International Journal of Engineering and Information Systems (IJEAIS)
ISSN: 2643-640X
Vol. 9 Issue 8 August - 2025, Pages: 13-15

Arduino Based Automatic Irrigation System

Zablon Yesaya

Clara Komba, Siza Bernad, Mwanaisha Kanka

Department of computer Sciences, Ruaha Catholic University (RUCU), Iringa, Tanzania

Corresponding Author: mwanaishakanka@gmail.com

Abstract: *The growing demand for efficient water use in agriculture has driven innovation in smart irrigation systems. This study present the development and implementation of an Arduino based automatic irrigation system integrated with mobile application. The system uses soil moisture, temperature and humidity sensor to monitor environmental conditions and automatically control a water pump via a relay[1]. A mobile application provides real-time monitoring and manual override functions. The proposed solution enhances water conservation by up to 70%, reduces human labor, and promotes sustainable agricultural practices[2]. The results demonstrate improved efficiency, ease of use, and scalability for small to medium scale farm*

Keywords –Arduino Uno, moisture sensor, mobile application, microcontroller

SECTION ONE: INTRODUCTION

1.1 INTRODUCTION

Agriculture remains the backbone of many economies, particularly in developing countries. However, traditional irrigation methods often result in excessive water usage and inefficient crop management[3]. To address these challenges, modern irrigation techniques are incorporating automated system to optimize water distribution[3]. This paper proposes an Arduino based automated irrigation system integrated with a mobile application, designed to monitor soil moisture levels and controlling irrigation efficiently and remotely[4].

1.2 BACKGROUND

Irrigation plays a crucial role in agriculture productivity by supplementing water supply to crops[5]. The advent of smart technology, such as microcontrollers and sensors, has allowed for automatic irrigation systems. Integrating Internet of Things(IoT) elements, such as remote monitoring and control via mobile application, improves water management and crop yield[6]. This project builds a system based on Arduino technology with mobile integration to enhance efficiency in water usage and ease of control for farmers[7].

1.3 STATEMENT OF THE PROBLEM

Most existing irrigation system are either manually operated or only semi-automated[8]. They often result in over irrigation or under irrigation, leading to water wastage and poor crop yields[4]. Additionally, the absence of mobile-based control makes it hard for farmers to manage their fields remotely[8]. This project seeks to develop an automatic irrigation system that uses soil moisture data to trigger irrigation, thereby saving water and enabling remote control via a mobile application[9].

1.4 MAIN OBJECTIVES

To design and implement an Arduino based automatic irrigation system integrated with a mobile application for remote monitoring and control.

1.5 SPECIFIC OBJECTIVES

i. To develop an Arduino based controlled unit capable of processing data from soil moisture sensor
ii. To develop a mobile application which enhancing farmers to control crop irrigation automatically
iii. To evaluate the system performance in term of water conservation

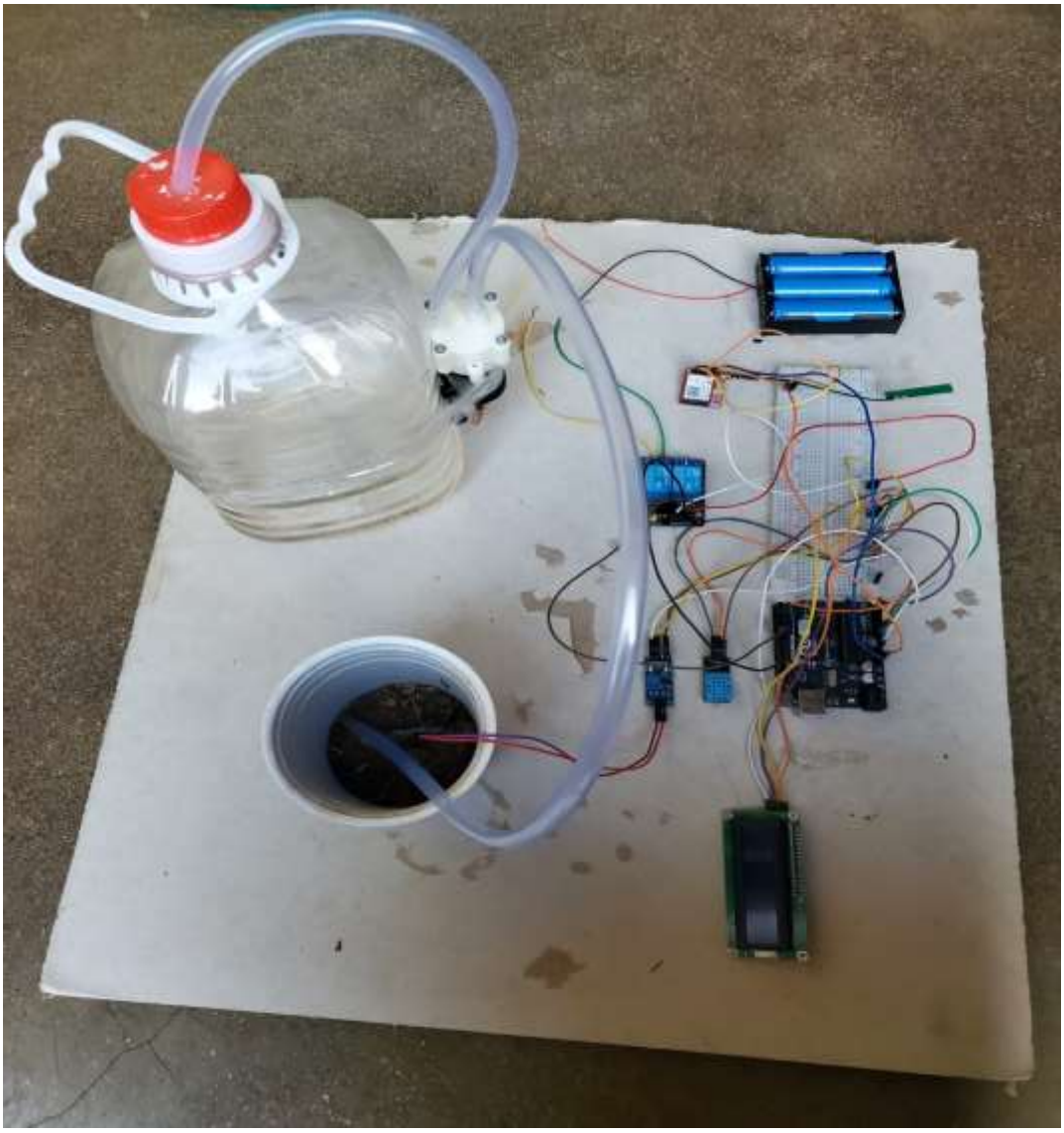
1.6 CONTRIBUTION OF THE STUDY

This study contributes to smart farming practice by demonstrating how low-cost, open source technologies can be used to improve irrigation efficiency[9]. It provides a practical solution for farmers, especially in water-scare regions, to manage irrigation more effectively[4]. The project also offers a foundation for future integration of weather data and predictive analytics in irrigation systems[10].

SECTION TWO: SYSTEM SCHEMATIC DIAGRAM

The schematic diagram illustrates the interconnection between various components of the Arduino based irrigation system. Key components includes the Arduino Uno microcontroller, soil moisture sensor, relay module, water pump, and the

mobile communication module such as SIM800L[11]. The sensor data reads the moisture level from the soil and sends data to the Arduino[12]. If the moisture level is below the threshold, the Arduino activates the relay to turn on the water pump[13]. The user can monitor and override the system using the mobile application[14].



SECTION THREE: RESULTS AND DISCUSSION

The prototype was tested under varying soil moisture conditions[15]. The system successfully automated the irrigation process when soil moisture dropped below the defined threshold[16]. Data was accurately displayed in real-time on the mobile application and the user was able to control the irrigation process remotely[17]. The system demonstrated efficient water usage, reducing consumption by up to 70% compared to manual irrigation methods. It also proved to be user-friendly, scalable, and adaptable for different environmental conditions[15]. Challenges observed included GSM signal reliability and sensor calibration in extreme conditions[18].

SECTION FOUR: CONCLUSION

This study successfully designed and implemented an Arduino based automatic irrigation system controlled via a mobile application. The integration of sensors, automation, and mobile control provided an effective and sustainable solution to modern agricultural challenges[5]. The system can be further enhanced by incorporating solar power, weather forecasts, and cloud data storage for historical analysis[1]. It presents a significant step forward in the adoption of smart farming technologies in rural and resource constrained settings

REFERENCES

[1] Y. Gamal *et al.*, "Smart Irrigation Systems : Overview," *IEEE Access*, vol. PP, p. 1, 2023, doi: 10.1109/ACCESS.2023.3251655.

[2] H. M. Yasin, "Arduino Based Automatic Irrigation System : Monitoring and SMS Controlling," *2019 4th Sci. Int. Conf. Najaf*, pp. 109–114, 2019.

[3] S. Das, S. Saha, and S. Podder, "ARDUINO BASED SMART IRRIGATION SYSTEM," no. 01, pp. 1089–1097, 2023.

[4] T. Stefanov, S. Varbanova, and M. Stefanova, "Mobile Application for Managing an Automated Irrigation System," vol. 13, no. 2, pp. 897–908, 2024, doi: 10.18421/TEM132.

[5] S. Gnanavel, "The Smart IoT based Automated Irrigation System using Arduino UNO and Soil Moisture Sensor," pp. 188–191, 2022.

[6] P. P. Karande, P. N. Sawardekar, P. B. Patil, and Z. J. Tamboli, "Study Of Arduino For Irrigation Based Control Using Android App," pp. 1708–1714, 2017.

[7] G. M. Barbade, M. Vasudha, P. Sanika, and S. Sandhya, "Automatic Sprinkler System using Arduino .," vol. 8835, no. 2, pp. 12–16, 2021, doi: 10.54105/ijmm.B1712.091221.

[8] C. Ashwini, D. Adhikary, A. Mishra, and S. Duggal, "AUTOMATIC IRRIGATION SYSTEM USING ARDUINO," pp. 7–9, 2018.

[9] V. B. Patil and A. B. Shah, "Automated Watering and Irrigation System using Arduino UNO," vol. 4, no. 12, pp. 928–932, 2019.

[10] G. Rajakumar, M. S. Sankari, D. Shunmugapriya, and S. P. U. Maheswari, "Iot Based Smart Agricultural Monitoring System," vol. 2, no. 2, pp. 474–480, 2018.

[11] I. Prasojo, A. Maseleno, and N. Shahu, "Design of Automatic Watering System Based on Arduino," vol. 1, no. 2, pp. 55–58, 2020, doi: 10.18196/jrc.1212.

[12] A. Roy, "Module," pp. 532–538, 2018.

[13] U. N. V. P. Rajendranath, "Implementation of an Automated Irrigation System," pp. 2–6, 2015.

[14] M. Alagarsamy, S. R. Devakadacham, and H. Subramani, "Automation irrigation system using arduino for smart crop field productivity," vol. 12, no. 1, pp. 70–77, 2023, doi: 10.11591/ijres.v12.i1.pp70-77.

[15] K. K. N, D. Vigneswari, and C. Rogith, "An Effective Moisture Control based Modern Irrigation System (MIS) with Arduino Nano," *2019 5th Int. Conf. Adv. Comput. Commun. Syst.*, pp. 70–72, 2019.

[16] A. Hassan, R. M. Asif, A. U. Rehman, Z. Nishtar, and M. K. A. Kaabar, "Design and development of an irrigation mobile robot," vol. 10, no. 2, pp. 75–90, 2021, doi: 10.11591/ijra.v10i2.pp75-90.

[17] A. Kagalkar, "Smart Irrigation System," vol. 6, no. 05, pp. 982–986, 2017.

[18] S. E. Babaa, M. Ahmed, S. A. Al-jahdhami, and J. R. Pillai, "Smart Irrigation System using Arduino with Solar Power," vol. 9, no. 05, pp. 91–97, 2020.