Retraction

Retraction: Irrigation of Water by Automatic Sprinkler System (IOP Conf. Ser.: Mater. Sci. Eng. 1145 012107)

Published 23 February 2022

This article (and all articles in the proceedings volume relating to the same conference) has been retracted by IOP Publishing following an extensive investigation in line with the COPE guidelines. This investigation has uncovered evidence of systematic manipulation of the publication process and considerable citation manipulation.

IOP Publishing respectfully requests that readers consider all work within this volume potentially unreliable, as the volume has not been through a credible peer review process.

IOP Publishing regrets that our usual quality checks did not identify these issues before publication, and have since put additional measures in place to try to prevent these issues from reoccurring. IOP Publishing wishes to credit anonymous whistleblowers and the Problematic Paper Screener [1] for bringing some of the above issues to our attention, prompting us to investigate further.

[1] Cabanac G, Labbé C and Magazinov A 2021 arXiv:2107.06751v1

Retraction published: 23 February 2022

Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

Published under licence by IOP Publishing Ltd
Irrigation of Water by Automatic Sprinkler System

R Nelson¹, U Sankar², E G Ramanathan², V Sankar Prasanth² and A Sherwin Daniel²
¹Assistant Professor, Department of Mechanical Engineering, Sri Krishna College of Technology, Coimbatore, Tamil Nadu
²Department of Mechanical Engineering, Sri Krishna College of Technology, Coimbatore, Tamil Nadu
nelson.r@skct.edu.in

Abstract. In all agricultural seasons, an automatic irrigation system has been designed to facilitate the automated provide of adequate water from a reservoir to field or domestic crops. One of the goals of this research is to determine how human control can be removed from irrigation while also optimising water use in the process. The method used is to continuously monitor the soil moisture level in order to determine whether irrigation is required and how much water is required in the soil. Various types of sprinkler irrigation systems were studied in this study, along with their design, construction, and installation. The planning was aided by the use of a rotating system to irrigate a small plot, which provides a suitable scientific basis for correct water scheduling, system evaluation, and minimising water waste and runoff. It was intended for a variety of crops. The significance of the design and installation is to provide the University's irrigation research Field with irrigation field demonstration practise facilities that can be used.

Key Words: Agricultural, Crops, Construction, Design, Irrigation, sprinkler.

1. Introduction
Irrigation may be a perfect methodology for distributing water to soil that strengthens the crops in the field. Irrigation is employed to complement the water on the market from downfall, field soil wetness. Quantity of downfall on the market in several components of the globe is light to satisfy crop wetness necessities [1]. As a result, adequate irrigation provision is important for sure-fire crop production. The job of irrigation system is often classified into indirect and direct advantages [2].

The most direct advantage includes an increase in crop production by higher yield to achieve food self-sufficiency, cultivation of crops, land value appreciation that makes land holders more wealthier and domestic water distribution system to towns and villages [3]. Sprinkler irrigation is a significant advancement over traditional surface irrigation[4]. This promotes natural rainfall therefore by distributing water in rainy form over the land surface while needed in the essential pattern and in required quantity.

The water should be distributed in an amount determined by the soil's infiltration level in order to avoid runoff from irrigation [5]. This type of Sprinkler irrigation systems is ideal for undulating terrain, an insufficient of available water, shallow soils and where uniform water distribution is required [6].

To optimise the use of water for agricultural crops, a proper automated irrigation system must be developed [7]. A proper automatic irrigation system must include all the components that automatically
monitors and controls the amount of water to be distributed to the plants without the need for human interference or failure [8].

**How the system functions**
- Constantly assess the quantity of water needed to plants (this is monitored using a sensor system).
- By the data collected from observing the water content in the soil, it can able to determine if the plants require watering.
- Provide the adequate amount of water required to the plants. This gets improved based on how good it meets the requirements.
- Turn off the supply of water once the necessary amount of water has been delivered to the plants.

2. **System Design**
The work is divided into four subsystems that comprise the automatic irrigation control system: supply of paper, a control unit, sensing unit, and pumping systems. A soil moisture sensor is built in order to note the soil’s electrical resistance. A 12V power supplying unit is built in order to provide enough power to the system [9]. An operational amplifier and timer were used to implement the control circuit; and a pumping subsystem which has a submersible micro water pump with less noise was built using a DC-operated motor [10]. Figure 1 shows the system design.

![Figure 1. System design](image)

3. **Working**
This automated system of irrigation is fabricated to constantly monitor the moisture level of soil. This system works accurately by supplying required amount of water to the soil and shutting off the supply of water when the necessary soil moisture rate is reached [11]. Corrosion resistant materials are used in fabricating soil moisture sensors and can be embedded in soil samples [12]. The resistance between the moisture detectors is measured and making it to match with the output voltages of the comparator circuit, computations are made of the voltages according to the dry and wet states of the soil [13].

The amount of water needed for the irrigation per unit time was calculated by taking the water pump’s capacity and the water sprinkler’s capacity into account [14]. The time needed for irrigation was calculated by taking the water pump's response time and the volume of water needed per irrigation into account. A proper timing circuit was also designed to guide the duration time of each irrigation occurrence using the required irrigation time [15].
4. System Components
The Control circuit consists of Bread Board, jump wires, relay module, resistors and high rated diode. The sensing circuit consists of Arduino UNO and Soil moisture sensor and also a pump, a DC motor and Water sprinkler [16-22].

4.1. Bread Board
Specifications
❖ Dimensions: “3.28 x 2.14 x 0.32”
❖ Breadboard: 400 coloured points
❖ Material-Plastic
Figure 2 shows the bread board.

4.2. Jumper Wires:
Specifications
❖ 40-pin ribbon cable jumper wires
❖ 0.1” sockets on any one of the ends and fits on standard-pitch 0.1”
❖ Wire: 28 AWG (36 AWG if 7strands)
Figure 3 shows the Jumper wires.

4.3. Resistor
Specifications
❖ Conformal coated
❖ Epoxy coated
❖ Controlled temperature coefficient
❖ High frequency
❖ Low noise: typically 0.10 μ V/V
❖ Low voltage coefficient upto ± 5 ppm/V
Figure 4 shows the resistor.
4.4. Diode

Specifications
- Case: Moulded
- Weight: 0.4 g(appx)
- Finish: Corrosion Resistant and Readily Solderable
- Polarity: Polarity Band indicated cathode

Figure 5 shows the diode and Figure 6 shows the Arduino.

4.5. Arduino

4.6. Soil Moisture Sensor
Type of battery: CR2450 x 1
3 years of battery life (typical)
Range of sight: 700 feet (210 metres) (at default setting.)
100 percent moisture, 8-bit
-40°C to 85°C temperature range
Typical sensor accuracy is +/-1°C, with a limit of -2/+4°C.
10-bit sensor quantization level (resolution), 0.25°C (0.45°F)

Figure 7 and Figure 8 shows the Soil moisture sensor and DC Motor
4.7. **Dc Motor**

- DC motor: 130 Type
- Voltage (4.6V to 9V).
- Recommended Voltage: 6V.
- Current with zero load: 70mA (max)
- Speed with zero load: 9000 rpm.
- Loaded current: 250mA (appx)
- Rated amount of Load: 10g*cm.
- Dimensions of the motor: 27.5mm x 20mm x 15mm

5. **Calculations**

Table 1 and Table 2 shows the calculations of Spray Head Flow and Lawn Watering Times

| Spray Head Flow – Average Gallons Per Minute (Gpm) |
|-----------------------------------------------|
| Spray Head | 1/4th | 1/3rd | 1/2 | 3/4th | Full |
| Arc Cover | R(1/4) | (1/3) | 1/2 | (2/3) | S(3/4) | L |
| Age | 90° Arc | 120° | 180° | 240° Arc | 270° Arc | 360° |
| Le | Arc | Arc | Le | Arc | Arc | Arc |
| Radius | 0.10 | 0.12 | 0.21 | 0.25 | 0.29 | 0.39 |
|--------|------|------|------|------|------|------|
| 8’     | 0.25 | 0.31 | 0.50 | 0.70 | 0.76 | 1.02 |
| 10’    | 0.40 | 0.55 | 0.80 | 0.97 | 1.04 | 1.60 |
| 12’    | 0.80 | 1.23 | 1.60 | 1.78 | 2.50 |
| 15’    | 0.61 | 1.20 | 1.80 | 2.34 | 2.75 | 3.70 |

Numbers Are Based On Average Of 3 Top Brand Spray Heads And At An Optimum Water Pressure 30kpa. Variation Will Occur With Various Brand And At Different Water Pressure.

Table 2: Lawn Watering Times

| WATERING MONTHS | JANUARY-APRIL | MAY | JUNE | JULY | AUGUST | SEPTEMBER | OCTOBER-DECEMBER |
|-----------------|---------------|-----|------|------|--------|-----------|------------------|
|                 | WATER TREES/SHRUBS AS NEEDED | 12  | 17   | 18   | 14     | 11        | WATER TRESS/SHRUBS AS NEEDED |
|                 | MINUTES TO WATER PER ZONE        | 24  | 35   | 36   | 27     | 23        | 28 |
|                 | FIXED SPRAY HEADS        | 30  | 43   | 45   | 34     | 28        |                          |
|                 | ROTOR HEADS               | 18  | 26   | 27   | 20     | 17        |                          |
|                 | ROTARY NOZZLES            |     |      |      |        |           |                          |
|                 | MANUAL SPRINKLERS         |     |      |      |        |           |                          |

These times are based on a sprinkler system running at an efficient level.
6. Result
With the same soil test, irrigation becomes precise, realistic, and simple. By this concept agriculture can be taken to the new and futuristic level. The water and quantity contents are not a normal output from moisture sensors, and the levelling system plays a vital role in deciding the quantity and volumetric water contents. Involvement in the development of the final product, the resistance of soil between the positive supply and non-inverting supply inputs is relatively high, which results in a lower positive supply to the non-inverting input which is higher than the inverting input, resulting in a logic low comparator performance when the soil is dry.

This is the order that Arduino receives. In this case, the microcontroller sends a logic high signal, which activates a relay driver transistor and turning on the pumping motor. As a result, water flow begins. The soil resistance decreases as the soil becomes sufficiently wet, allowing an available voltage to the non-inverting input resulting in a comparator’s output that is high logic and provided to the microcontroller. In this case, the microcontroller sends a low logic signal to transistor which switches off the relay and turns on the motor pump.

7. Conclusion
A proper algorithmic proposal in designing a sensor-based controller system for measuring several critical parameters for a plant culture such as moisture of the soil, humidity, intensity of the light, and temperature are under consideration. The final result of the evaluations after the parameter values have been sensed must be definitive and precise. The framework must prevent many of the flaws found in current systems by carefully managing complexity while still offering a versatile means of preserving the environment. The aim is to keep hardware and software costs as low as possible.

This hardware and software cost reduction will increase the use of electronic systems in agriculture that paves the growth of the agricultural industries in many areas thereby increasing the rate of quality and quantity of the production. By using required technologies and components several similar systems can be developed.
References

[1] Arshad ali, International journal of advanced and applied sciences, Internet Of Things embedded smart sensors system for agriculture and farm management, 7(10), pp 38-45, 2020.

[2] Ms. Darshana chaware, IJERT, Sensor based automated irrigation system, 04, (2015).

[3] Jose cavero, agronomy journal, Relevance of sprinkler irrigation time and water losses in maize yield, 105(3), p 827, 2013.

[4] Glande et al, journal on automatic sprinkler irrigation system, 2007.

[5] Swarup et al, Effect of continuous sodic irrigation water, 73(2), pp 111-118, 2005.

[6] Saleemmaleek, Design and implementation of solar powered automatic irrigation system, IEEE International conference, 2013.

[7] Prathyusha et al, international journal of computer science engineering and applications, 3(4), pp 75-80, 2013.

[8] Cosmin et al, International conference of advance research and innovation, 2012.

[9] Yetharaj et al, Method of water irrigation and water productivity, international journal on research and innovation, 2012.

[10] Haldorai, A. Ramu, and S. Murugan, Social Aware Cognitive Radio Networks, Social Network Analytics for Contemporary Business Organizations, pp. 188–202, doi:10.4018/978-1-5225-5097-6.ch010.

[11] R. Arulmurugan and H. Anandakumar, Region-based seed point cell segmentation and detection for biomedical image analysis, International Journal of Biomedical Engineering and Technology, vol. 27, no. 4, p. 273, 2018.

[12] Pranit et al., International conference of advance research and innovation, 2014.

[13] Udupa et al, Using arduino board for automatic pulse irrigation system, misr journal of agricultural engineering, 2015.

[14] Kiran kumar et al, Different irrigation water sources in a typical black soil, an asian journal of soil science 10(1), pp 154-157, 2015.

[15] Mamta et al, Journal of applied and natural science, 7(2), pp 1070-80, 2015.

[16] Suraj et al, Effects of waste water on the soil and irrigation process, Journal of geographical studies, 1(1), pp 46-55, 2015.

[17] Rayala et al, Study on automated irrigation system process, 2015.

[18] Archana and Priya et al, Automatic water conserving irrigation system, (IJCSIT) International journal, 2016.

[19] SonaliD. Gainwar and Dinesh V. Rojatkar et al, International Research journal of engineering and technology (IRJET), 2015.

[20] R. Balaji and M. Sudha et al, International journal of innovative technology and exploring engineering (IJIITEE), 2016.

[21] S. Reshma and B. A. Sarathy, IOT based Automatic irrigation system, International journal, 2016.

[22] Joaquin Gutierrez, Automated Irrigation systems using a wireless sensor network and GPRS module, IEEE transactions on instrumentation and measurement, 2013.