

# Leak Detection in an IOT- enable Liquid Transmission System

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## ABSTRACT

This paper relates to an intelligent method for detection of leakage in liquid transmission systems. Leak Detection in Liquid Transmission System is performed to detect and avoid the unnecessary loss of liquid such as water, milk and oils. In order to detect the leakage in the water tank, volumetric sensors are kept in the water tank for the detection of the leakage and further a reserved tank is present underneath the main tank to store the leaked liquid with the assistance of electric valve.

**Keywords:** Leak Detection, Water, Oil, Milk, Liquid, Internet of Things, Volumetric sensors, Reserved Tank, Electric Valve, Liquid Transmission System

## 1. INTRODUCTION

The present invention relates to the field of Internet of things (IOT) in the detection of leakage in Liquid transmission system.

Liquid transmission systems are exposed to risks of leakage, even though they are well designed and built to withstand any pressure, stress, corrosion, etc. They tend to get damaged and leakages cause severe economic loss and high workload for the workers involved. Leakage cause pressure change and completely disturb the entire flow of the system.

Current methods for the detection of leakages use diagnostic methods to monitor and identify the defect based on the flow, pressure and other parameters. However, a system that measures and allows the user to control/ monitor the liquid level from the user end is not available.

To overcome these issues and provide a smart system for monitoring the complete leakage detection process, our team has developed a smart technology that detects the defects in the system and immediately informs the user/admin and also a GSM module that tracks the exact location of the vehicle whenever required.

The invention has the following advantages:

1. Volumetric Sensors to indicate the leakage
2. A microcontroller that alerts once the leakage is detected and the electric valve present in between the main and reserve tank allows the transfer of the liquid
3. Load sensors to measure the quantity of the liquid getting transferred
4. GSM module and GPS for informing/alerting the admin/user on the leakage

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## 2. DESCRIPTION

This paper discusses on an invention that includes a liquid flow optimizer and a leakage detector to detect the leakage in the mobile water tank.

By and large there are issues with respect to the leakages in the pipeline, tanks, water vessels, container of the industry. There are different techniques present that identify the leakage in the overhead water tank, vessel, boiler etc. In this present disclosure we are focusing on the leakage detection in the liquid transmission system.

The system proposes an IOT-enabled liquid monitoring system for all vehicles that are connected to a government body or a private company. The liquid monitoring system monitors the level of the liquid by detecting the leakage in the tank during the transfer of the liquid such as water, oil, milk etc.

The leakage in the tanks or the vessels are due to pitting or rusting, corrosion and some time the leakage in the water tanker is because of the slackening of the pipe or the top gate of the container might have remained open. It's not possible for driver to recognize the spillage of liquid from the container during the travel. So the present disclosure provides the system that will assist the driver to detect the leakage.

In this present disclosure to detect the leakage in the mobile vehicle a water leakage detector 101 is placed inside the liquid storage tank 100 as shown in the fig. 1. The storage tank 100 is further divided in to four equivalent chambers such as zone 1 102, zone 2 103, zone 3 104 and zone 5 105 which will be helpful in leakage detector. There is another tank present underneath of the main tank 100 which is termed as reserved tank 108 which can store the liquid in case of any emergency.

There are four leakage detectors present in that four different chambers which will detect the leakage and it will send information to the microcontroller with the help of zigbee transceiver. As soon as the microcontroller gets the information of leakage, it will send electrical signal to the electric valve of respective zone. The microcontroller is interfaced with the leakage detectors, zigbee, load sensor and GSM communication module.

There are also four electric valves present for the respective four zones. After getting the electrical signal, the respective valve will open immediately to allow the transmission of liquid to the reserved tank

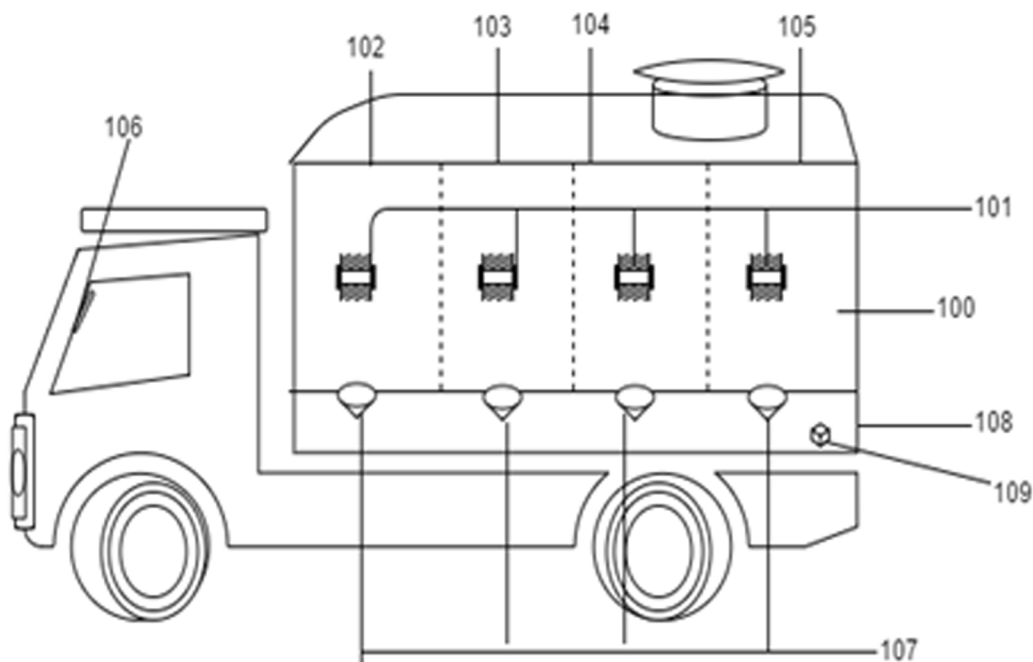


Figure 1: Liquid Storage Tank

108 from the zone which is having leakage. Further a load sensor is placed in the reserved tank to measure the volume of the transferred liquid and the microcontroller which is in interface with the load sensor will send the information regarding the quantity of liquid transferred. If further, there is any leakage in the reserved tank the alarm system will indicate the driver.

While delivering the liquid from the mobile water tank the liquid present in the reserved tank will be delivered first followed by the other four zones.

The water leakage detectors 101 present in the storage tank 100 work on the volumetric testing technique. This technique involves measurement of liquid volume which must be added or expelled from system to maintain constant pressure; volume changes indicate either leaks or thermal expansion/contraction of liquid. Based upon this technique the leakage detector will identify the leakage and inform to the microcontroller. The volumetric sensors are placed in each of the four compartment of the tank to sense the liquid volume which is added or removed from system.

Further there is a GPS system 106 which is placed in a safe housing that provides information regarding the present location of the vehicle whenever the leakage detector 101 detects the leakage in the water tank. When the leakage detector 101 detects the leak, the microcontroller will get informed by zigbee and the microcontroller will send alerting signal to the electric valve as well as to the GPS system 106 to send the location of the vehicle to the admin.

In one of the embodiment RFID can be used in place of GPS system which provides resistance to internal or external conditions depending on the placement of the RFID tag. The liquid transmission system is equipped with RFID reader that is capable of reading the information stored on the RFID device placed in each vehicle as it comes within the range of the RFID device on the vehicle. The information generated includes the details of the driver, his identity, the company to which the vehicle belongs, details of the payments between the donor and the acceptor etc. Using the RFID the admin can keep tracking the vehicle and can get information anytime he wants.

Fig. 2 explains the whole scenario that takes place in the liquid transmitting system. Whenever a leakage detector 101 detects the leakage 202, a transceiver called zigbee 203 will transmit the information to the microcontroller 204. Then the microcontroller will send electrical signal to the electric valve to open

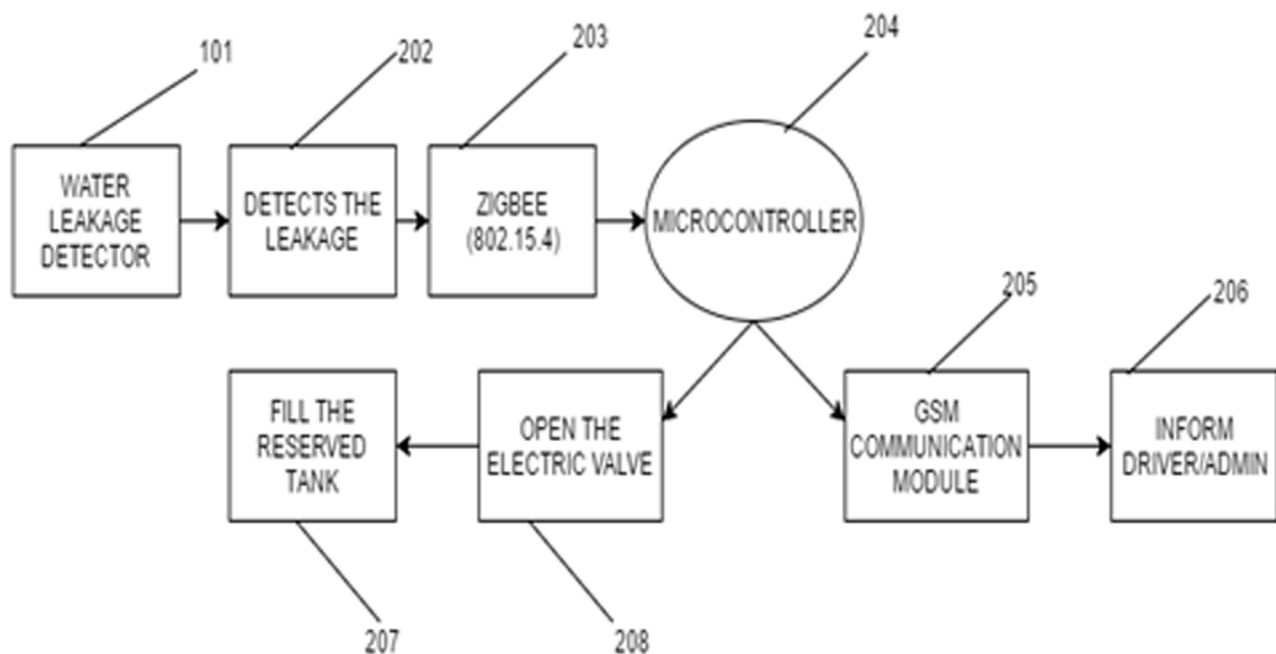


Figure 2: Scenario in the Liquid Transmitting System

immediately for the transmission of liquid 208 from leak detecting zone to fill the reserved tank 207. At the same time the microcontroller will send the information 206 to the driver and admin with the help of GSM communication module 205.

### 3. IMPLEMENTATION

The present invention provides means to optimize the flow of liquid and to detect the leakage of liquid in a liquid transmission system.

The liquid transmission system includes any mobile vehicle that are connected to a government body or a private company which carries liquid such as milk, water, oil etc.

The mobile vehicle which transfers water, oil, milk or the like from the source to the destination area there is the chance of leakage amid the journey, so to get rid of this problem researchers accompanied distinctive arrangement with various strategies

The present disclosure provides the system to keep monitoring the liquid level in the moving vehicle to avoid the important economic loss. The vehicle that carries the liquid is provided with leakage detector that detects the leakage with volumetric technique.

Further the liquid container is divided into four equivalent chamber and a reserved chamber is present underneath the main container to transfer the liquid from main container in the event of any leakage identification in any of the four chamber of main container with the assistance of electric valve.

Whenever the leakage detector detects any leakage then it will send data to the driver and the administrator with the assistance of the correspondence module to intimate them regarding the leakage as well as the transfer of liquid to the reserved container.

A GPS module is present so that whenever leakage detector detects the leak in the water tank, GPS system will send the exact location of the vehicle to inform the admin.

### 4. APPLICATION

The invention as described in the drawing finds applications in:

1. Construction
2. Mining
3. Agriculture
4. Railroads
5. Forestry
6. Power Utilities
7. Pipelines
8. Private Lands

### 5. CONCLUSION

The major advantage of the invention is it provides a leak detection in liquid containers and also methods that allows the user to control/ monitor the liquid level from the user end.

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