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Microcontroller Based Logger Design For Water Distributed Network

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***Abstract*:** Water distribution systems consist of an interconnected series of pipes, storage facilities, and components that convey drinking water and meeting fire protection needs for cities, homes, schools, hospitals, businesses, industries and other facilities. Public water systems depend on distribution systems to provide an uninterrupted supply of pressurized safe drinking water to all consumers. It is the distribution system mains that carry water from the treatment plant (or from the source in the absence of treatment) to the consumer. This paper introduces a design of a data logger based on using microcontrollers for recording the data related to the water distribution network. The logged data includes recording the pressure and rate of flow sensing in the water distribution network. The system design operates automatically. Any malfunction in the water distribution network will be reported in real time in order to take immediate action and therefore avoiding possible damages.

Keywords: microcontroller, data logger, water distribution system, pressure, rate of flow.

I. INTRODUCTION

The processes to collect, analyze and store the data for later use is called logging. It is a process to record events during a test or measurement with the use of a system or product. The human brain and its memory, the nature's creation, no doubt is the best data logging mechanism. A data logger (or data recorder) is an electronic device that records data over time or in relation to location either with a built in instrument or sensor or via external instruments and sensors. Increasingly, but not entirely, they are based on a digital processor (or computer). They generally are small, battery powered, portable, and equipped with a microprocessor, internal memory for data storage, and sensors. Some data loggers interface with a personal computer and utilize software to activate the data logger and view and analyze the collected data, while others have a local interface device (keypad, LCD) and can be used as a stand-alone device .

Logging is one of the usability methods that can and should be used to gather more supplementary information as an integral part of the iterative design of the usability engineering cycle. Logging has the major advantage compared with other usability methods of not interfering with the users in performing their tasks. Users can basically ignore the log and use the system in exactly the way they would anyway.

A data logger is a comprehensive and highly advanced data acquisition system. It is made versatile and flexible, to render it suitable for widely varying applications, specific requirements being met simply by setting up a suitable program. It can measure electrical output from any type of parameters and log the value automatically. The system is simple to use, requires no additional hardware and allows the selection of amount of data and the time intervals between them. The collected data can easily be exported to a PC computer via a serial port.

Microcontrollers and microprocessors are widely used in embedded system products. An embedded product uses a microcontroller to do one task and one task only. In addition to the description of criteria for choosing a microcontroller, the interfacing with the real world devices such as LCDs, ADCs, sensors and keyboard must be done precisely . Finally; the issue of interfacing external memories, both RAM and ROM is necessary in the system.

II. METHODOLOGY

Leakage and diversion of water are the most common problems. They cause loss in the water and waste of it. Leakage water disrupts people from their daily lives because they need water in all their affairs .It costs a lot to maintain and repair the damage so it requires time , efforts and money . So we must build a good and organized structure to facilitate the management and maintenance.

The design work should meet the specifications as it is capable of logging the pressure and the rate of flow of water in the pipes on a continuous base and send text massage whenever a pre-set values are exceeded.

Microcontroller based data logger will be designed to collect and store data over time then analyses the recorded data to observe the normal rate of the wanted parameters . The design aims to improve the water distribution systems in the network.

III. SYSTEM LAYOUT

The aim of the hardware and software design is to automate the monitoring operation of water flow in the water distribution networks and establishing sms message in case of malfunctions in the network..The electronic devices required to construct the system include a personnel computer, microcontroller , pressure sensor , rate of flow sensor , keypad , LCD , GSM modem plus interconnection links and lab link cables. The block diagram of the hardware implementation of the entire system is shown in Figure (1) below.

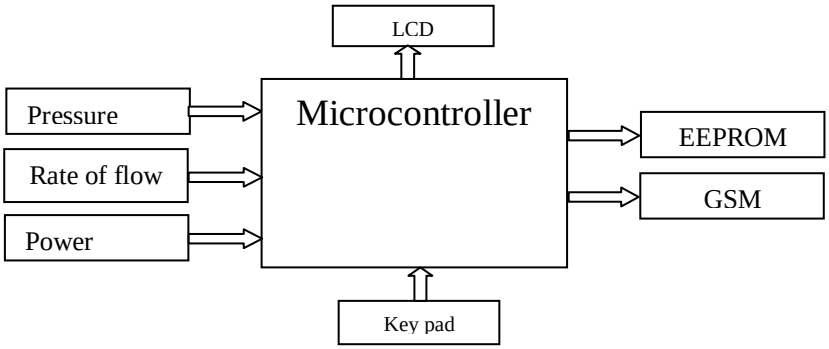

Figure (1): Block diagram of the system.

The hardware components in the system design are:

Personnel computer (PC) :
A PC furnished with parallel ports is used for programming the microcontroller.
Lab links:
Lab links are sort of cables that connect the computer port to external electronic devices. They are used for programming the microcontroller.
Microcontroller:
Atmega 32 microcontroller captures data from the sensors . It feeds the EEPROM with data and connects to the GSM modem.
Rate of flow sensor:
It measures the rate of flow of water in the water distribution network.
Pressure sensor:
It measures the pipes pressure in the water distribution network.
Twelve keys matrix keypad:

The keypad is connected to the ATmega 32 microcontroller .It represents data entry to the microcontroller. The operation can be changed when desired. To reset the operation or start logging an external human interface is required.
LCD:
LCD is used to display the data entry and the real time data during the system operation. Power supply:
The PSU for the system should be capable of providing the required supply voltage and current to all the various sub-units in the system.
Memory for data storage (EEPROM):
The EEPROM is used to log the pressure, rate of flow and any needed parameter at specific intervals.
GSM Modem:
It is responsible for sending short messages when required.

IV. PROGRAMMING

To achieve an automation procedure for the system operation, we need to go through the following steps:
- Step one is developing a Bascom program in the microcontroller.
- Step two is downloading the (.Hex) file into the microcontroller using Pony prog program.

The flow chart for the system operation is shown in figure (2) below;

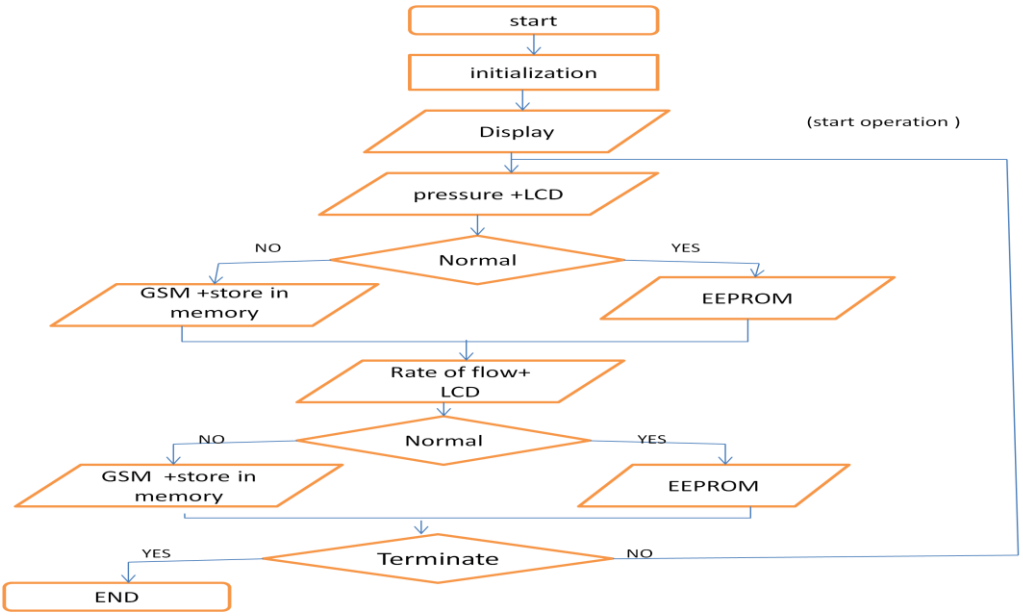

Figure (2) flow chart for the system operation .

V. RESULTS

Equation (1) gives the initiation of sms message due to excessive pressure on the water pipes:

(Pressure sensor) $_{readings}$ > Maximum preset pressure value …….. (1)

Where ;

(Pressure sensor) $_{readings}$ = the reading of the pressure sensor (mili-bars).

Equation (2) gives the initiation of sms message due to excessive rate of flow of water in the water distribution network :

(Rate of flow sensor) $_{readings}$ > Maximum preset rate of flow value …….. (2)

Where ;

(Rate of flow sensor) $_{readings}$ = the reading of the rate of flow sensor (meter / seconds).

VI. CONCLUSION

This paper suggested a design based on using a microcontroller for processing . The microcontroller performs processing and control of the peripheral devices in the system. The processing is sequential and repetitive for data acquisition from the sensors , data logging in the EEPROM , displaying on the LCD and issuing sms message in case of malfunctions in the water distribution network.

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