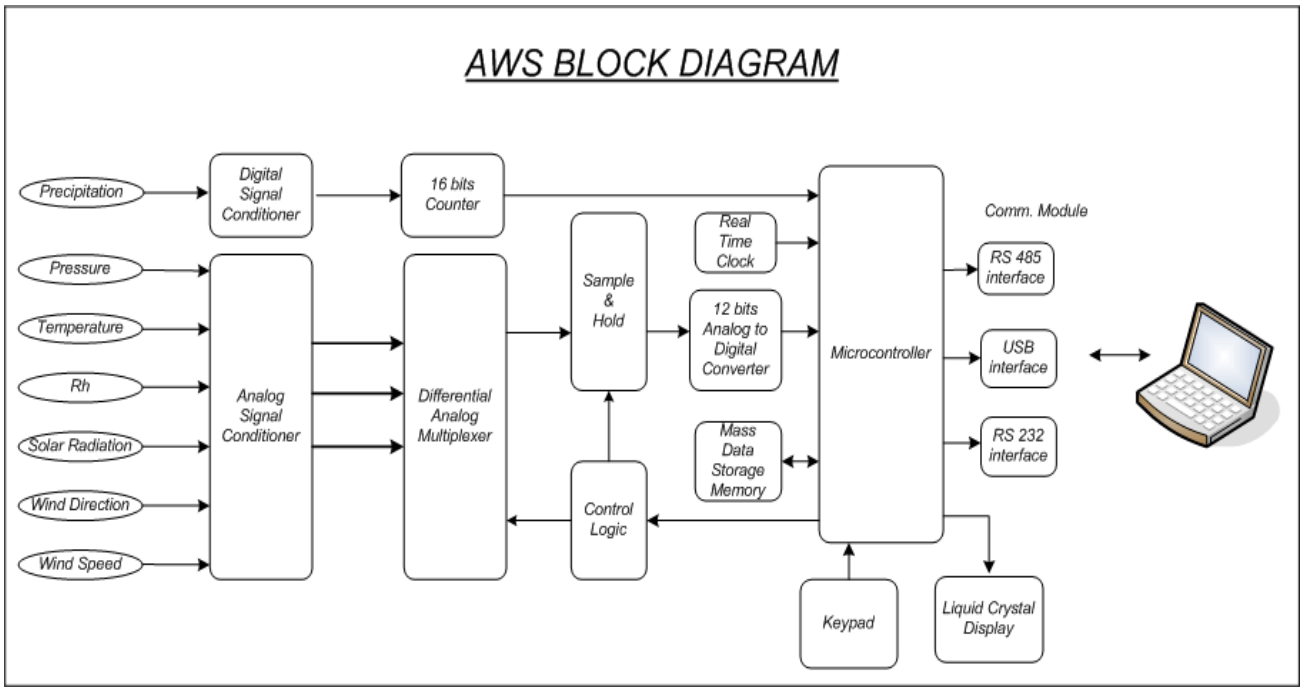

Figure 5, Block diagram design concept of the MGA-06 AWS