Wireless module for smart cities

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ABSTRACT

The automation becomes need for now and the government is also taking an initiative to support the automation by carrying the programs like "SMART CITIES". One of the main area under the smart city is water management. Loss of water due to leakage and breaking of pipeline is significant problem which affects water utilities over worldwide and this became worse due to underground infrastructure.
Problem faced by leakage can be overcome by using wireless module and advance technology, use of flow sensor, RF module and GSM in this project can communicate to the appropriate authority for management and action regarding leakage. With the help of water flow measurement and GSM module for messaging helps to stop wastage of water at the time of leakage. In rural and urban area this management of water plays an important role.

Keywords-*Water leakage management, wireless module, RF module.*

I. INTRODUCTION

Water distribution carry water from supply sources and storage tank to residential areas, small and big scale industries commercial zone through pipeline system. This system face problem of water leakage lots of time. In many countries water systems are more than 100 years old particularly in large cities on the east coast for example, 2010 audit in Philadelphia revealed 27% water loss due to leakage and another 7% due to metering inaccuracies water theft, and data handling and management issues.

By 2016 2/3rd of world will experience shortage of water to overcome this leakage problem may help most of the country from water stress in future. Leakage detection complain and management is one of the long process in many countries. Loss of water due to leakage and breaking of pipeline is significant problem which affects water utilities over worldwide and this became worst due to underground infrastructure. Our society having large pipeline network to distribute water in different areas.

By arranging the flow sensors in appropriate distances in between pipeline. The leakage of water is sensed through GSM network and alert will be send to municipal officer or water contractor at that particular place through short message service (SMS).

The main objective of this paper is to develop wireless module, that continuously monitor water flow and water leaks in the water pipes and report the monitor data to control station that can do the analytics for detection and localization.

II. LITRATURE SURVEY

This is not an original idea, to build water leakage detection from wireless module the idea has excited many years. Leakage detection can be obtained by various techniques like pressure sensors, acoustic sensors, and ultrasonic waves. The recently published paper underground facility pinpointing finding a precise locating system for buried underground facility (Faray and vetter 2011). The paper published by GTI shows that independent evaluation of a variety of locating tools. This invention largely focused on electromagnetic locators which is used for metallic pipe and GPR which are in the water industry.

Investigation of field equipment:-

American water invent an equipment investigation of leak locating. The focus on plastic pipe equipment investigated for pipe location, ground penetrating radar & vibration induced plastic pipe location.

Leak Locating equipment:-

Wachs water service marketed leak detection technology demonstration at PA American water of leak detection product began in 2012. Recently PLD which manufactured by 64 seconds, programmed to track frequencies in the range of plastic pipe leak and alter the infrasonic frequencies that it is "audible to the human ear". Using met Rotech unit PA American reports improved detection of leaks on plastic service.

Analysis of different techniques for locating leaks in pipes in water distribution system using WSN published by Shikha Gupta, Abha Mahalwar, P. Udhaykumar. This paper deals with the various techniques of leakage detection their limitation and how to overcome those limitation.

Leakage detection in water pipe network using acoustic sensors and identifying codes by Francesco De Pellegrino and Roberto Riggio. This paper shows that the set of sensors are placed in such a way that to improve the resolution by which leakages are located. This solution is validated through extensive numerical experiment.

Water flow driven sensors networks for leakage and contamination monitoring by Amitangshu Pal and Krishnakant. This paper shows that reduced the leakage reporting time and adaptation reduced circulation by 33% and transmitted data by 30%.

III. PROBLEM STATEMENT.

The wastage of water creates the big issues in day to day life. many villages, cities, nation are suffering from water problems so to reduce these problem a wireless module for water management is made, this module help to solve some of these major problems in day to day life

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IV. OBJECTIVE

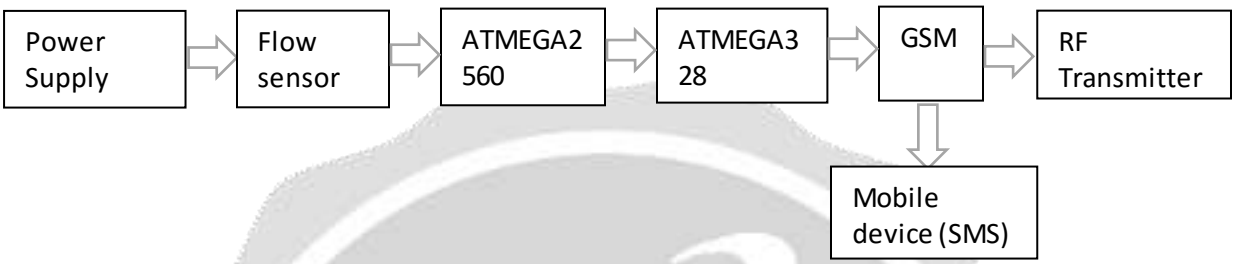
- To save large amount of water due to leakages in pipeline
- To do work effectively and timely manner.
- To easily check the water flow in pipeline and water level in municipal water tank.
- To easily calculate the water distribution in cities or particular area.

V. SCOPES

- Level sensor is used to sense water level from the storage tank
- Flow sensor helps to know what amount of water is flowing and total amount of water supplied
- Water management module can be used in rular and urban both area

VI. SYSTEM OVERVIEW

Transmitter section



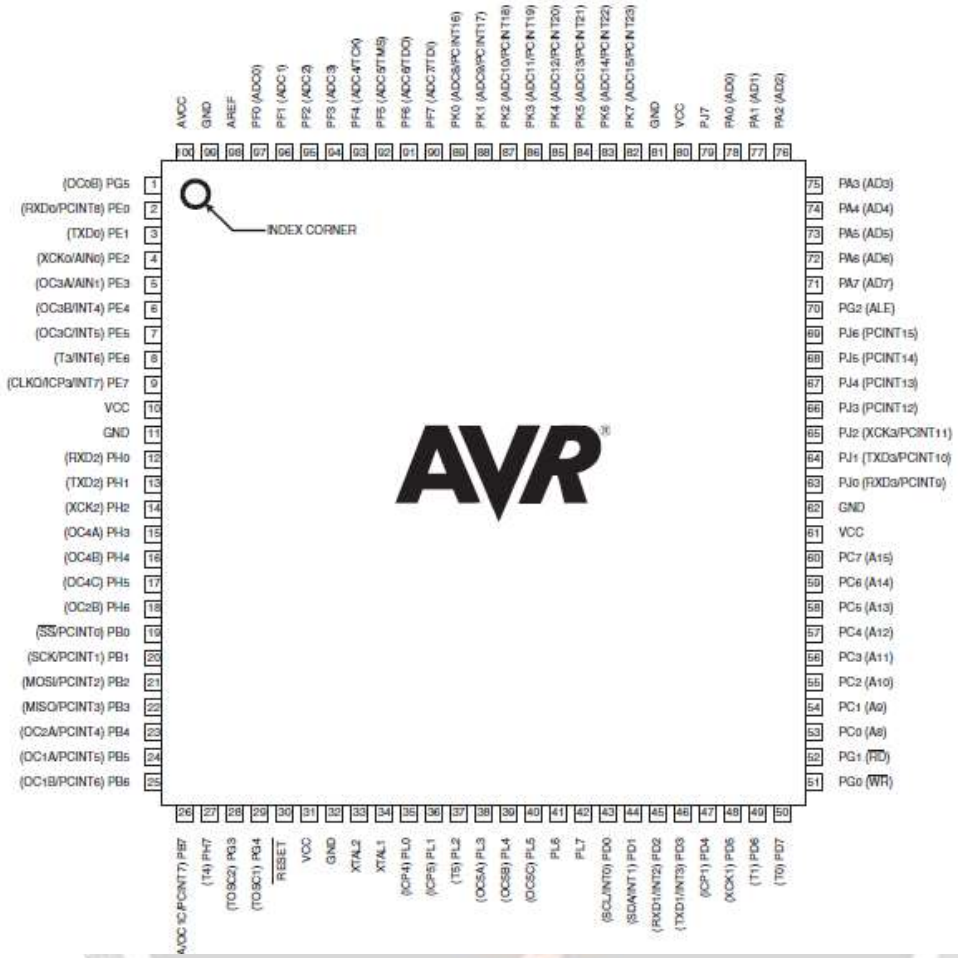
Receiver section

Functional block diagram of the system.

It consist of following parts:-

1.Power supply
2.Flow sensors
3.ATMEGA2560
4.ATMEGA328
5.GSM
6.RF transmitter
7.RF receiver

Pin Diagram Of ICATMEGA2560



Features

• High Performance, Low Power Atmel® AVR® 8-Bit Microcontroller
• Advanced RISC Architecture
– 135 Powerful Instructions – Most Single Clock Cycle Execution
– 32 × 8 General Purpose Working Registers
– Fully Static Operation
– Up to 16 MIPS Throughput at 16MHz
– On-Chip 2-cycle Multiplier
• High Endurance Non-volatile Memory Segments
– 64K/128K/256KBytes of In-System Self-Programmable Flash
– 4Kbytes EEPROM
– 8Kbytes Internal SRAM
– Write/Erase Cycles:10,000 Flash/100,000 EEPROM
– Data retention: 20 years at 85□C/ 100 years at 25□C
– Optional Boot Code Section with Independent Lock Bits
• In-System Programming by On-chip Boot Program
• True Read-While-Write Operation
– Programming Lock for Software Security
• Endurance: Up to 64Kbytes Optional External Memory Space • Atmel® QTouch® library support
– Capacitive touch buttons, sliders and wheels
– QTouch and QMatrix acquisition
– Up to 64 sense channels
• JTAG (IEEE® std. 1149.1 compliant) Interface
– Boundary-scan Capabilities According to the JTAG Standard
– Extensive On-chip Debug Support

– Programming of Flash, EEPROM, Fuses, and Lock Bits through the JTAG Interface
• Peripheral Features
– Two 8-bit Timer/Counters with Separate Prescaler and Compare Mode
– Four 16-bit Timer/Counter with Separate Prescaler, Compare- and Capture Mode
– Real Time Counter with Separate Oscillator
– Four 8-bit PWM Channels
– Six/Twelve PWM Channels with Programmable Resolution from 2 to 16 Bits
(ATmega1281/2561, ATmega640/1280/2560)
– Output Compare Modulator
– 8/16-channel, 10-bit ADC (ATmega1281/2561, ATmega640/1280/2560)
– Two/Four Programmable Serial USART (ATmega1281/2561, ATmega640/1280/2560)
– Master/Slave SPI Serial Interface
– Byte Oriented 2-wire Serial Interface
– Programmable Watchdog Timer with Separate On-chip Oscillator
– On-chip Analog Comparator
– Interrupt and Wake-up on Pin Change
• Special Microcontroller Features
– Power-on Reset and Programmable Brown-out Detection
– Internal Calibrated Oscillator
– External and Internal Interrupt Sources
– Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby,
and Extended Standby
• I/O and Packages
– 54/86 Programmable I/O Lines (ATmega1281/2561, ATmega640/1280/2560)
– 64-pad QFN/MLF, 64-lead TQFP (ATmega1281/2561)
– 100-lead TQFP, 100-ball CBGA (ATmega640/1280/2560)
– RoHS/Fully Green
• Temperature Range:
– -40□C to 85□C Industrial
• Ultra-Low Power Consumption
– Active Mode: 1MHz, 1.8V: 500µA
– Power-down Mode: 0.1µA at 1.8V
• Speed Grade:
– ATmega640V/ATmega1280V/ATmega1281V:
• 0 - 4MHz @ 1.8V - 5.5V, 0 - 8MHz @ 2.7V - 5.5V
– ATmega2560V/ATmega2561V:
• 0 - 2MHz @ 1.8V - 5.5V, 0 - 8MHz @ 2.7V - 5.5V
– ATmega640/ATmega1280/ATmega1281:
• 0 - 8MHz @ 2.7V - 5.5V, 0 - 16MHz @ 4.5V - 5.5V
– ATmega2560/ATmega2561:
• 0 - 16MHz @ 4.5V - 5.5V

Flow sensors

Measure liquid/water flow for your solar, water conservation systems, storage tanks, water recycling home applications, irrigation systems and
much more. The sensors are solidly constructed and provide a digital pulse each time an amount of water passes through the pipe. The outpu can easily be connected to a microcontroller for monitoring water usage and calculating the amount of water remaining in a tank etc

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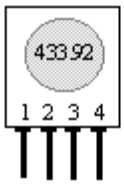
Features:
Model: YF-S201
Working Voltage: 5 to 18V DC (min tested working voltage 4.5V)
Max current draw: 15mA @ 5V
Output Type: 5V TTL
Working Flow Rate: 1 to 30 Liters/Minute
Working Temperature range: -25 to +80?
Working Humidity Range: 35%-80% RH
Accuracy: ±10%
Maximum water pressure: 2.0 MPa
Output duty cycle: 50% +-10%
Output rise time: 0.04us
Output fall time: 0.18us
Flow rate pulse characteristics: Frequency (Hz) = 7.5 * Flow rate (L/min)
Pulses per Liter: 450
Durability: minimum 300,000 cycles
Cable length: 15cm
1/2" nominal pipe connections, 0.78" outer diameter, 1/2" of thread
Size: 2.5" x 1.4" x 1.4"

RF RX-TX MODULES:

RF Transmitter and Receiver- The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK). Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line-of-sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. An RF transmitter receives serial data and transmits it wirelessly through RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter.

TWS-434A RF Transmitter

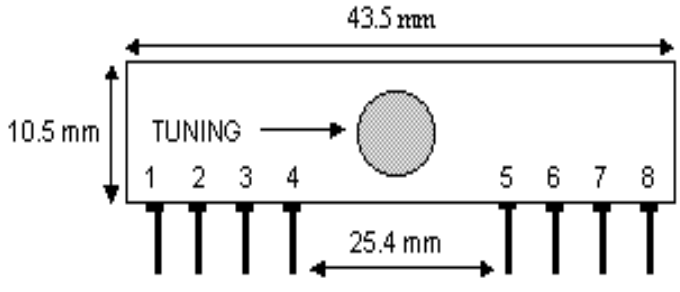


Pin - 1 Gnd
Pin - 2 Data Input
Pin - 3 Vcc
Pin - 4 RF Output

Frequency: 433.92MHz
Modulation: AM
Operating Voltage: 2 – 12 VDC

Symbol	Parameter	Condition	Min	Typ	Max	Unit
Vcc	Supply Voltage		2.0	-	12.0	V
Ip	Peak Current	2V / 12V	-	1.64 / 19.4	-	mA
Vh	Input High Voltage	Idata = 100uA (High)	Vcc-0.5	Vcc	Vcc+0.5	V
Vl	Input Low Voltage	Idata = 0 uA (Low)	-	-	0.3	V
Fo	Operating Frequency		433.90	433.92	433.94	MHz
Tr / Tf	Modulation Rise / Fall Time	External Coding	-	-	100 / 100	uS
Po	RF Output Power – Into 50Ω	Vcc = 9 to 12 V Vcc = 5 to 6V	-	16 14	-	dBm
Dr	Data Rate	External Coding	-	2.4K	3K	Bps

RWS-434 RF Receiver



Pin – 1 Gnd
Pin – 2 Digital Data Output
Pin – 3 Linear Output
Pin – 4 Vcc
Pin – 5 Vcc
Pin – 6 Gnd
Pin – 7 Gnd
Pin – 8 Antenna (approx 30 – 35 cm)

Frequency: 433.92MHz
Modulation: AM
Operating Voltage: 4.5 – 5.5 VDC
Output: Digital & Linear

Symbol	Parameter	Condition	Min	Typ	Max	Unit
Vcc	Supply Voltage		4.5	5	5.5	V
It	Operating Current		-	3.5	4.5	mA
	Channel Width	+ / - 500				kHz
Rd	Data Rate				3k	Bps
Vdat	Data Out	Idata = +200 uA (High)	Vcc-0.5	-	Vcc	V
		Idata = -10 uA (Low)	-	-	0.3	V

VII. CONCLUSION

In this paper we presented an architecture and implementation of a water management modular. By using the wireless system smart cities are developed for saving water resource. Due to the use of module the complexity of the project is removed i.e the wired connection is converted to wireless connection. It work with real time clock easy to use in the society helpful for society public

VIII. ACKNOWLEDGMENT

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