

AICTE-ECI-ISTE Chhatra Vishwakarma Awards

“Empowerment of Villages through Technologies “

PROJECT SUMMARY

Project Name: Nava-Sechanam

Team Name: Y E S C (Young Engineers for Social Cause)

Team Lead & Members:

Team Lead	Member	Member
Ritam Gupta Roll No: 16UEC084 Third Year (5th Semester) Student LNMIIT Jaipur, Rajasthan	Mradul Maurya Roll No: 16UEC136 Third Year (5th Semester) Student LNMIIT Jaipur, Rajasthan	Manvendra Singh Roll No: 16UEC063 Third Year (5th Semester) Student LNMIIT Jaipur, Rajasthan

Mentors name: Dr. M V Deepak Nair

Institute Name & Address: The LNM Institute of Information Technology, Jaipur
Rupa Ki Nangal, Jamdoli, Jaipur, Rajasthan, 302031.

Sub-Theme: Water and Irrigation

1. Title of the Innovation Proposal:

“Adaptive and Affordable Sensor Network Based Irrigation System”.

2. Project Description:

Our proposed project is an effort to provide solution to simplify the life of farmers by utilizing hi-tech engineering solutions for irrigation. The main focus of our team is to improve the savings of the farmers and improve quality of crops utilizing cutting edge but cheaper engineering solutions.

2.1: Development Challenge and Market Need

India holds 157.35 million hectares of agricultural land, ranking 2nd worldwide in terms of agricultural land holding capacity. Moreover, financial year 2017 recorded an upsurge of 8% compared to the last year, which accounts for 273.83 million tons of food grain production in India which is a significant sign that demand for technological advancement in agricultural field is high and is growing faster than ever before.

India accounts for 4% of freshwater resources which is unevenly distributed and around 42% of the total cultivable land lies in drought prone areas. According to facts, 54% of India's net sown areas are dependent mostly on rain. The imprudent usage of groundwater sources (62.7% in 2012) through tube wells has also raised several sustainability issues. Hence, water management is a prime concern in irrigation.

As per available estimates, from the total cultivable area of 328.7 m.ha, about 120.4 m.ha (i.e., 37%) is affected by various kind of land degradation. Thus, a proper automated system is required for systematic and smooth running of the process of irrigation and farming, which should be adaptive in nature according to the type of soil, water required by the type of crop, etc.

In 2014, crop failure accounted for 16.84% of the total 5,650 farmer suicides. Pertaining to the above problems there is urgent need of a solution for water and electricity problem, thereby also increasing the yield and reducing human effort.

2.2: Proposed Innovation of Solution

Our group has exploited the latest technologies such as embedded systems, wireless communication and sensor networks to serve the farmers of our country by developing very cheap and robust solution to improve the irrigation techniques used in India.

Our proposed solution for intelligent, cheap, secure and advanced irrigation technique has following features:

- ***Self-healing and expandable wireless sensor network*** (supports maximum 256 sensor nodes) for automatic irrigation systems which can cover farm ranging from in-house green house to open field farming.
- Use of solar panels for individual sensor nodes and coordinator node generates almost ***zero carbon footprints***, therefore our solution is a completely green technology for irrigation.
- Depth and moisture based algorithms to control the water pumps to minimize wastage of water and power consumption, therefore this project is following the mantra of ***more crop per drop***.
- ***Robust and secure network*** consisting RF links, GSM links and GPRS links with optimal power utilization of power.
- By this project we are ***attempting to design and deploy world's cheapest sensor network based highly intelligent and fully automatic irrigation system for Indian farmers and agriculturists***. We are also supporting ***Make in India*** campaign by designing and developing sensors and algorithms within our institute

Most of the automatic irrigation systems available in the Indian market only tests the presence of waters in the agricultural land, whereas our proposed solution will not only test the presence of water, it will also measure the moisture content at different depths below the surface of land (*Experimental results are reported in appropriate sections*). Such a solution will allow the farmers to optimize the usage of water for crops according to the different phases of the crop.

Capacitive sensor used in this project is developed and tested indigenously by our team (***with the support of our institute***). Experimental results shows that the capacitive sensors developed are highly accurate, robust and much cheaper than any similar sensors available in the market.

1. They can be integrated into a printed circuit board or a micro-strip to offer non-contact sensing with very high resolution.
2. They can be used for liquid level sensing. Since they are non-contact based, such sensors can be deployed in soil or water without fearing corrosion or oxidation.

3. The sensor developed is highly immune to temperature, humidity or mechanical misalignment, and shielding against stray electric fields is simple compared to other sensor techniques.
4. Capacitive sensor developed by our team consume very little power (i.e, few microwatts) which allows battery life of the node to be extended to couple of years.
5. We have developed a very accurate but cheap sensor for this project keeping in mind the Indian farmers.

2.3: Technology Used

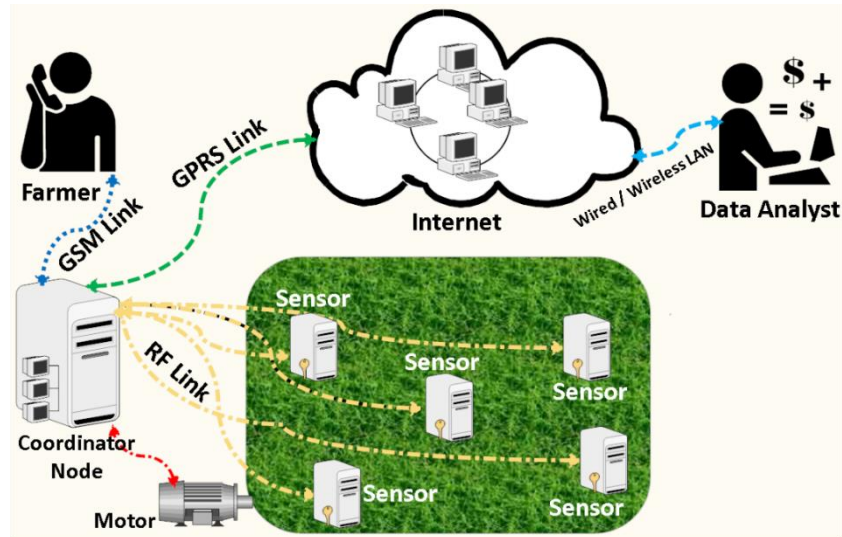


Figure1. Overview of the Proposed Project

Figure shown above depicts the broader image of the solution provided by proposed project.

Wireless sensor network with depth and moisture based algorithm to control the water pumps to minimize wastage of water and power consumption required the following the technology:

1. **Wireless networking using nRF24L01** sensor nodes are used to design and implement adaptive, robust, power efficient and secure mesh network.
2. **Capacitive sensor** technology to measure the depth of water and moisture levels below the soil. Hardware design implemented by us, using printed circuit board, is highly efficient in detecting and measuring the presence of water at different depth under the soil.
3. Using **GPRS** technology, the sensor data of all the nodes in the network is sent to the cloud which can be processed further for water and power optimization purpose.
4. Using **GSM** technology, information of the power consumed by the motor is transmitted to the mobile handset of farmer.

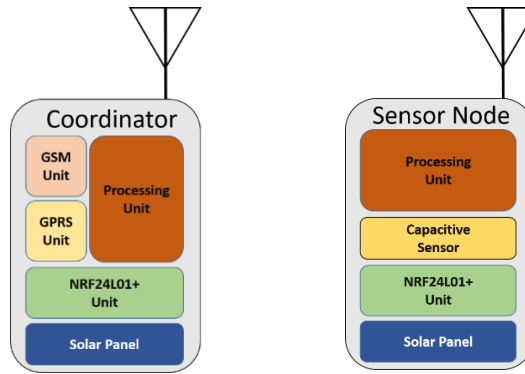


Figure 2. Coordinator Figure 3. Sensor Node

2.4: Target groups, size of market and immediate and long term benefits

Target Groups and size of market: In India, which has approximately 600 million farmers, vast diversity in farming techniques and heterogeneous soil portfolios, the size of market for intelligent, greener and cost effective irrigation system is huge. Also, keeping in view the economic conditions of most of the farmers in India, our product, which is much cheaper than any other competitive solutions available in the market, holds a great opportunity to set foot in and expand with rapid pace the market. Our product is beneficial for farmers having small to large farming land, gardeners, greenhouse cultivators and large agricultural production firms.

Our proposed project will provide the following *short and long term benefits* to our nation:

- Reduce financial burden on farmers by reducing power wastage, better water management, higher and better yields of crops, leading to lesser depression and suicides in Indian farming community.
- Efficient and effective farming technology providing latest cutting edge solutions using embedded systems and sensor networks.
- Since our goal is to develop a complete open source technology in irrigation systems, such a system will motivate youth to utilize this technology and serve our country for a better cause.
- Future goals of this technology are to introduce and implement only green resources (like solar panels) to almost nullify carbon footprints in the environment.
- Support government visions like more crops per drop and achieve the targets of second green revolution.

2.5: Implementation in the market

In a country like India with approximately 600 million farmers, huge diversity in farming techniques and heterogeneous soil portfolios, developing a distribution channel strategy is a big challenge. Given these dynamics, in initial phase we will be focusing on launching and distributing our product in Indian market using some of the government and private distribution channels.

Government of India has launched many platforms and schemes under which farmers can buy products and farm machinery at subsidized price or on lease. For online distribution, government has put on several websites which are maintained by government agencies such as ***Kisanpoint*** and ***farmers' portal***. For private channels, we will focus on different credit societies such as Primary

Agricultural Credit Society (PACS). We will try to connect to these channels in the initial stages for raising awareness among farmers and also for launching our product.

Our product is to be used as a tool by farmers, gardeners and large agricultural production firms. Using our product, farmers can save a lot of money, time and water compared to manual irrigation systems. We are providing a fully automated sensor network-based irrigation system, which will give farmers the freedom to control the irrigation process without being physically present at the field.

Team Capability & Competency (maximum 100 words)

Our team consists of three members and we all three are pursuing B.Tech. in electronic and communication engineering from LNMIIT, Jaipur, Rajasthan. Since last two years our team is involved in designing and developing simple solutions for day to day problems using embedded systems. The team leader Ritam Gupta has been actively involved in finding important problems around us and he coordinates the team by making roadmaps and timelines for the completion of the projects at time. Mradul takes care of developing codes and hardware solutions for the projects undertaken by the team. Manvendra is highly motivated member of our team involved in coding and developing CAD solutions. We all three are actively involved in our research activities by gaining knowledge from various sources such as the courses taught in our institute, online courses from NPTEL and Coursera. We have won several technical competitions at institute as well as national level. We have been working on this project since last 6 months and we have designed and tested our solutions in real time at nearby farms. We are in touch with farmers and with their feedback we are still in the process to improve our project for better and smarter irrigation.

Conclusion:

This project not only will allow the Indian farmers to save water, electricity and grow better crops within a controlled and intelligent irrigation system, it will also allow the Indian market to experience and admire products developed in India. Getting a platform like this will encourage our team as well as provide most needed support to improve the quality of our research to make a complete product from our presently working prototype. Support and encouragement from this platform will allow us to fulfill our dream to make the worlds smartest but cheapest wireless sensor network based smart irrigation system.

Signature:

Ritam Gupta
(Team Leader)

Mradul Maurya
(Team Member 01)

Manvendra Singh
(Team Member 02)

Declaration: I hereby declare that all the above information furnished herein by the team is true to the best of my knowledge. I understand and accept that our application for the contest may be cancelled in case the above declaration is found to be false.

Dr. M V Deepak Nair
(Name & Signature of Mentor)

Place:

Date:

Date: ____/____/____

No Objection Certificate

This is to certify that the YESC (Young Engineer for Social Cause)(Team Name) is a team of the students of LNMIIT, Jaipur (*Name of the Institute*). The Team wishes to apply for the AICTE-ECI-ISTE Chhatra Vishwakarma Awards 2018.

Team Details:

1. Ritam Gupta (Team Lead)
2. Mradul Maurya (Team Member)
3. Manvendra Singh (Team Member)
4. _____ (Team Member)

Team Mentor: Dr. M V Deepak Nair

The Institute has no objection in their participating in the AICTE-ECI-ISTE Chhatra Vishwakarma Awards 2018 and have submitted their online application on **10-08-2018**.

It is hereby declared that the idea being submitted by the Team is their original work and has not been submitted anywhere else for the award of any Associateship, Fellowship or other similar title or recognition.

With best regards,

Signature: _____

Name: _____

(Head of Institute/Head of Department)

Seal with date

Name of the Institution: LNMIIT, Jaipur