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Leakage Detection Using Microcontroller

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ABSTRACT: This work to detect the leakage of pipeline by the microcontroller using flow sensor. At the first stage, the data is obtained from the flow sensor. If there is any leakage in the pipeline there will be a change in the flow. Hence in the flow rate is due to the leakage in the pipeline system. The obtained data is given to the microcontroller there is a LCD display which show the measured value and also shows the leakages in the pipeline system, this data is transmitted by using the zigbee. Zigbee act as a transponder hence the data is monitored from the any location using the DOCKLIGHT software.The zigbee receives the signal and give its data to USB-UART which is connected with the personal computer. The leakage can be monitored from any location.

KEYWORDS: Leakage of pipeline, Water flow sensor, Zigbee, LCD, ATMEGA328,DOCKLIGHT, USB-UART.

I.INTRODUCTION

The efficiency of water distribution networks represents a major problem for all utilities involved indrinking water supply. Available statistics show that the amount of real (physical) water losses mayexceed 30% of the input volume. Real losses are given by both background leaks (very small leaks occurringat storage tanks or pipe joints and fittings) and burst leaks (resulting from pipe holes and damages). Whilethe former ones are associated with the normal system functioning and cannot be reduced under the limitcommonly known as Unavoidable Annual Real Losses, the latter ones are considered potentially recoverablelosses. Hence adopting proper policies for managing burst leaks appears essential. To reducing this kind of burst and small leakages we are using the flow sensor for measuring the data and analysing the data. This type of leakage detection mainly to avoid the bulk leaks of water, in this we are going to see about the processing of monitoring the leakages and transmitting to the required station where the leakages being monitored. To transmit the data from the measured location to the monitoring locations some of the components can be used such as ZIGBEE, BLUETOOTH, WIFI, GSM and GPRS. The water flow sensor which have been used in this leakage detection method is turbine water flow sensor it can measure the range of 30 lit/min. There is LCD display and it is 16*2 type through which the value is displayed. Zigbee receives the data from the microcontroller and transmits to the zigbee that have been placed in the measuring location. Zigbee cannot be connected to the personal computer, hence to use the zigbee USB-UART is connected to the personal computer. This measured data is monitored by using the DOCKLIGHT software. This DOCKLIGHT will show the accurate measurement of the water flow through the pipeline system.A particularly critical issue for the leakage management is represented by burst leaks occurring in service connections (i.e. small diameter pipes connecting customers to the water mains). Such leaks frequently present low rates of the leaking flow, thus being characterized by long awareness periods (namely the time from the burst occurrence to its detection), whereas large leaks are generally much more rapidly detected or reported. Consequently the total runtime (i.e. the total period to the burst repair) of these smaller bursts tends to be much longer, thus leading to higher overall losses. In addition, the increasing percentage of plastic service connections in water supply networks may further hinder the control of leaks. Indeed, problems concerning the significant damping of vibro-acoustic phenomena in plastic pipes are known even if thedetection of water leaks still appears achievable.

II.LITERATURE REVIEW

In order to overcome the disadvantages of this leakage detecting system and to get the high efficient output.We are going for leakage detection using flowsensor and microcontroller.As per reference made in the other leakage system using sensor has some disadvantages of measuring and getting accuracy**.** But this overcomes the disadvantages of leakage detection system using sensor.

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III.SYSTEMMODELANDASSUMPTIONS

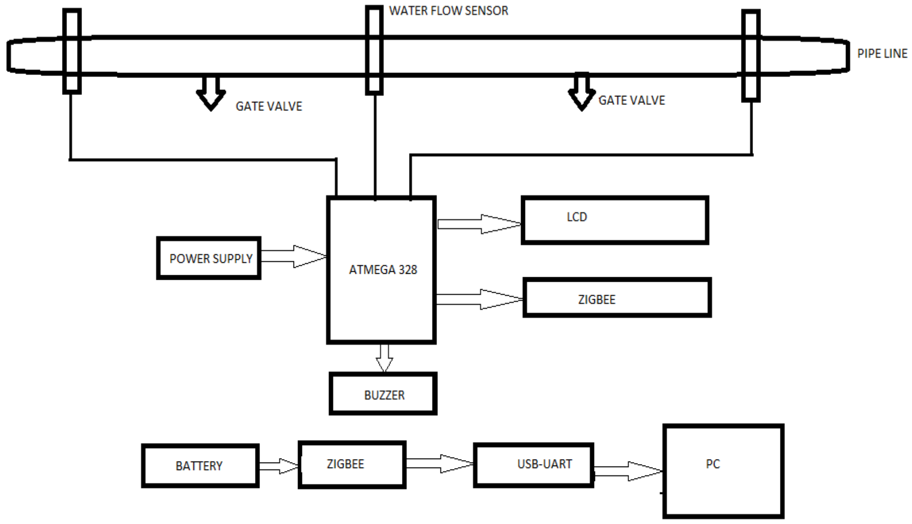

Fig1.1.Block diagram for the detection of leakage system

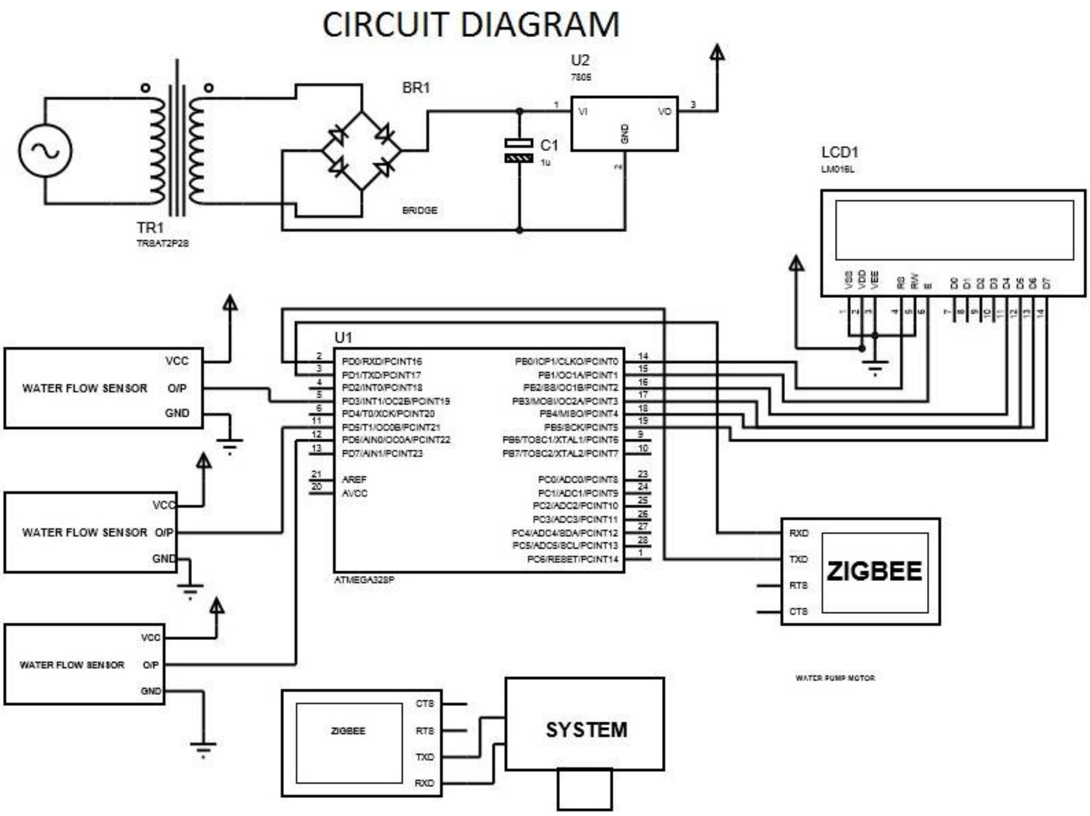

Fig 1.2. Circuit diagram for the detectionof Leakage system

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III.MATERIALS AND METHODS

Zigbee is a special suite for high level communication protocols using small, low-power digital radios based on the ieeestandard for wireless personal area networks (wpans), such as wireless headphones connecting with cell phones via short-range radio. The technology defined by the zigbee specification is intended to be simpler and less expensive than other wpans, such as bluetooth. Zigbee is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking.Zigbee is designed for wireless controls and sensors. It could be built into just about anything you have around your home or office, including lights, switches, doors and appliances. These devices can then interact without wires, and you can control them all from a remote control or even your mobile phone. It allows wireless two-way Communications between lights and switches, thermostats and furnaces, hotel-room air conditioners and the front desk, and central command posts. It travels across greater Distances and handles many sensors that can be linked to perform different tasks.

Fig 1.3. Zigbee (WPAN’s)

LCD Connection: Depending on how many lines are used for connection to the microcontroller, there are 8- bit and 4-bit LCD modes. The appropriate mode is determined at the beginning of the process in a phase called “initialization”. In the first case, the data are transferred through outputs D0-D7 as it has been already explained. In case of 4-bit LED mode, for the sake of saving valuable I/O pins of the microcontroller, there are only 4 higher bits (D4-D7) used for communication, while other may be left unconnected. Consequently, each data is sent to LCD in two steps: four higher bits are sent first (that normally would be sent through lines D4-D7), four lower bits are sent afterwards. With the help of initialization, LCD will correctly connect and interpret each data received.Microcontroller: The high-performance AVR ALU operates in direct connection with all the 32 general purpose working registers. Within a single clock cycle, arithmetic operations between general purpose registers or between a register and an immediate are executed. The ALU operations are divided into three main categories – arithmetic, logical, and bit-functions. Some implementations of the architecture also provide a powerful multiplier supporting both signed/unsigned multiplication and fractional format. See the “Instruction Set” section for a detailed description.
The Status Register contains information about the result of the most recently executed arithmetic instruction. This information can be used for altering program flow in order to perform conditional operations.
SREG – AVR Status Register:
• Bit 7 – I: Global Interrupt Enable:The Global Interrupt Enable bit must be set for the interrupts to be enabled. The individual interrupt enable control is then performed in separate control registers. If the Global Interrupt Enable Register is cleared, none of the interrupts are enabled independent of the individual interrupt enable settings. The I-bit is cleared by hardware after an interrupt has occurred, and is set by the RETI instruction to enable subsequent interrupts. The I-bit can also be set and cleared by the application with the SEI and CLI instructions, as described in the instruction set reference.
• Bit 6 – T: Bit Copy Storage:The Bit Copy instructions BLD (Bit LoaD) and BST (Bit STore) use the T-bit as source or destination for the operated bit. A bit from a register in the Register File can be copied into T by the BST instruction, and a bit in T can be copied into a bit in a register in the Register File by the BLD instruction.
• Bit 5 – H: Half Carry Flag: The Half Carry Flag H indicates a Half Carry in some arithmetic operations. Half Carry Is useful in BCD arithmetic.

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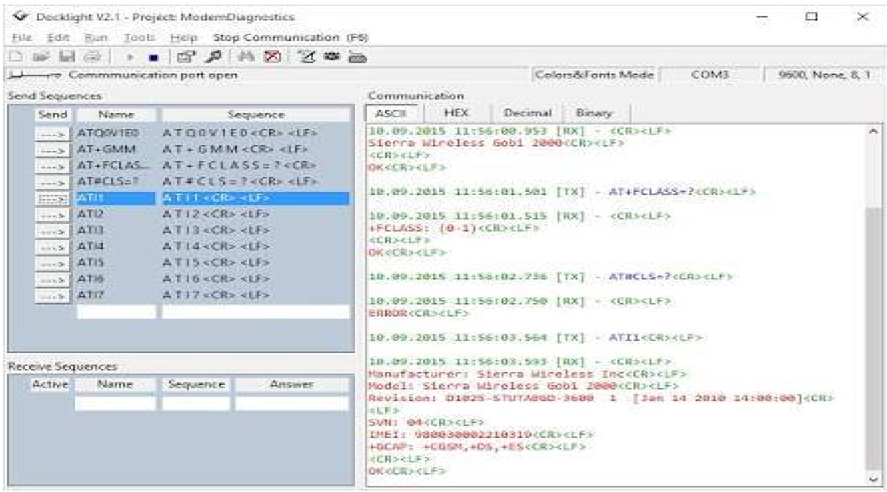
• Bit 4 – S: Sign Bit, S = N ⊕ V: The S-bit is always an exclusive or between the Negative Flag N and the Two's Complement Overflow Flag V.
• Bit 3 – V: Two's Complement Overflow Flag: The Two's Complement Overflow Flag V supports two's complement arithmetics.
• Bit 2 – N: Negative Flag:The Negative Flag N indicates a negative result in an arithmetic or logic operation.
• Bit 1 – Z: Zero Flag:The Zero Flag Z indicates a zero result in an arithmetic or logic operation.
• Bit 0 – C: Carry Flag: The Carry Flag C indicates a carry in an arithmetic or logic operation.

The main function of the CPU core is to ensure correct program execution. The CPU must therefore be able to access memories, perform calculations, control peripherals, and handle interrupts.In order to maximize performance and parallelism, the AVR uses a Harvard architecture with separate memories and buses for program and data. Instructions in the program memory are executed with a single level pipelining. While one instruction is being executed, the next instruction is pre-fetched from the program memory. This concept enables instructions to be executed in every clock cycle. The program memory is In-System Reprogrammable Flash memory.

The fast-access Register File contains 32 x 8-bit general purpose working registers with a single clock cycle access time. This allows single-cycle Arithmetic Logic Unit (ALU) operation. In a typical ALU operation, two operands are output from the Register File, the operation is executed, and the result is stored back in the Register File – in one clock cycle. Six of the 32 registers can be used as three 16-bit indirect address register pointers for Data Space addressing – enabling efficient address calculations. One of these address pointers can also be used as an address pointer for look up tables in Flash program memory. These added function registers are the 16-bit X-, Y-, and Z-register, described later in this section. The ALU supports arithmetic and logic operations between registers or between a constant and a register. Single register operations can also be executed in the ALU. After an arithmetic operation the Status Register is updated to reflect information about the result of the operation.

Program flow is provided by conditional and unconditional jump and call instructions, able to directly address the whole address space. Most AVR instructions have a single 16-bit word format. Every program memory address contains a 16- or 32-bit instruction. Program Flash memory space is divided in two sections, the Boot Program section and the Application Program section. Both sections have dedicated Lock bits for write and read/write protection. The SPM instruction that writes into the Application Flash memory section must reside in the Boot Program section. During interrupts and subroutine calls, the return address Program Counter (PC) is stored on the Stack. All user programs must initialize the SP in the Reset routine (before subroutines or interrupts are executed). The Stack Pointer (SP) is read/write accessible in the I/O space.In addition, the ATmega328P has Extended I/O space from 0x60 - 0xFF in SRAM where only the ST/STS/STD and LD/LDS/LDD instructions can be used. A flowsensor is a device which weused for sensing the rate of fluid flow. The water flow sensor at the rate of 1-30 L/min depends upon the situation.
USB-UART: It is used to transfer data from zigbee to system docklight software.

IV.RESULTS AND DISCUSSION



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The above image shows the outcome of our research regarding the leakage detection. This outcome is obtained on the DOCKLIGHT software. This software shows the error occurred during the leaks in the pipeline.

V.CONCLUSION

This paper presented a study concerning the detection of burst leaks in water pipes by means of microcontroller using flow sensor. An experimental campaign was started for measuring flow associated with real leaks occurring in actual service pipes of a water distribution network. The effectiveness of a prototypal algorithm for leak detection purpose was verified with the first acquisitions performed within the campaign. The measured signals are being monitored by the DOCKLIGHT software , thus being very simple to be implemented in practice and requiring very limited computational resources to be executed. The tests provided satisfactory results, thus proving the algorithm as an effective tool for detecting leaks. Hence the implemented algorithm appeared worthy to be further investigated and developed. Signal filtering was successfully tested as a possible solution for incrementing both the algorithm robustness and sensitivity to leaks. The use of proper component gives us high efficiency output.. In the future steps of the research the experimental campaign will be continued for collecting a statistically representative database. The algorithm will be tested on the enlarged database in order to enhance the leakage detection performance, by further refining the algorithm steps and possibly optimizing the leakage detection.

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