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One Water System Design

Our product One Water is a must in today's scenario where water is getting scarcer. Every few years, the situation of drought appears in many areas of the world. Nearly 1 billion people in the developing world don't have access to clean and safe drinking water. Yet, we take it for granted. Designing a solution which is cheap requires understanding the basics of water consumption which gives an indication that the maximum of fresh water (about two-thirds of global water use) gets used in agriculture and about 60 % of that is wasted in leaks and inefficient techniques.

Nascent Info Technologies, with its strong research and development team, has designed an innovative solution that can help reduce the wastage of water in irrigation.

This white paper elaborates on the design approach and technology exposure for One Water for water management.

Managing this problem:



Contents

Preface	3
Concept	4
The Solution	5
System Description	6
Design Challenges And How We Addressed Them?	8
Hardware	8
Software.....	8
Field Testing / Data Collection	8
App	8
Potential Benefits.....	9
Farmers	9
Government.....	9
Other Citizens.....	9
About Us	10
Contact Us.....	10

Preface

Our clean and safe drinking water is derived from fresh water. Nearly 1 billion people in the developing world don't have access to clean and safe drinking water. Yet, we take it for granted. Not only this, the water we use for our day to day activities is all fresh water. Fresh water is naturally occurring water on Earth's surface in ice sheets, ice caps, glaciers, icebergs, bogs, ponds, lakes, rivers and streams, and underground as groundwater in aquifers and underground streams. All the water we get from taps is fresh water. We cannot use the saline water available abundantly all over the world.

Time has come that we realize that we should never waste water.

In the summer of 2016, India faced drought in 13 states. Hence, fresh water could not be used for maintaining the cricket grounds. So matches were moved from drought hit areas to other places.

May be, we would not have faced this situation if we had planned agriculture well! Yes, agriculture! 2.5% of world's water is fresh and the rest is saline, out of the total fresh water only 1 % is accessible. Agriculture accounts for two-thirds of water use globally, and it is predominant in developing countries. Almost 60% of the water is wasted due to leaks and inefficient techniques. This is attributed to the waste of water due to inefficiencies. In Gujarat 85% of available water is used in agriculture and 80% irrigation is done by ground water.

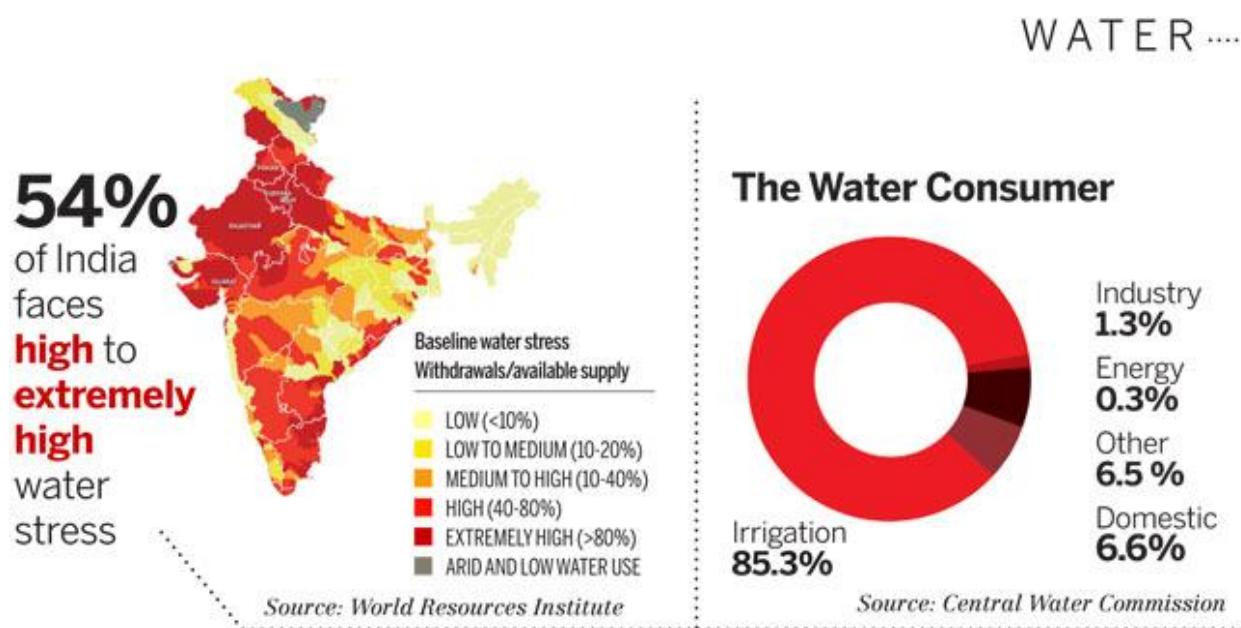
That is, if we had saved the water wasted in irrigation, and channelized the excess water to arid places (through canals), not only that we would have saved water crisis but also farmers from suicides.

Concept

The concept of the solution is to save water in irrigation. As shown in the infographic below, 85.3 % of the water consumption in India is in irrigation. And we all know how many farmers do not go for drip irrigation. We want to save water spent in drip irrigation also. We do it by automating it, i.e. making it soil moisture based.

So, when the soil moisture is below a lower threshold, drip irrigation would start and when it is above a higher threshold, it would stop. This ensures that water is supplied only when required and its supply is stopped when there is no need.

This will help save water tremendously given that most of the irrigation done today in India is not drip based.



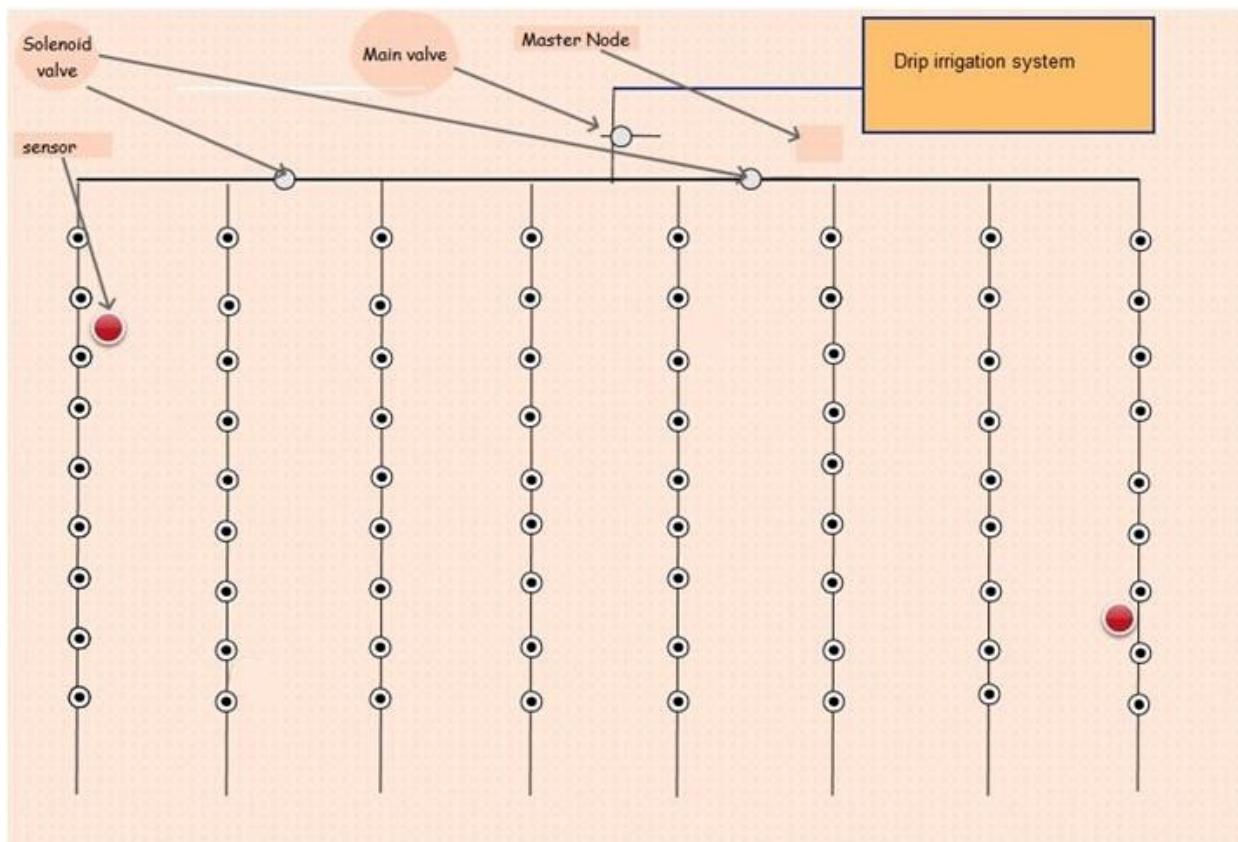
The Solution

Water can be saved on the largest possible scale by automating drip irrigation and using such a system in almost all possible farms. It will end many problems of society including farmer suicides and education of rural children who go for filling water instead of going to schools.

We optimize the water use in drip irrigation by automating it. Soil moisture sensor nodes are used to measure the need of water by crops and they communicate it to the master node over a multi-hop ad hoc network. Automatic solenoid valves are valves which can be turned on or off automatically.

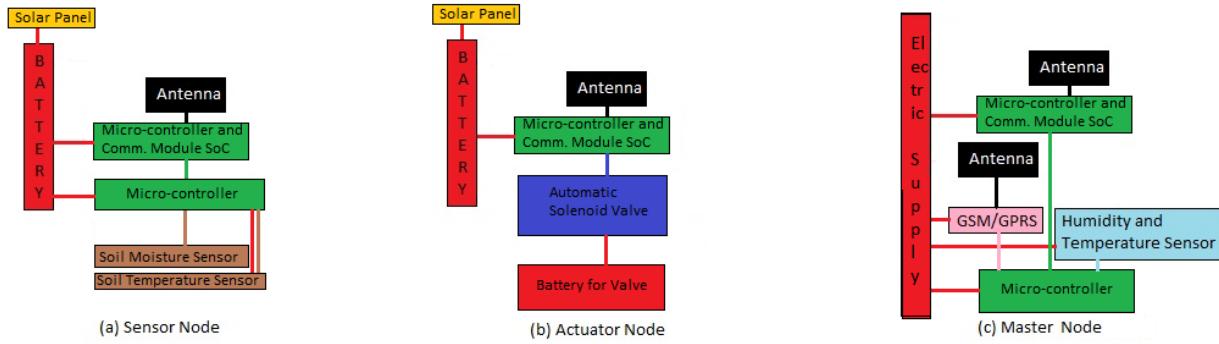
The master node gets data from all nodes in the network and relays them to the server using a GSM/GPRS module.

The different nodes will be deployed as shown in the below diagram.



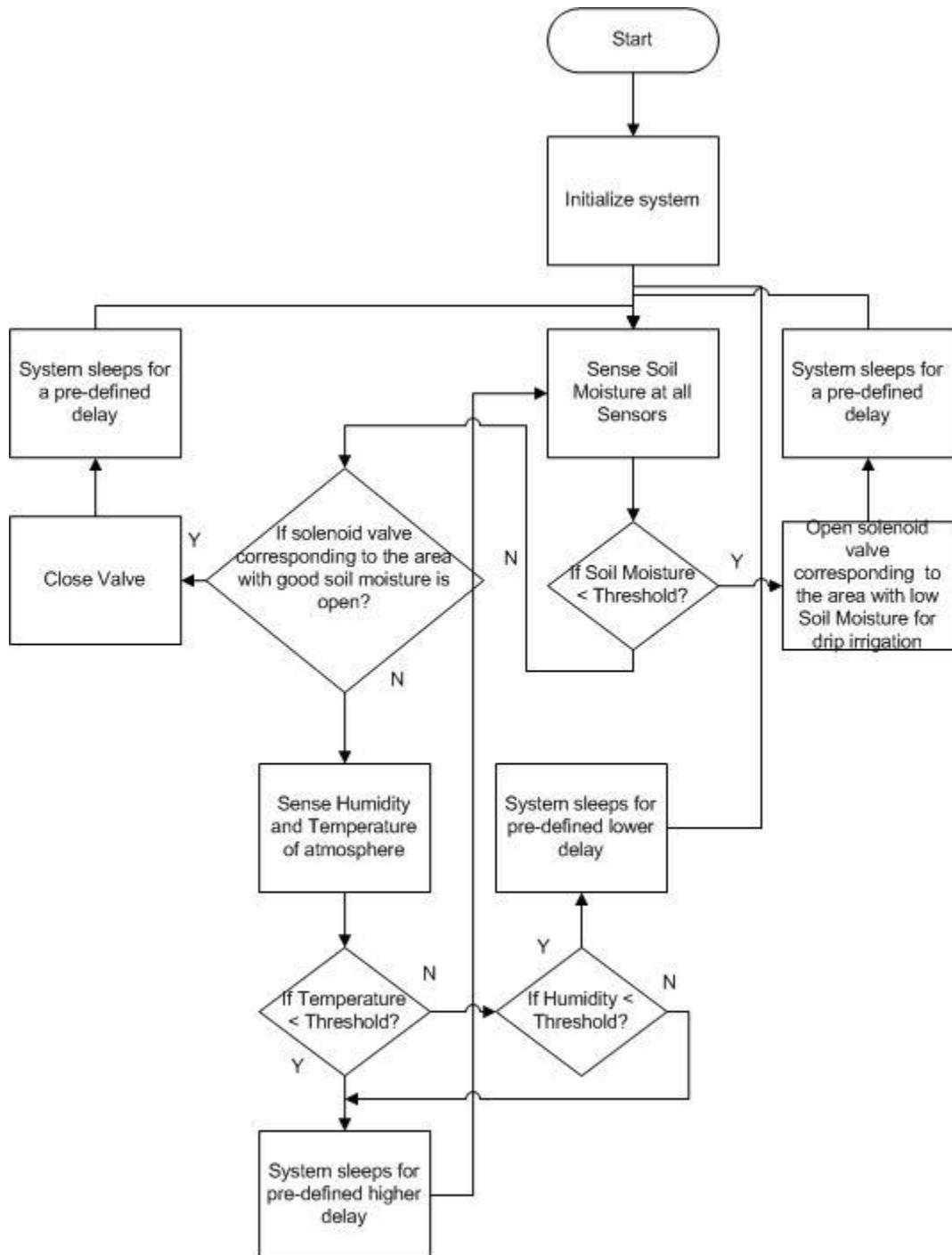
System Description

Using soil moisture sensors and automatic solenoid valves, with microcontrollers and wireless transceivers (communication modules), we built a solution that can be used for saving water on a large scale.



The components of the nodes are as shown in the above diagram.

The microcontroller + communication module is a System-on-Chip (SoC) which consists of a processor with peripherals and a wireless transceiver on a single chip. As its form factor is small, it has very few pins, but as we do not have many peripherals, we do away with them only and thus reduce the size of node.



Flow-Chart for System Operation

Design Challenges And How We Addressed Them?

Hardware

- Few SoCs got damaged: A couple of SoCs got damaged in our process of learning. We tried to debug the boards and identify the cause of problem. Then we made best possible use of the remaining functionality of the damaged chips. One SoC was not going into sleep mode, reason still unknown.

Software

- Mesh network: For implementing a mesh network out of the given set of nodes which can communicate over wireless medium, we implemented a routing algorithm for communicating any node on the network from the master node. This can be easily extended to form a mesh network.

Field Testing / Data Collection

- Node design: We started with data collection with two nodes – one sensor node and a master node. We put both of them in Sintex boxes and kept them on ground and antennas were stuck to the boxes horizontally i.e. parallel to ground. This caused the wireless communication to fail many times. Our solar panel on sensor node was also not working to charge the battery because its circuit was running the sensor node as well as charging the battery. So the experiment of field testing failed in just five days when the battery of sensor node got depleted. Then we moved to sticking the two boxes to two poles and changed the circuitry of solar panel to charge only the battery. Then it worked.
- Electricity: For field testing as well as pilot testing, we required electricity to the master node because GSM/GPRS SIM900A board requires 2 A current at 12 V DC supply which is too much to be supplied by a battery.

App

- Decision of going with app: We carried out a survey of rural people in a few villages to find out whether the people who go for drip irrigation use smartphones.

Potential Benefits

In lines with the Nascent's mantra of "Technology Exists To Advance The Human Race", we hope that the following class of people will benefit from our product.

Farmers

- Farmers would benefit by lesser consumption of water and electricity and better crop productivity.
- In the long run, if ground water table rises and canals provide water to all arid areas, then this can even help in stopping farmer suicides!

Government

- In the long run, if government understands the utility of this product and hence promotes this product, ground water table will rise and canals can be built to provide water to all arid areas. This will in turn lead to better prosperity of the country at large and hence help the government in easing its governance policies for agriculture.

Other Citizens

- Definitely, the citizens of the country will benefit from this product at large by getting water supply adequately without frequent conditions of droughts.

About Us

Nascent Info Technologies Pvt Ltd, an Ahmedabad based CMMI Dev Level 3 certified IT / ITeS company which is into software and applications development as well as into Digital Communications.

Nascent Info Technologies specializes in the business of providing services like Software design and development, product planning and development, mobile apps development, data centre management, data centre consultancy and technical support, GIS application development and deployment and Digital Media campaign management. Our expertise helps in reducing costs and enhancing output by bringing the strategic advantage of Software Outsourcing.

Nascent deals with PHP and other Open source technologies, adding Value to information system through R&D. Crafting machine intelligence in line with human intelligence.

Nascent has developed various wide ranges of Mobile apps for smart phone, useful apps for travelers, Book readers, developed comprehensive apps for conducting Survey and integrated apps for ERP as well as decision making mobile based apps for tourism.

We are also dealing in GIS based products and services. Nascent has developed decision making web based tools for hospitality and power sector. Provided services to urban development authorities and municipal corporation authorities and in private sectors too.

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