

Chapter 1

1.1 Overview

Sustainability of available water resource in many reason of the word is now a dominant issue. This problem is quietly related to poor water allocation, inefficient use, and lack of adequate and integrated water management. Water is commonly used for agriculture, industry, and domestic consumption. Therefore, efficient use and water monitoring are potential constraint for home or office water management system. Last few decades several monitoring system integrated with water pressure detection have become accepted. Measuring water pressure is an essential task for government and residence perspective. In this way, it would be possible to track the actual implementation of such initiatives with integration of various controlling activities. Therefore, water controlling system implementation makes potential significance in home applications.. This is not properly supported for adequate controlling system. Besides this, liquid level control systems are widely used for monitoring of liquid levels, reservoirs, silos, and dams etc.. Audio visual alarms at desired levels and automatic control of pumps based on user's requirements can be included in this management system. Proper monitoring is needed to ensure water sustainability is actually being reached, with disbursement linked to sensing and automation. Such programmatic approach entails microcontroller based automated water sensing and controlling of losses.

Control the water pump by connecting it with an output pin of microcontroller via a motor driver circuit. When microcontroller sends a positive signal (+5v) or a ground signal (0v) to the motor driver circuit, then the water pump become on or off respectively. We also would like

to use a manual switch on the motor driver circuit which is supposed to use for controlling it manually. It makes this system more users friendly.

For water pressure level indication unit we can use some sensor which will work for water pressure level indication. By touching different water levels through water level sensor, SENSOR should be indicated as on/off.

Microcontroller is a computer on a chip that is programmed to perform almost any control, sequencing, monitoring and display the function. Because of its relatively low cost, it becomes the natural choice to the designer. Microcontroller is designed to be all of that in one. Its great advantage is no other external components are needed for its application because all necessary peripherals are already built into it. Thus, we can save the time, space and cost which is needed to construct low [5].

Awareness that water loss is occurring in a water system is the first step in identifying leaks and making repairs. Once water loss has been documented and identified, a water system operator can then determine whether the water loss is a real loss or an unavoidable loss. The first step in accounting for water used and lost in a water distribution system is appropriate data collection, especially from water meters [8].

Important data needed to assess water use and loss in a system includes:

A) Information relating to the water system infrastructure:

- ❖ production water meters (quantity, age, diameter, type, location, accuracy); water mains (age, material, diameter, length, location, depth, condition); water service lines (quantity, material, diameter, location, depth, length); valves (quantity, age, diameter, type, location);

- ❖ fire hydrants (quantity, age, type, location); customer water meters (quantity, age, diameter, type, location, accuracy).
- ❖ Storage reservoirs (volume, location, type).
- ❖ Bulk metering of water imported and water exported (quantity, age, diameter, type, location, accuracy).

B) The quantity of potable water supplied to the water distribution system including water imported and existing system sources, such as:

- ❖ Surface water delivered via a water purification/treatment plant;
- ❖ Ground water from wells delivered via a water purification/treatment plant; and purchased water (water imported)

C) The quantity of water metered or consumed and non-revenue

D) Operations and maintenance activities within the water distribution system, such as:

- 1) Continuous water system pressure readings;
- 2) maintenance activities related to water mains (e.g. number of water main breaks/repairs each year, blow-offs for water quality or freezing concerns, water main replacement or rehabilitation programs, water main Flushing/swabbing/pigging programs, discharges at pressure relief valves, etc.).
- 3) hydrant use or maintenance activities (e.g. physical inspection, fire flow testing, pool filling, temporary water services from hydrants, tanker truck filling, sewer cleaning, leaks on hydrants, etc.).
- 4) valve maintenance activities (boundary valve between two different pressure zones, pressure-reducing valves within the water distribution

system, maintenance on valve stems, seats, leaks on valves, check valve maintenance and inspection).

5) water service and curb box inspection and maintenance (leaks on service connections).

6) Active leak detection programs.

7) Reservoir use (filling/emptying throughout the day, cleaning, leakage, etc.)

Most water loss can be prevented by effective and pro-active infrastructure management. The following infrastructure management activities will help reduce real water losses [7]:

1- Distribution system operation and maintenance to prevent breakdowns in equipment and the associated leakage (valves, hydrants, etc.)

2- Material and construction standards to assure quality of future infrastructure installation.

3- Maintain proper inventory to repair all sizes of main breaks or leaks

4- Inspection of new water mains; observance of pressure and leakage tests.

5- GIS mapping of system components in order to quickly find valves to isolate main breaks.

6- Report leaks, repairs, complaints, theft, vandalism, etc, by geographic location to concentrate future leakage activities.

7- Increased surveillance in areas with aging infrastructure or reported leaks.

8- Periodically checking proper operation and control of pumps used to fill storage tanks.

9- Leak detection surveys/studies and leak repair.

10- Water main rehabilitation and replacement.

11- Pressure management.

The following activities will help reduce apparent water losses:

13- Metering of all source inputs, water exports or sales, and customer accounts (includes both billed, authorized use and non-billed authorized)

14- If not going to meter hydrant usage, accurately estimate and record the water used for firefighting or flushing.

15- Billing practices designed to detect potential problems.

an estimated **six billion gallons per day** of water is taken from water resources and never reaches the customer; this is enough water to supply the drinking water needs of the ten largest cities , this number is estimated at **150 million gallons per day**. Water suppliers are experiencing real water losses due to physical infrastructure failures and apparent losses resulting from inaccurate meter readings and erroneous billing practices. As demand for water increases, it is essential to ensure that water supplies and the infrastructure delivering water are dependable and efficiently move water from source to customer [8].

1.2 Problem Statement:-

Increasingly, water loss via leakage is acknowledged as one of the main challenges facing water distribution system operations. The consideration of water loss over time, as systems age, physical networks

grow, and consumption patterns mature, should form an integral part of effective asset management, rendering any simulation model capable of quantifying pressure-driven leakage indispensable.

Water loss from a water distribution system is a significant factor affecting water delivery to customers. Water loss can be either:

- (a) The **apparent losses** due to meter inaccuracies or unauthorized consumption.
- (b) **Real losses** due to leakage at water service lines, breaks or leakage on mains and hydrants/laterals or at storage facilities

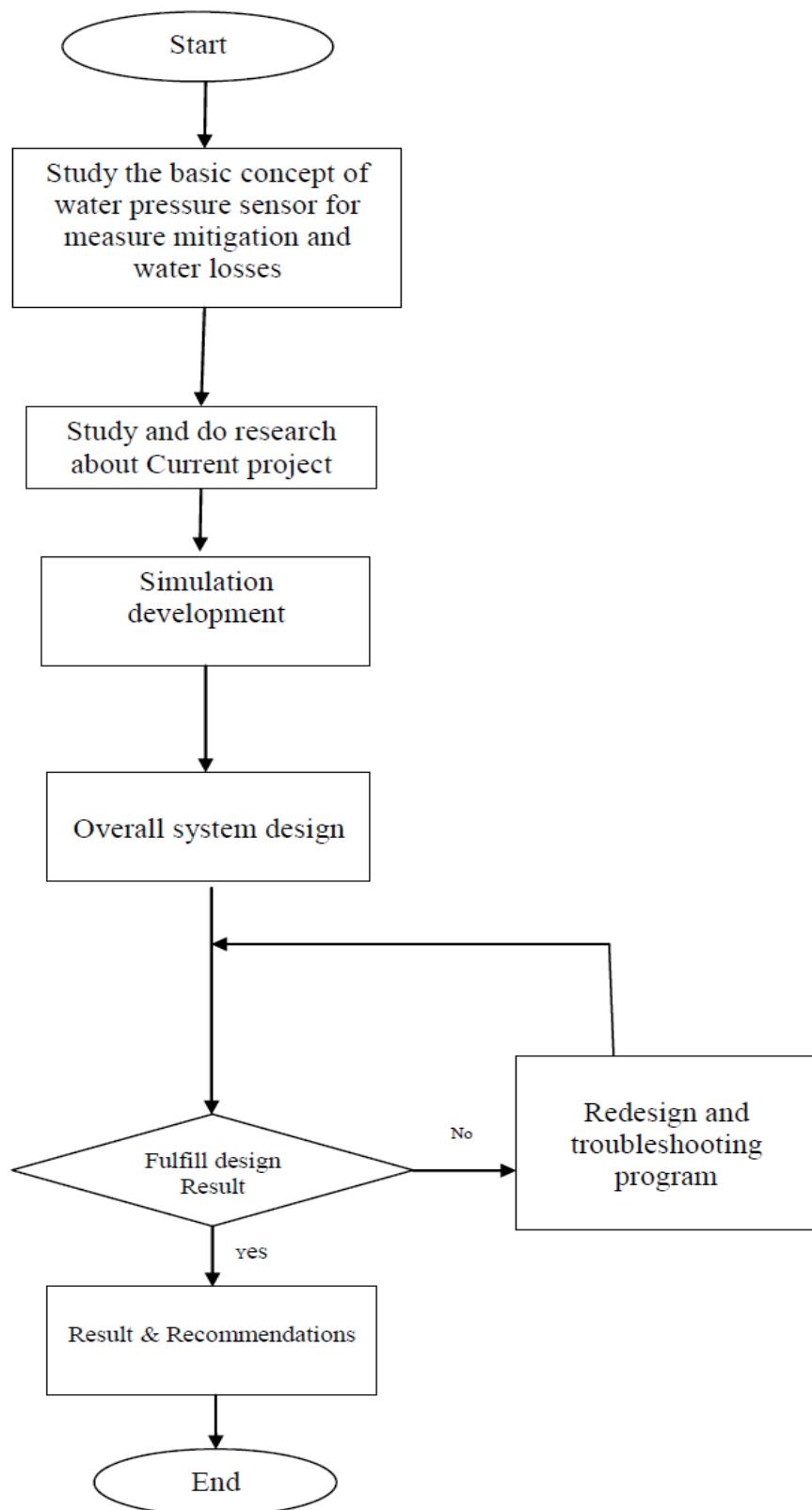
1.3 Research Aim:-

The research aims to design control circuit for mitigate water losses in distribution system ,The high quality of service, through the optimal use of the microcontroller and pressure sensor interfacing for controlling the water mitigation and losses.

1.4 Methodology:-

Presented here in is a methodology for evaluation of water losses based on discrimination of the two components of uncontrolled water in a water distribution network: physical losses in mains and service connections, and the volume of water consumed but not measured by meters. The water balance calculations consider that all non-measured consumption is uncontrolled water and consequently an apparent loss. The methodology is applicable to an entire network or portions thereof, and presumes that real losses in certain physical states of a network are a function of pressure; while apparent losses (defined as non-metered consumed water) are a function of consumption patterns (i.e., domestic, industrial, institutional, etc.). An extended period simulation of a water distribution network is employed to accurately determine both terms.

The methodology of control mitigation of drinking water losses



1 .5 Objectives:

The main objective is to design a control system to manage the water distribution system.

To achieve this objective:

- 1) A control circuit wiring microcontroller and sensor units will be designed.
- 2) A simulation for the proposed circuit will be run.
- 3) Performance evaluation for the system will be carried out.
- 4) Prototype control circuit will be implemented in order to check the performance in real time.

1.6 Scope of work:-

There are a lot of fields and knowledge that must be applied to make sure the research work on.

This research will cover areas of control and mitigate water losses in distribution system of drinking water only. Such as how this technology is working and how to apply it, the necessary equipment and devices that are going to be used and a lot more factors that need to consider.

For the implementation part, the main technology covered in this research is about RF technology. The simulation is been designed by using simulation software (PROTEUS), circuit and few electronic devices. Wireless (ASK module) where it will control the whole operation of the transmission signal. The Code vision Avr[©] language that used also must be suitable to write code.