

Smart Water Supply Management

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Abstract – In urban areas the water supply to residence and commercial establishments are provided at a fixed flow rate. There are incidents of excess water drawing by certain customers/users by connecting motor-pump sets to the water lines which is considered as water theft. In this project it is proposed to develop an embedded based remote water monitoring and theft prevention system by recording the flow rates at the consumer/user end. In order to implement the proposed water supply system, each consumer end should be provided with an embedded based water flow monitoring system consisting of a microcontroller to record the flow rate using a flow sensor and to transmit the same to a remote monitoring station using wireless transmitter and it is also provided with an electrically operated solenoid valve to supply water to the consumers. The valve turns on/off by the central processing station PC to stop the water supply whenever the flow rate exceed a predefined limit. It is proposed to employ a GSM MODEM for wireless communication so that the information can be passed to many responsible officers cell phone for immediate action.

Key words – MSP 430G Launch Pad , GSM Modem ,Water Solenoid valves , RS 232 Trans receiver, LED indicators.

INTRODUCTION

In this research work, it is proposed that the usage of Anti - theft control system for drinking water supply. By implementing this proposed system in a real time; surely it will be able to control the drinking water theft in the domestic areas. In urban areas the water supply to residence and commercial establishments are provided at a fixed flow rate. There are incidents of excess water drawing by certain customers/users by connecting motor - pump sets to the water lines which is considered as water theft.

With the continuous economic growth, the water demand of enterprises is also increasing. The monitoring of water resource for these enterprises can prevent the occurrence of stealing water and leaking water effectively. Therefore, the monitoring system of urban water supply has aroused extensive attention in recent years. Urban water supply networks form the link between drinking water supply and drinking water consumers. These large - scale networks are vital for the survival of urban life, for maintaining a healthy level of economic development, and for the continuous operation of factories and hospitals.

In world, urban water supply systems are public enterprises, usually part of a local government, and the recent increased interest in privatizing public enterprises has not led to reforms of water systems. Nevertheless, in about 50 cities in the developing world, the water system either has been privatized or franchised to a non - governmental entity for its operation and maintenance.

In this research work it is proposed to develop an embedded based remote water monitoring and theft prevention system by recording the flow rates at the consumer/user end. In order to implement the proposed water supply system, each consumer end should be provided with an embedded based water flow monitoring system consisting of a microcontroller to record the flow rate using a flow sensor and to transmit the same to a remote monitoring station using GSM Network.

II. BLOCK DIAGRAM

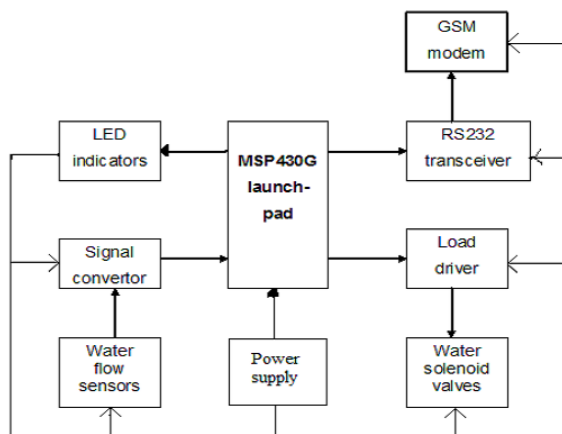


Fig1: Block Diagram of the project

Methodology: the simplified block diagram of the project “Water Theft Identification & Automated Water Supply System using MSP430 and GSM Network” is shown here which gives the idea about circuit connection in block-wise.

MSP430 microcontroller: MSP430 microcontrollers (MCUs) from Texas Instruments are 16-bit, RISC-based, mixed-signal processors designed specifically for ultra-low power. MSP430 MCUs have the right mix of analog and digital integrated intelligent peripherals, ease of use, low cost and lowest power consumption for thousands of applications ranging from simple sensor designs to complex electricity meters.

Oscillator: Microcontroller needs clock pulses for its operation. This unit generates the clock pulses using standard crystal.

RS232 trans-receiver: Controller unit works on TTL [logic 1 and 0] signals while modem require RS232 type signals, so this unit is needed to convert controllers signals into RS232 form and vice versa.

Flow Sensor: The flow sensor is relatively simple liquid flow thro’ the pipeline impinges upon the turbine blades which are free to rotate about axis along the center line of the turbine housing. The angular velocity of the turbine motor is directly proportional to the fluid velocity thro’ the turbine. The output of the proximity sensor senses the rotating blades taken out. The output frequency of this electrical pick up is proportion to the flow rate. Either the time interval between the pulses or the frequency can be used to measure the flow rate

Solenoid Valve: The valve that has been selected here is 1/1way Normally Open (NO) Valve. It enables the water flow in its resting position. It has two ports (one inlet port and one outlet port) and only one orifice seat. A short electrical impulse enables the solenoid valve to be opened or closed. The residual effect of a permanent magnet is sufficient for maintaining the

valve in a particular working position with no electrical energy consumption. The opposite polarity of the electrical impulse will make the valve to retain its original position

Signal converter: Here 555 timer based monostable circuit acts as signal converter and converts variable resistance value into logic levels.

Driver: When controller send load trip / reconnect signals then this unit is require doing the action as controller can not drive any load directly.

GSM modem: This unit is require to send error / fault signals towards authority when circuit detects any mischief in water flow. This unit also sends the consumed units towards authority for billing.

III. CIRCUIT DIAGRAM

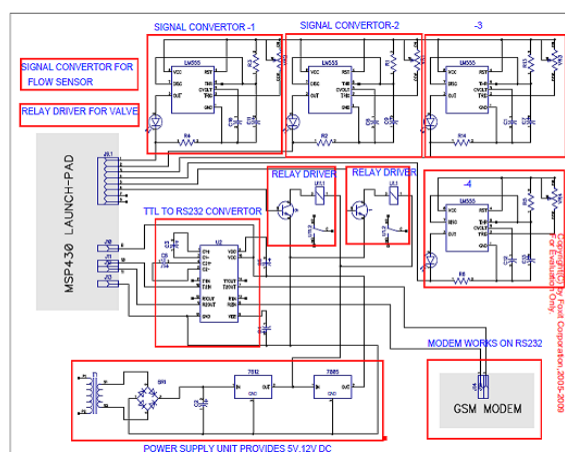


Fig 2: Circuit Diagram

IV. SIM900 GSM MODEM



Fig 3: GSM Modem Kit

Features :

- 1) High Quality Product

- 2) Quad Band GSM/GPRS
- 3) 850 / 900 / 1800 / 1900 MHz
- 4) Built in RS232 level converter
- 5) Built in SIM card holder
- 6) Built in network status LED
- 7) Input Voltage : 5V to 12V DC

V. INTERFACING MODEM TO MICROCONTROLLER

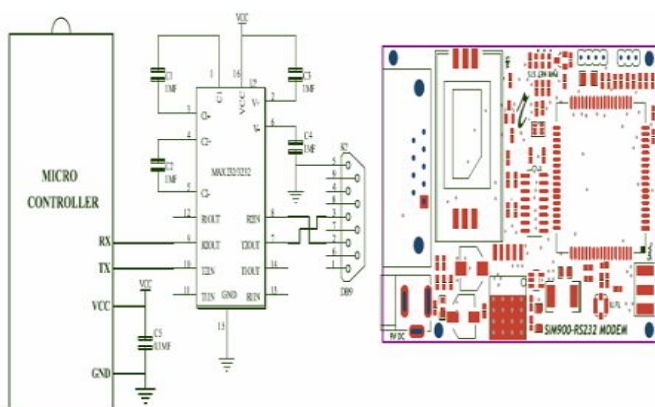


Fig 4: Interfacing modem to microcontroller

The Modem can be directly interface with 5V microcontrollers like PIC, AVR, 8051 Derivatives, Arduinos and 3V3 Microcontrollers like ARM, ARM Cortex XX etc. Make ensure V_INTERFACE pin is supplied with same voltage level as the microcontroller VCC. As per the above Fig 4 there is only 2 connections are required to use the modem. Connect RX pin of the modem to the TX pin of the microcontroller and TX pin of the modem to microcontroller's RX pin. The connected power supply (4.2v to 12v dc) should be capable of handling current up to 1 A.

Things to keep in mind when using the GSM modem

- The GSM Modem consumes a lot of current during transmission, make sure your power supply can handle large currents without giving substantial voltage drops at the output
- If the GSM Modem is unable to connect to the network, try coming to a place with clear surroundings for best reception
- The SIM Card holder used on the Modem is quite delicate and can easily break upon rough use. Use it with care and caution.

VI. ADVANTAGES

- Water theft by connecting pump-set directly to water line will be minimized to some extent.
- Line break will be detected and so wasting precious drinking water will be avoided.
- Consumer will get monthly bill on his cell as a SMS.

VII. CONCLUSION

The system uses GSM system for communication protocol, provides low cost and long distance communication which helps in monitoring water supply in metropolitan city. The development of this system can reduce the waste of water resources substantially, and make the management of water even more effective and convenient in the city.

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