A New Technique to Efficient Water Consumption System Using ARM7

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Abstract—*Though earth is filled with 75% of water, only 2% of water is used by living beings. Moreover, water gets wasted unnecessarily due to the lack of awareness in utilizing water efficiently. Also the major challenge which the earth faces day by day is water scarcity.   Hence if steps were taken to efficiently utilize the water resources, it would be quite useful for the present and future generations survive wealthy. To make this possible, an automated system for consuming water had been developed so as to make the earth green. The system consists of an ARM Board along with Hall Effect Sensor, relay and GSM Module controls the flow of water, when the quantity of water utilized in a particular building exceeds the threshold. The Hall Effect Sensor figures out the amount of water utilized by the building under concern. When the amount exceeds threshold, the sensor acknowledges the controller ARM which immediately on receiving the signal, triggers on the relay, which further closes the valve connected to the pipe line. Intimation is also passed on to the Water Control Board through the GSM Module. The core idea of this project is to develop a system which makes the water consumption effective which would be given in substance, which when implemented would make the future generation grow wealthy.*

Keywords – ARM7, Valve, GSM module, LCD, Water Control Board, GPRS, UART, Hall Effect Sensor.

I. INTRODUCTION

Water should be supplied effectively in order that every building receives proper and correct amount of water so that the amount of water is not wasted unnecessarily. This is done by the Water Control Board which is wholly responsible for the equal and useful distribution of water [1]. Water is in demand now a days and this demand keeps on increasing rapidly [2].There exists a few techniques but the major thing is that these techniques should be simple and cost- effective [3]. Proposed technique will be quite useful for all those regions which suffer out of drought or where there exists a need for efficient water utilization. This system utilizes ARM, Hall Effect Sensor, Relay, Valve to control the water flow while GSM module communicates with the Water Control Board, making the control board know the valve of the particular building has been closed. The Hall Effect Sensor tracks the quantity of water utilized by the building and when the water consumption exceeds the pre- defined amount, makes the ARM7 know and the ARM7 controller further lets the relay on making the valve close which interrupts the water flow to that particular building. The GSM Module also gets to know about the closure of the valve, which intimates it to the Water Control Board. An LCD is fixed to each house, which makes the people know as how much amount of water consumed, water to be consumed and so on.

II. SYSTEM ARCHITECTURE

Automated drinking water control system must be implemented in every major spots since water finds its demand these days. A valve is made open or close based on the water consumption of a particular house. The system automatically regulates the water flow and also communicates with the Water Control board. The System Block Diagram is shown in fig. 1

Fig.1 Block Diagram of proposedEfficient Water Consumption System

In a building, the amount of water entering is determined by the Hall Effect Sensor which is placed in the pipeline entering in to the building. Depending on the output of the Hall Effect Sensor, the processor, ARM7 will take measures. When the water consumption of a building exceeds a threshold value, the controller closes the valve. And once the valve gets closed, the controller lets the GSM Module know about the closure in a particular building which further lets the Water Control Board know about the closure. Here, LCD displays the amount of water consumed by the building in liters and also displays the amount of water left to be used. Following are the main modules of the system.

A.   Hall Effect Sensor:

A sensor converts a physical quantity into an electrical quantity. Hall Effect Sensor works on the Hall Effect principle. When the magnetic flux density of the sensor exceeds a limit, the sensor senses the change and generates a Hall Effect Voltage. The quantity of water is measured in the count of pulses. The pulse rate increases with the velocity of water entering into the system and vice-versa. The controller takes necessary measures once the pulse count exceeds a certain value.

B. ARM7

The LPC2148 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, which contains high speed flash memory ranging from 32 kB to 512 kB. The board also contains a 128-bit wide memory interface and an accelerator architecture which let 32-bit code execution at the maximum clock rate. the alternative 16-bit Thumb can also be used . forcritical code size applications Due to their tiny size and low power consumption, LPC2148 are ideal for applications involve miniaturization as an important fact. Serial communications interfaces are also available which ranges from a USB 2.0 Full-speed device, multiple UARTs, SPI etc. On-chip SRAM of 8 kB up to 40 kB, make these devices much suitable for communication gateways and protocol converters, soft and high processing power. Many 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers suitable for industrial control and medical systems
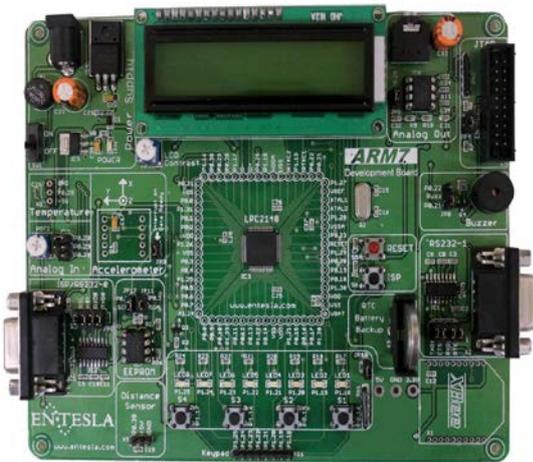
Fig. 2 LPC2148

C. Software

1) Keil IDE

ARM7 is programmed with Keil uVision4 IDE. Keil lets the users with wide varieties of options for exploring and debugging. A plenty number of processors can be programmed via Keil. Options are also available for testing the peripherals through software.
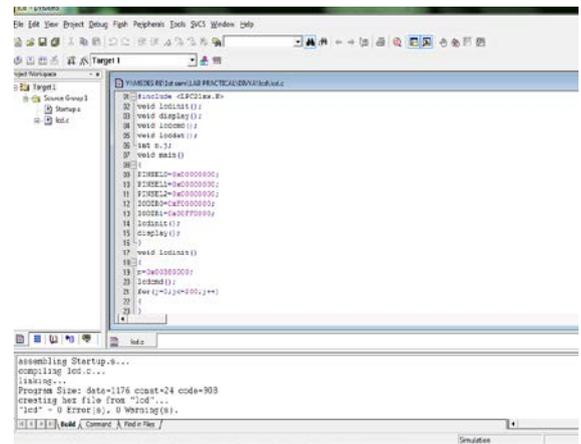
Fig. 3 Keil IDE

Following are the steps for programming an ARM7:

- Open the Keil uVision7 IDE.
- Select New Project from the Project tab from the IDE that appears.
- Name the project and then select the Philips and then LPC2148 is chosen from the list of processors that appear. Press ok button once processor is chosen.
- Create a new file by choosing File> New File..
- Type the program and add the file to the Source Group.
- Compile and download the Hex files to the LPC2148 kit.

D. GSM Modem

A GSM modem works with GSM wireless network and is a wireless MODEM, supported by GPRS technology. GSM operates on fully duplex mode which is transported through circuit-switched transport and then packet data transport is done by GPRS (General Packet Radio Services) and EDGE (Enhanced Data rates for GSM Evolution).

Usually the GSM is connected to the processor by means of a serial cable or a USB cable. LPC2148 consists two UARTs out of which one is used for communicating with the GSM. UART stands for Universal Asynchronous Receiver Transmitter is a serial communication protocol.

E. Solenoid relay

Generating magnetizing field is the major principle involved in a solenoid relay. A coil is wound on an insulating material. When a magnetizing shaft is inserted which gets energized when subjected to a magnetic field and hence a current flows through the coil.

When the coil gets energized, a shaft from north to south and vice- versa.

A solenoid valve is a device which when subjected to a power supply,lets a plunger move towards or away. When such energization takes place, in our case makes the water flow restricted.. A relay is constructed by means of solenoid principle and is called solenoid relay. When the current flows through the solenoid valve, it makes the relay close the pipeline. When the ARM7 microcontroller sends instructions to the relay, it makes the solenoid valve closed.

F. Liquid Crystal Display

An LCD is a cost effective display unit.The LCD used in the system is DG6894R0. It is a 5x8 Dots Cursor. It has 16 characters * 2 lines display. There is a built- in microcontroller inside the LCD module. A signal ground for LCD is connected to pin1 which is represented as V_{ss}. The power supply is given to pin2 called as V_{cc}. Register Select Signal (RS) is connected to 4th pin and Read/Write (R/W) signal is at pin5. Enable Signal is connected to pin6 and data bus lines are connected from pin7 to pin14.   An LPC2148 has a built- in LCD module within it.

III. METHODOLOGY

The Proposed System consists of Flow Sensor Module, Signal Conditioning element, Embedded System Development Board, GSM Module.
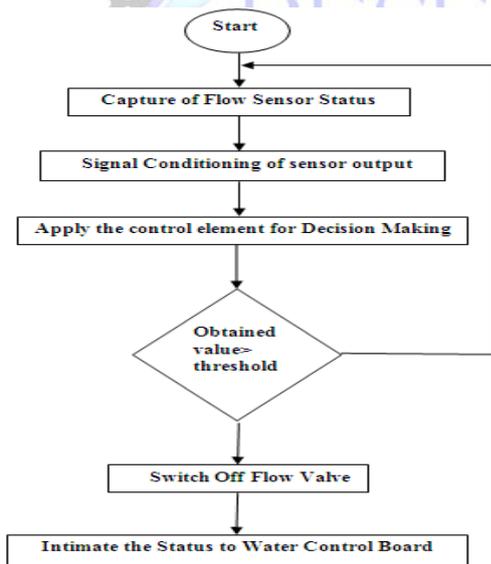
Fig. 4Flow Diagram of the proposed methodology

The Flow Sensor element monitors the quantity of water passing through the pipe and captures the status.The Signal Conditioning element converts Flow Sensor output in to an appropriate form that is acceptable by the microcontroller. The microcontroller compares the input with the threshold. The threshold is fixed by the Water Control Board based on the availability of water resource. When the input of the sensor exceeds limit, the Flow valve is to be switched OFF. In addition to monitoring and

controlling of water consumption, the system is designed to be configurable parameters such as quantity to be consumed via GSM Module to intimate the Water Control Board and also to inform the consumer about the arrival time of water. The work flow diagram of the project is given in Fig. 4.

IV. DESCRIPTION

The system contains of the Hall Effect sensor, YF-S201 and when power is fed to it, determines the flow of water. The amount of water is determined by the number of pulses counted. The number of pulses generated is high when water flow velocity is high and it is other way around when the water flow velocity is low.
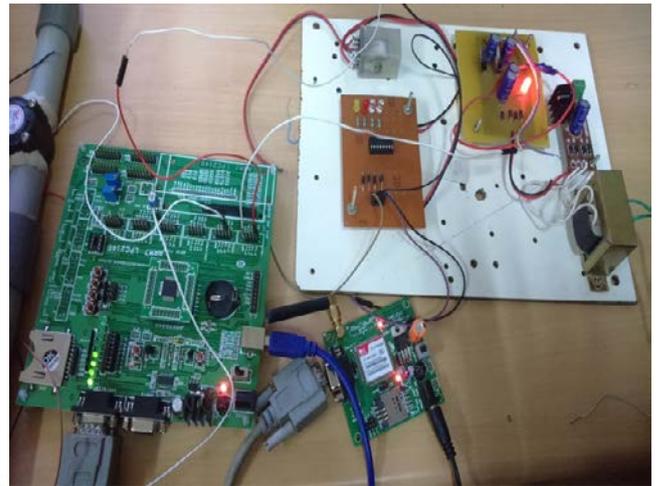
Fig. 5 Hardware Prototype of the Water Consumption System

The pre-defined quantity of water, that is, the amount of water that can be consumed by a particular building is determined with number of pulses. The number of pulses from the all Effect Sensor is counted by means of ARM7. The controller counts the number of pulses generated out of the Hall Effect Sensor.. If the pulses go above the threshold, then the controller detects and switches the relay ON which inturn closes the solenoid valve, thereby leasing no water flow through the pipeline to the particular building from the water tank. Also, the water control board is intimated regarding the closure through GSM. A GSM receives the signals from the controller and further transmits it to the control board. An LCD is also provided at the houses so as to make people aware of the amount of water consumed and amount of water left for further consumption.

V. CONCLUSION

The core focus of this paper is to design a fully automated system for efficient water consumption. The system also gives the people the report of the amount of water consumed a day, amount of water still available to be consumed a day. The relay gets turned ON when there is a signal from the ARM7 microcontrollertriggered on by the Hall Effect Sensor. The system also informs the water control board about the valve closure, thereby making the water control board acknowledged. Thus the system

monitors the water supply and restricts the flow when the consumptiongo beyond the threshold. This system lets the efficient water utilization, making the future planet sustain well.

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