© MAR 2026 | IRE Journals | Volume 9 Issue 9 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I9-1715473

Design And Development of An Automated Drip Irrigation System for Coconut Farming

BHAVADHARANI B[1], DHANUSH PANDI T[2], MOHAMMED ARSATH A[3], YUVANSANKARRAJA S[4]

[1] *Assistant Professor, Department of Agricultural Engineering, Kongunadu College of Engineering and Technology, Trichy, Tamil Nadu, India.*

[2, 3, 4] *UG Student, Department of Agricultural Engineering, Kongunadu College of Engineering and Technology, Trichy, Tamil Nadu, India.*

Abstract- ***Farming feeds populations, even as it lifts economic conditions worldwide. Where land sustains lives, survival often takes root in dust and demand. In tropical regions such as India, coconut cultivation forms a core part of agricultural life. Because warmth and rainfall support growth, villages depend on this palm for livelihoods along with everyday needs. Thriving best in coastal sand, the trees suit environments shaped by sea winds. With little seasonal change, picking nuts occurs throughout the year. Knowledge about care and harvest travels from parent to child over time. Families rely on coconuts for food, supplies, yet income through local trade. With consistent water intake, palm trees mature predictably - fruit weight increases across seasons. Yet irrigation methods from earlier times - like dousing entire fields - often lose much of the supply, delivering uneven coverage across farmland. Positioned at regular intervals across the space. Through narrow pipes under the soil, water creeps toward plant roots. This method keeps supply steady without flooding fields. Farmers usually notice improvements gradually. With every droplet going straight to the root zone, little spreads outward across the surface. Roots receive water directly through tiny channels and narrow openings. Monitoring happens continuously, so delivery responds only when needed. This kind of setup reduces waste by acting precisely. Instead of fixed schedules, timing shifts with actual ground moisture. Efficiency rises because inputs match plant demands closely. Decisions rely on sensors, removing guesswork from maintenance routines. whenever required by the plants, operating automatically.***

Key Words – Automatic Drip Irrigation, Coconut Farming, Water Management, Precision Agriculture, Smart Irrigation System

I. INTRODUCTION

Food systems and economies rely heavily on farming in our nations. Across warm climates like India's, growing coconuts stands out as key work for rural households. For strong growth and better harvests, coconut plants need consistent moisture. Still, older techniques such as flooding fields they can tend to waste water while leaving some areas too dry. Instead, delivering water drop by drop directly to roots shows clear advantages in saving resources. Water reaches plant roots directly using a system of tubes and small outlets. Because it targets only the needed of root zone, less moisture into the ground. Even so, the various setups still depend on people turning them on and off water pipes .The arrangements detect ground moisture and adjust flow without human input, matching what crops actually need. creating an automatic drip setup to the coconut cultivation. Efficiency gains come through smarter watering uses, less human effort, a drop in excess water use. Sustainability takes shape not by theory but daily operation. Progress shows when fields need fewer resources yet grow stronger critically as its initial construction. When water supply freely to the root zone. The system aims to reduce water wastage, minimize labour requirements, and improve irrigation efficiency.

Objective

A central aim here involves creating a drip irrigation setup featuring Internet of Things capabilities. This effort focuses on construction plus execution phases without deviation. System functionality relies upon automation through connected devices.

© MAR 2026 | IRE Journals | Volume 9 Issue 9 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I9-1715473

- To develop a smart irrigation system that integrates soil moisture sensors and Arduino automation to optimize
- To improve crop productivity using drip irrigation.
- To develop a smart irrigation system that integrates soil moisture sensors and Arduino automation to optimize water usage and nutrient delivery.

Problem Identification

Though some coconut growers rely on age-old watering techniques, uneven moisture levels frequently result. Where routines remain unchanged, efficiency tends to lag behind need. Outdated systems sometimes fail under shifting weather patterns. In places far from modern supplies, progress moves slowly. Too much irrigation drains resources unnecessarily; meanwhile, some areas receive too little supply. Unequal access shapes how crops or fail Slows down how fast coconut trees grow and reduces their output. Water shortages are growing in many farm regions, so better methods must be used to save resources. Still, progress depends on how quickly outdated systems get replaced. They are small changes can reduce waste significantly over time. The farmers face pressure without enough support. Then again, simpler techniques sometimes work best under stress automated irrigation solution for sustainable coconut cultivation.

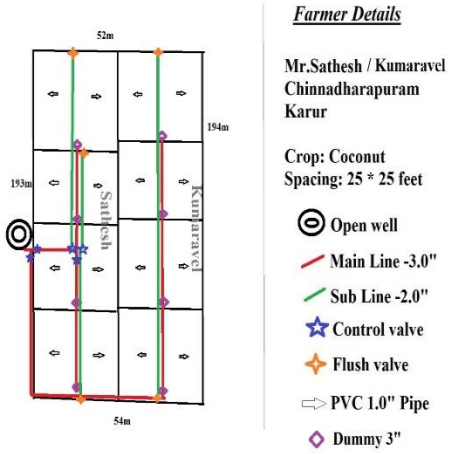
Materials and Components

1.Study Area Selection

One day, researchers stepped into a coconut farm. There, dry soil stretched under hot sun. Water showed up too little, sometimes not at all. Rain didn't help much either. Irrigation ran wild - some trees drowned, others cracked. Problems piled without warning. Roots struggled through shallow floods or dust. Farmers watched crops slow down. Patterns formed over months. Mistakes repeated in silence. Pipes leaked while palms waited. Efforts missed their mark again and again Under a gray sky, workers noted how water moved through the ground. Soil texture played a role, shaping where moisture settled. Different watering styles already in place gave clues about what had been tried before. Each method left traces in the crops' growth patterns. What stayed unclear was how deeply roots reached when rain failed

2. Designing Systems and Making Plans

A setup that waters coconut trees began sending moisture right where roots can grab it. This method uses timed drips instead of broad spraying across soil surfaces Water flowed from a source through a pump, moving along mainlines that fed smaller sub-mains. From there, tubes carried liquid slowly toward roots via drip lines spaced across the ground. A sensor buried in earth watched dampness levels constantly. Each piece linked directly to the next, forming one quiet system a microcontroller-based control unit.



3.Component selection

Component that are PVC pipes took their place alongside drip spitters. Valves for steering flow got picked too. Moisture sensors for earth slipped into the setup. Each piece fit without fuss Wires link up with tiny sensors, sending signals to a small brain like an Arduino. Water flow gets turned on only when needed, thanks to smart timing. Each piece works together without extra noise or steps. The system runs by reading ground conditions quietly. Parts stay connected through simple circuits that respond fast. Automation happens slowly at first, then smooths out over time Moisture levels get checked by the system, so watering adjusts on its own. It keeps track below ground while managing flow without help.

© MAR 2026 | IRE Journals | Volume 9 Issue 9 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I9-1715473

4. Setting up drip irrigation system

From the water supply, workers ran a large pipe all through the field. Coming off that line, smaller sub-mains branched out in turn feeding even narrower laterals Close to the palm trunks, small watering points took position

5. Sensor Integration and Automation

Close to where coconut roots grow. When moisture dips under the limit, irrigation begins as the system turns on the pump.

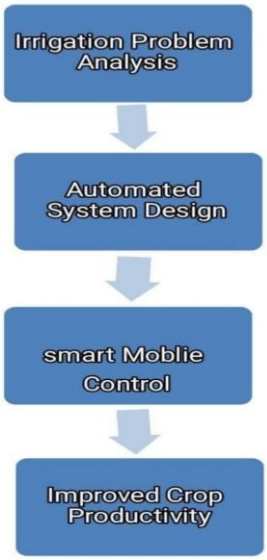
6. System Operation and Monitoring

A few days into the trial, sensors began recording changes in ground humidity. Though pumps ran on a preset schedule, adjustments happened when thresholds were crossed. Following weekly checkups, technicians noted patterns tied to weather shifts.

Performance and Evaluation

Water saved, how well crops were irrigated, and their growth shaped the test results. System behavior showed up clearly when watched through these three parts behavior showed up clearly when watched through these three parts Water savings showed up when machines took over tasks once done by hand. Some fields stayed drier, others got more - balance changed field by field. Decisions came from data feeds, not habits passed down through years and labour reduction.

Methodology



Literature survey

Various studies have been carried out to improve irrigation efficiency through the use of automation and modern irrigation techniques. The Food and Agriculture Organization has emphasized the importance of efficient irrigation management for Environmental protection begins where farming methods support long-term crop growth while preserving freshwater supplies [1]. Micro Irrigation Methods Studied by Indian Council of Agricultural Research Drip irrigation enhances water use effectiveness while supporting better harvest outcomes across farmland areas [2]. Drip Irrigation Lowers Water Use Based on Tamil Nadu Agricultural University Studies Approximately 40 to 60 percent lower than standard methods of watering crops [3].Automated drip Irrigation Developed by Researchers Water delivery are adjusts automatically when sensors detect changes in ground dampness [4].IoT irrigation system to detailed in IEEE study Automated oversight of watering routines becomes the possible through these setups, leading to less hands-on water involvement. Where technology manages flow, human effort decreases noticeably. Through integration of sensors, adjustments happen without intervention. Operation continues steadily, guided by preset conditions rather than constant supervision.

© MAR 2026 | IRE Journals | Volume 9 Issue 9 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I9-1715473

Efficiency emerges that not from speed but consistency. With each cycle regulated electronically, resource use aligns more closely to actual need intervention [5]. Studies show automation may impact research outcomes irrigation technologies are particularly beneficial for small-scale farmers as they help improve irrigation efficiency Labour needs decrease as a result [6]. The Central Plantation Crops Research Institute emphasizes careful watering methods for healthy development of coconut crops, careful management is needed to support steady growth and higher yields [7]. Still, findings detailed in an Elsevier release indicated improved water efficiency through intelligent irrigation systems Achievement of effective oversight supports long-term farming progress [8].

Automation installation

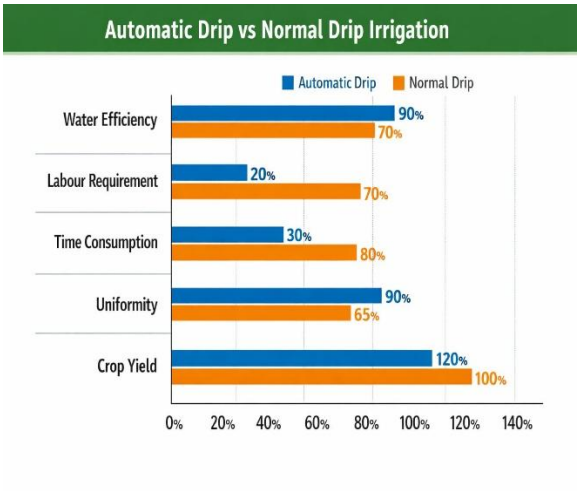
Smart Agricultural Monitoring System

Results and Discussion

The automatic drip irrigation system adjusted the soil moisture the drip system reduced water consumption by about 30 to 50 percent. Root zone moisture remained consistent, since irrigation responded to demand rather than preset timers. As a result of this alignment, nutrient uptake improved, along with resilience during high temperatures or low rainfall periods. Canopy development increased, and nut yields climbed from approximately 14 to 25 percent compared to conventional methods.

© MAR 2026 | IRE Journals | Volume 9 Issue 9 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I9-1715473

After automation took effect, manual oversight declined significantly - field inspections required far less effort. Reductions in workforce needs began at 40 percent, escalating beyond fifty in expansive fields. Although initial costs stay high, lower operational demands yield accumulating returns over time.



Conclusion

Water use gets better when farmers set up a drip system that runs on its own for coconut crops Water delivery gets smarter when tech watches the ground. Machines tweak flow without waiting for people. Moisture sensors decide timing instead of guesses. Roots get what they need because systems respond fast. Details matter more than routines here. Supply matches demand through constant updates Every drop reaches where coconut roots need it most. Less spills happen because flow stays targeted through steady delivery lines. Consistency shows up in how evenly each tree drinks across the whole stretch Delivery happens smoothly while cutting back on hands-on work. Farmers working smaller plots find good help here. Water reaches crops more easily because the setup runs smarter. Growth gets a boost when plants drink evenly through each week Even where water is scarce, coconut plants can grow. Because of automation, watering happens on time - keeping the soil just right wetness stays balanced while crops grow strong. In total, machines that slowly feed water to roots work well for today's coconut fields without spending too much or harming nature Making better use of water, cutting down on work needed, while also boosting how well farms are irrigated practices.

REFERENCES

[1] S. R. Kumbhar and A. P. Ghatule, "Automatic Drip Irrigation System Using Soil Moisture Sensor," International Journal of Engineering Research and Technology (IJERT), 2017.

[2] T. B. Dcunha, "Automated Irrigation System Using IoT," IJERT, vol. 8, no. 5, 2019.

[3] N. Agrawal and S. Singhal, "Smart Irrigation System Using IoT," IEEE, 2019.

[4] P. Pavithra and M. S. Srinath, "Automation of Irrigation System," International Journal of Scientific and Research Publications, 2019.

[5] S. R. Desai, R. R. Jadhav, M. S. More, A. U. Mali, and V. S. Patil, "Automatic Drip Irrigation System Using Wireless Sensor Technique Powered by Solar System," IJERT, 2020.

[6] M. Gayathri, D. Arun Shunmugam, and I. Andoni Raj, "Smart Irrigation System Using IoT," International Journal of Innovative Research in Engineering & Multidisciplinary Physical Sciences, 2021.

[7] "An Automatic Irrigation System Using IoT Devices," Materials Today: Proceedings, 2022.

[8] Y. Pandey, N. Mehraj, M. Maryam, S. M. Dadhich, and G. M. Mir, "Studies on Smart Irrigation System Using IoT Approaches," Journal of AgriSearch, 2023.