

AN IOT BASED SMART WATER MONITORING SYSTEM AT HOME

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Abstract— *The advancement of science and technology using present trend pacing at a high speed. The trend of trend of IOT based technology is being applied in various applications of home like water level monitoring and leak detection in pipes.*

Water is one of the most important substances on earth. People now days always want something that can make their life easier. In this thesis is used to define the water monitoring systems such as Tank water level sensing monitoring, water pollution monitoring and water pipeline leakage sensing monitoring. By using Wireless Sensor Technology we avoid the huge amount of water is being wasted by uncontrolled use of large apartments/offices.

The microcontroller (PID) based Water level monitoring is used to indicate the level of water in the tank to agent. Leak detection in water pipelines, we use the pressure into the pipe using on force sensitive resistors (FSR) generated from a leak is detected, it will be indicated by an increase in the LED meter and a rushing sound will be heard in the headset. This thesis our motivation is to prevent the water by using technologies and the monitoring system uses daily life device like laptop or mobile phone.

The unnecessary wastage of power also can also be cut down by this system. It can be low cost installation on a rural home and can be extended to bigger projects also.

Keywords— *PID, LED, wireless sensor, Bluetooth technology, Arduino*

I. INTRODUCTION

Present days Water is a limited resource and is especial for agriculture, industry and for creatures existence on earth including human. Lots of people don't realize the true importance of drinking enough water every day. More water are wasted by many uncontrolled way. This problem is quietly related to poor water allocation, inefficient use and lack of adequate and integrated water management. Therefore efficient use and water monitoring are potential constraint for home or office water management system.

II. LITERATURE SURVEY

Water is a limited resource and is essential for agriculture, industry and for creatures existence on earth including human beings. Lots of people don't realize the true importance of drinking enough water every day. More water are wasted by many uncontrolled way. This problem is quietly related to poor water allocation, inefficient use, and lack of adequate and integrated water management. Therefore, efficient use and water monitoring are potential constraint for home or office water management system. Every living thing on earth needs water to survive. Human bodies are made up of more than 60 percent water. We use clean water to drink, grow crops for food, operate factories, and for swimming, surfing, fishing and sailing. Water is vitally important to every aspect of our lives. Monitoring the quality of surface water will help protect our waterways from pollution. Farmers can use the information to help better manage their land and crops. Our local, state and national governments use monitoring information to help control pollution levels.

III. INTERNET OF THINGS

The Internet of things (IOT) is the network of physical devices, vehicles, and other items embedded with electronics, software, sensors, actuators, and network connectivity which enable these objects to collect and exchange data. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure. Experts estimate that the IOT will consist of about 30 billion objects by 2020. The IOT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. When IOT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, virtual power plants, smart homes, intelligent transportation and smart cities.

IV. SYSTEM ARCHITECTURE OF WATER MONITORING SYSTEM

In Fig-1 depicts, It defines the overall architecture of water monitoring system. A sensor is a hardware device that produces a measurable response signal to a change in a physical condition such as temperature, pressure and humidity. The continual analog signal sensed by the sensors is digitized by an analog-to-digital converter and sent to the embedded processor for further processing. A sensor node can have one or several types of sensors integrated in or connected to the node. First the water level indicator is used to indicate level of water in the tank. LED light sensor will fixed in the side of the tank. In the tank we fixed the Number of Led light based on size of the tank. For example: We use LED 1,LED 2 and LED 3 sensor fixed. LED 1 is the lowest point, LED 2 is the middle point and LED 3 is the highest point. When the water will reach the Lowest Point LED 1 sensor light, The microcontroller (PID) will passed the input signal to the pump and the pump will automatically ON.

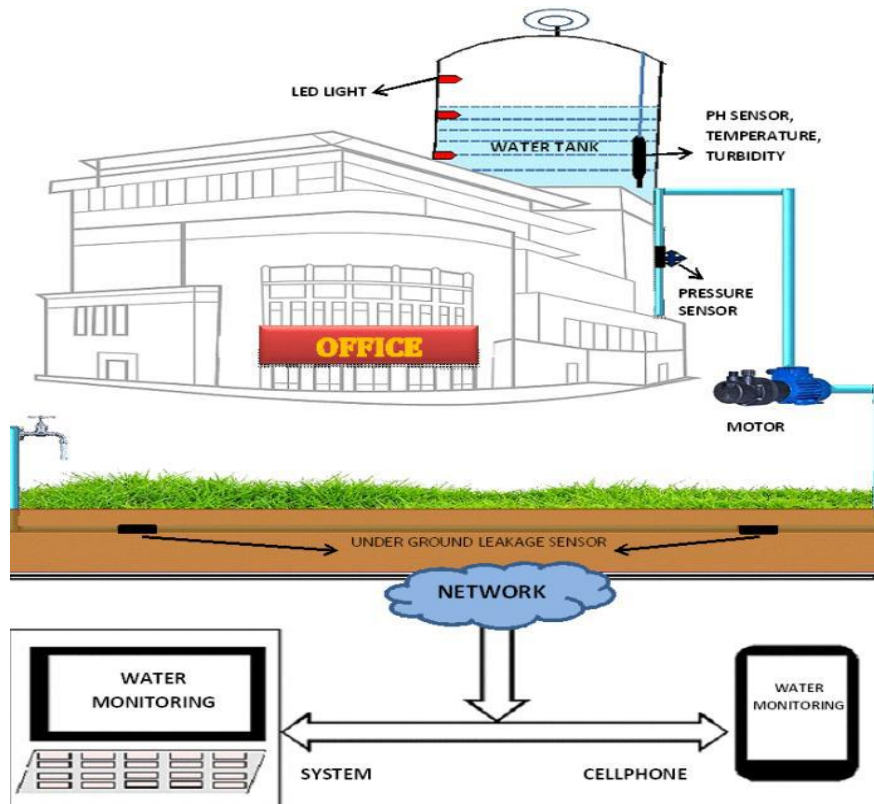


Fig 1: SYSTEM ARCHITECTURE OF WATER MONITORING SYSTEM

V.WATER LEVEL SENSOR

The technique of tank water level sensing system monitoring concentrated with some basic parts which are softly aggregated together in our proposed method. The water level sensor is a reliable circuit. It takes over the task of indicating the water level in the overhead water tanks. It is being used to detect liquid level, as the liquid to be measured either can be inside a water tank. Basic descriptions of some parts are described below

- Water Level Indicator: In water level indication unit we can use some LED light which will work for water level indicate.
- Water Level Sensor: To make special water level sensor we would like to introduce some convenient materials such as Iron rod, nozzles, resistance, rubber etc.
- Water Pump Controlling System: We can control the water pump by connecting it with an output pin of microcontroller to a motor driver circuit. When microcontroller sends a positive signal (+5v) or a ground signal (0v) to the motor driver circuit.
- Microcontroller : Microcontroller is a computer on a chip that is programmed to perform almost any control, sequencing, monitoring and display the function. In addition, the current is changed up to positive signal (+5v) to ground or its reverse then the inductor can tolerate some resistance as shown in Fig-2. For this reason we should use a diode. An on/off switch is used to control the motor driver circuit manually.

The system we should use some necessary parts such as PIC 16F84A microcontroller, Crystal Oscillator, 2 capacitor having capacitance 22 pF and 27 pF, inverter, LED, water tank, water level sensor, water pump, transistor, inductor and some capacitor. The graphical Figure of the whole circuit diagram is shown in figure.

If four pins RA0, RA1, RA2 and RA3 gets ground signal (0v) that means there is no water in the water tank. So, all LEDs should be off. We can also set this issue more intelligent way, if pin RA3 senses ground signal then we can be sure that there is no water in the tank. And if we found pin no RA0 senses positive signal (+5v) then we can tell that water tank is full of water. So, when water tank is empty then water pump should become on and all LED light becomes off. If pin no RA3 gets positive signal (+5v) and other three gets ground signal (0v) that means water tank has 1/4th water. For this reason water pump remains on and the first LED should be on now; other three LEDs are still remaining off. If the four pins RA0, RA1, RA2 and RA3 get positive signal (+5v) that means water tank is now full of water.

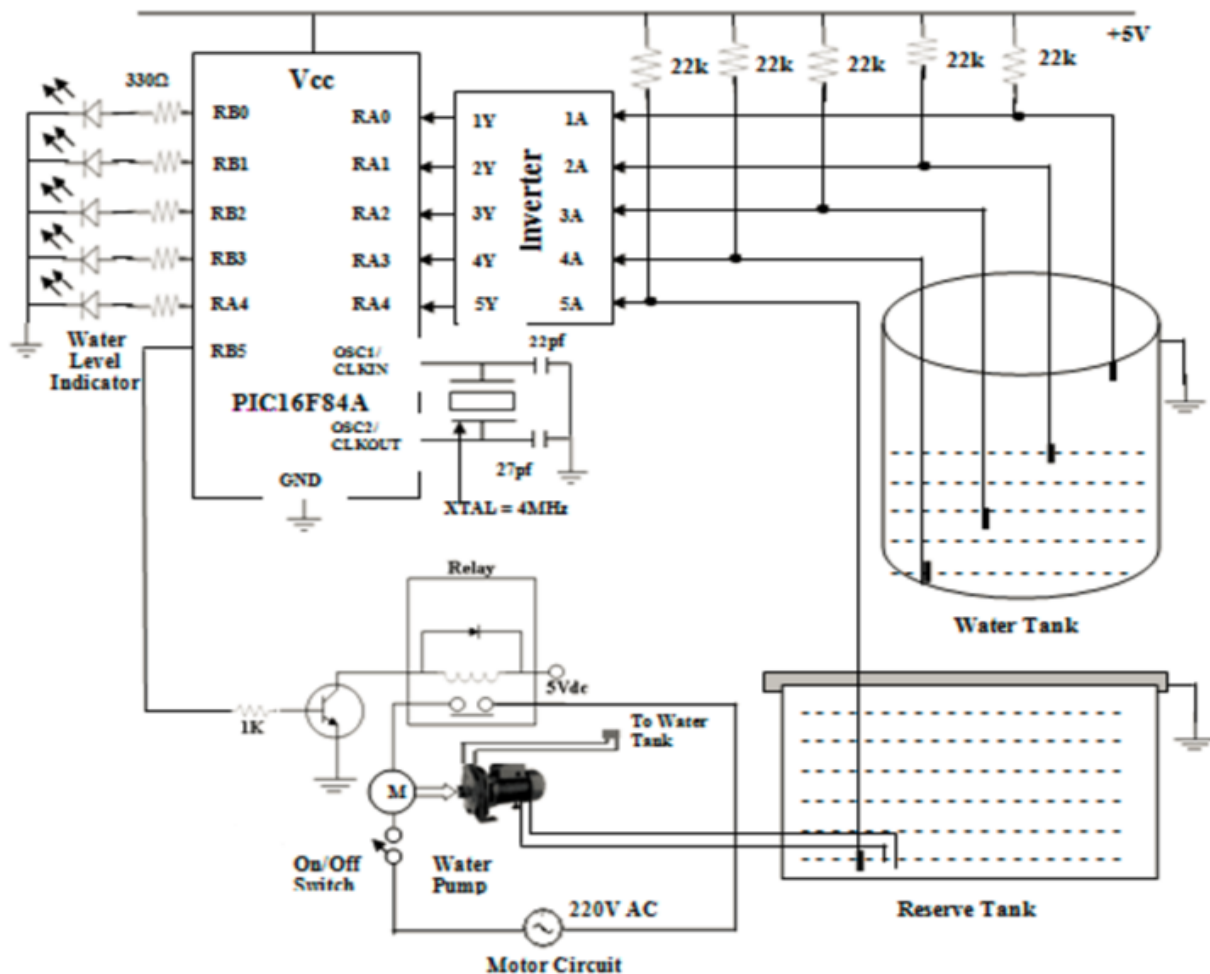


Fig-2: Liquid Level Sensor Block Diagram

VI. PIPE LEAK DETECTION SENSOR

Leak detection in water pipelines, which will detect the leakage in the pipelines. When an ultrasonic leak detector is produce the ultrasonic signal generated from a leak is detected, it will be indicated by an increase in the LED meter and a rushing sound will be heard in the headset. And force sensitive resistors (FSR) is used for pressure measurements to find the leak. Common pressure sensors used to measure the pressure inside water pipes require pressure tapings or special valves that allow access to the sensor to the inside of the pipe A novel, relative pressure sensing method based on force sensitive resistors (FSR) is used for pressure measurements in the proposed UWSN for pipeline monitoring. This system operates based on the principle of a changing diameter of the pipe caused by an internal pressure change.

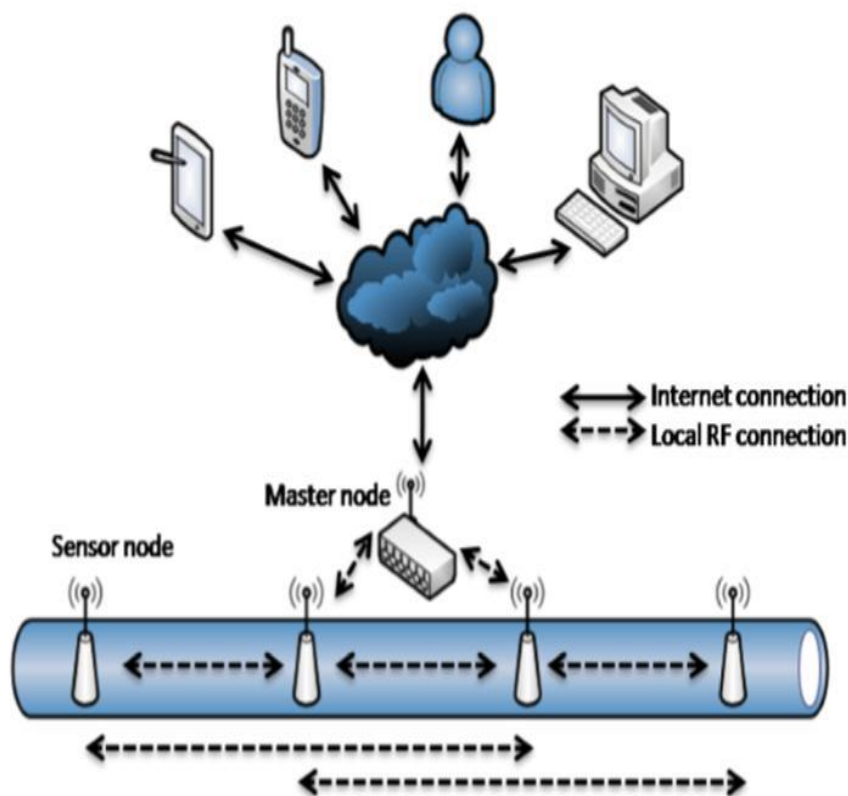


Fig-3: Underground Wireless Sensor Network (UWSN) for a Pipeline System

Fig-3 depicts, In UWSN each node communicates with both nodes in front and behind itself via RF signals. For every 4–5 nodes (up to maximum of 10 nodes) there is a master node which has the capability to communicate with the sensor nodes via RF transmission. Moreover, these master nodes should be able to connect to the internet and transmit the received data from the nodes to the cloud. Data in the cloud can then be accessed via different devices with internet connectivity.

The ideal sensor for pipeline monitoring should be non-invasive to the pipe, low in power consumption and easy to install. Furthermore, they should be able to gather useful information without extensive data processing or high sampling rates. One of the key parameters in pipeline monitoring is the internal pressure of the pipe. Leaks or blockages can potentially alter the normal pressure in the pipe and hence monitoring the pressure can potentially help to identify these. Temperature measurements of a pipe and its surroundings can also provide useful data in pipeline monitoring. A slow leak might not have a major effect on the internal pressure of the pipe, but it can potentially change its surrounding temperature profile.

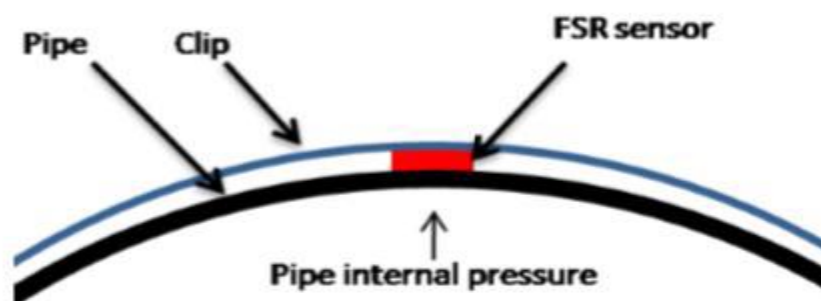


Fig-4: Schematic Of The Pressure Sensor Assembly FSR Sensor

Common pressure sensors used to measure the pressure inside water pipes require pressure tapings or special valves that allow access to the sensor to the inside of the pipe that shown on Fig-6. A novel, relative pressure sensing method based on force sensitive resistors (FSR) is used for pressure measurements in the proposed UWSN for pipeline monitoring . This system operates based on the principle of a changing diameter of the pipe caused by an internal pressure change.

VII. WATER MONITORING SYSTEM

VII.I Results of Tank Water Level Monitoring

The program we used to control the entire process is written in ATmega328 microcontroller's assembly language. All the codes have been tested and simulated using MATLAB Proceedings software which is provided by MICROCHIP. The external timer we have used in our system is a Crystal Oscillator (XTAL) 4MHZ. When the system powered up, microcontroller took the input from the water sensor through the inverter. Inverted inputs from RA0, RA1, RA2 and RA3 of microcontroller are loaded by register and its combination is being checked.

When the water is decreasing from the tank by home use, the display LED should start to become OFF one after another from the top to bottom. If all the LEDs becomes OFF that means the tank becomes empty again and the water pump should become automatically ON again exactly after the last LED becomes OFF. These operations should automatically perform as a cycle. The corresponding experimental result is presented here (see Table 8.1).

The combination checking was done in the following way. A) When microcontroller gets the first pin signal then it loads the signal to its register. After that it checks the next pin signal and then loads it to its register. Other pin signals operation also done respectively in the same way. Finally it loads all (four) required pin's signal to the register. By using these four signal combinations it decides an output and sends that signal to the output pin. B) The whole operation makes a cycle or repeats itself with respect to the input signals.

INPUT FROM WATER SENSOR		OUTPUT						
Res. Tank	Water Tank	LED 1	LED 2	LED 3	LED 4	MOTOR	TANK	Res. TANK
0	0000	OFF	OFF	OFF	OFF	OFF	EMPTY	EMPTY
1	0000	ON	OFF	OFF	OFF	ON	EMPTY	WATER EXIST
1	1000	ON	ON	OFF	OFF	ON	1 / 4	WATER EXIST
1	1100	ON	ON	ON	OFF	ON	2 / 4	WATER EXIST
1	1110	ON	ON	ON	ON	ON	3 / 4	WATER EXIST
1	1111	ON	ON	ON	ON	ON	FULL	WATER EXIST

Table-1: Experimental Result of Water Level Sensing Unit

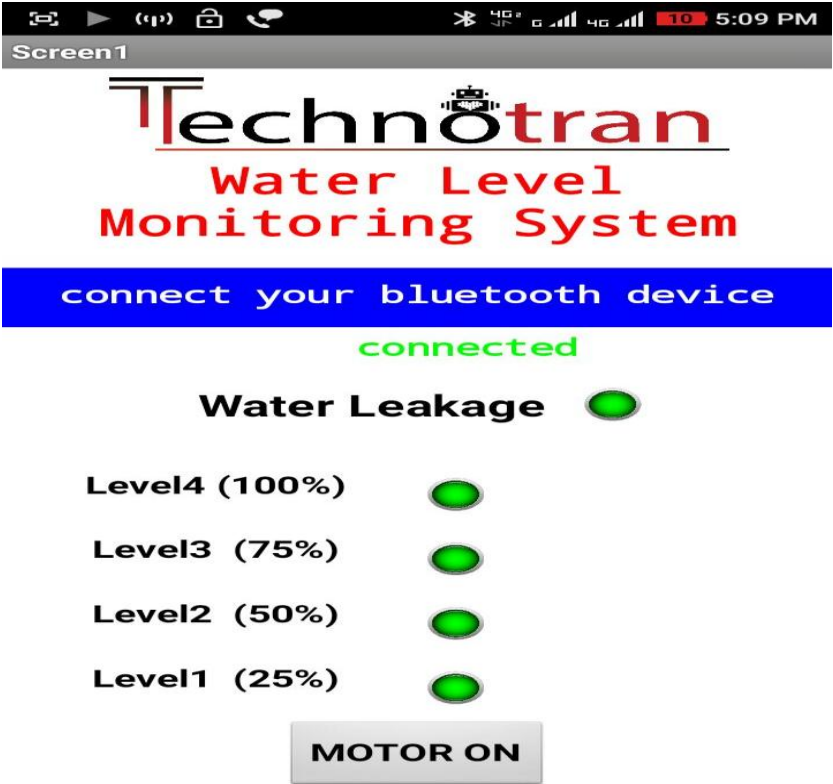


Fig 5: Tank full

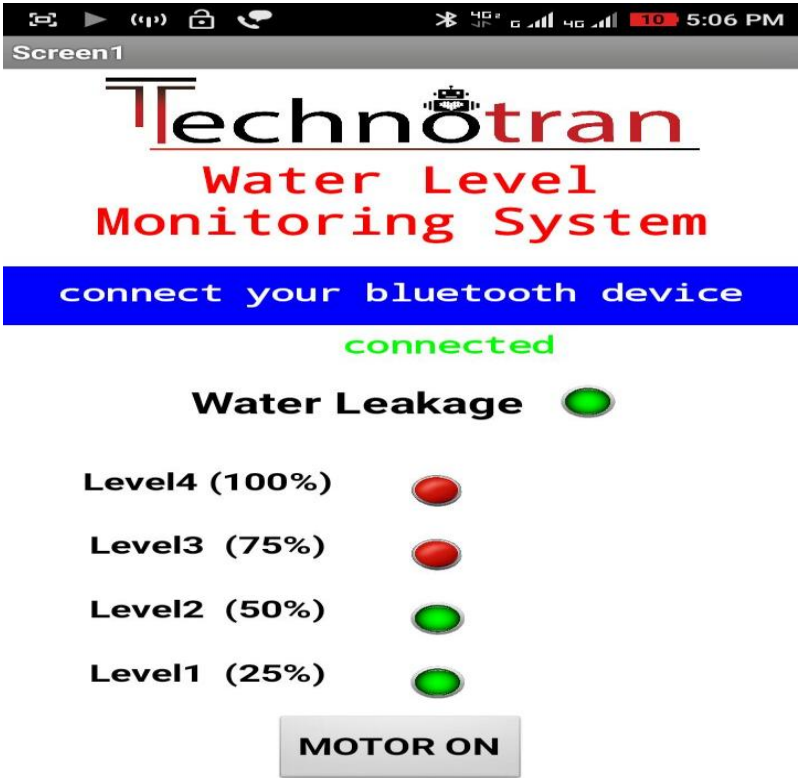


Fig 6: Half Tank full

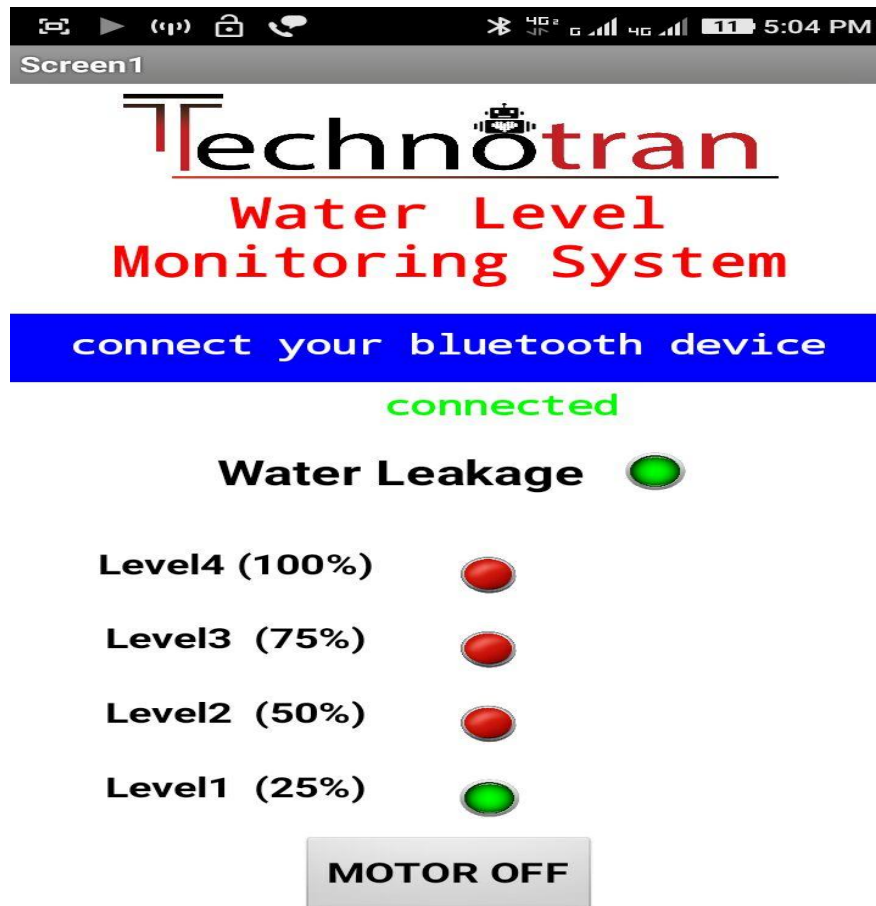


Fig 7: 1/4 Tank full

VII.II Results of Tank Water leakage

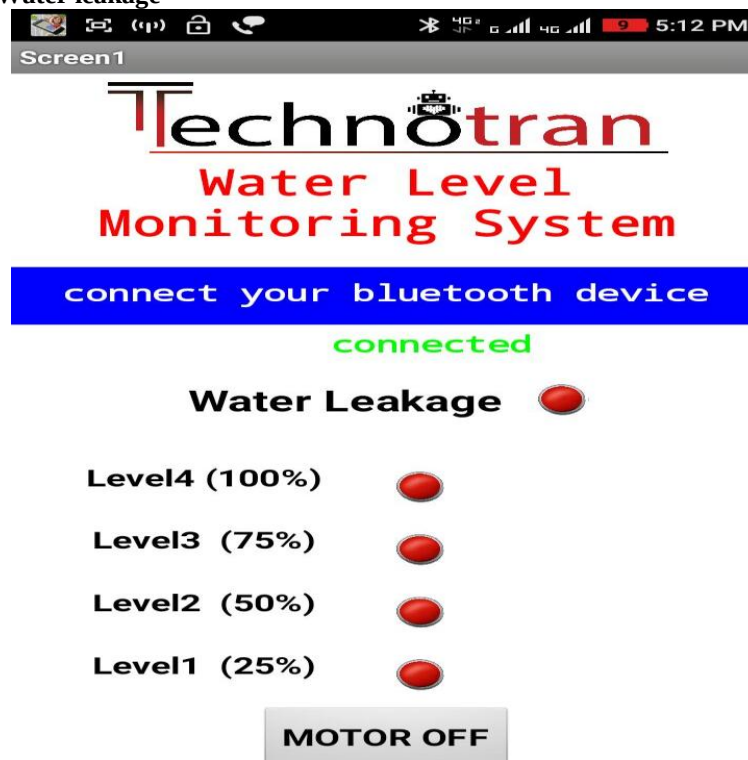


Fig 8: Water leakage

V. CONCLUSIONS

Water is one of the most important basic needs for all living beings. But unfortunately a huge amount of water is being wasted by uncontrolled use. The main issue that is being addressed in this project is about developing an efficient wireless sensor network (WSN) based water monitoring system. Three different ways to monitoring the water such as water level monitoring and water leakage monitoring. Finally the water monitoring system of smart homes concept will be completed by using wireless sensor technology. By using the monitoring system we can easily prevent the water and the water will be save to our generation.

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