SOROTI UNIVERSITY

School of Engineering and Technology

Department of Electronics and Computer Engineering

BACHELOR OF ENGINEERING IN ELECTRONICS AND COMPUTER ENGINEERING

EEE 3108: WIRELESS SENSORS NETWORKS

PROJECT PROPOSAL

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1. INTRODUCTION

1.1. BACKGROUND AND SUMMARY

The Sustainable Development Goals are a call for action by all United Nations Member states, regardless of their income level, to promote prosperity while protecting the planet. They recognize that ending poverty must go hand in hand with strategies that foster economic growth and address a range of social needs, including education, health, social protection, and job opportunities, while also tackling climate change and promoting environmental protection [1].

1.2. SDG OVERVIEW

The project is centered on SDG 2- Zero Hunger of the United Nations Sustainable Development Goals. Goal 2 seeks to end hunger, achieve food security, improve nutrition, and promote sustainable agriculture by 2030. Despite progress in some areas, hunger and food insecurity have been rising since 2015 due to conflict, climate change, inequalities, and the pandemic.

By 2023, nearly 1 in 11 people faced hunger, and over 2.3 billion experienced moderate to severe food insecurity, which is an increase of 383 million since 2019. Children remain highly affected in 2024, 23.2% suffered stunted growth, and 6.6% of under-fives were wasted [2].

Hunger reduces productivity, increases vulnerability to disease, and traps people in poverty. As part of a vicious cycle, hunger can also fuel conflict**.** Urgent global action is needed to ensure access to safe, nutritious, and sufficient food for all [3].

2. PROBLEM IDENTIFICATION

2.1. DESCRIPTION

Agriculture is the backbone of food security. Farming, as part of agriculture, is crucial for feeding people worldwide. It gives billions of people food and money. A sound farming system makes sure everyone gets healthy and safe food [4]. Yet, millions of smallholder farmers still rely on traditional farming methods, including manual watering and flood irrigation. These methods are inefficient because they either over-irrigate, resulting in water wastage and reduced soil fertility, or under-irrigate, leading to crop stress and low yields. These low crop yields, in turn, lead to hunger in communities and, consequently, across the world.

Since 70% of global freshwater withdrawal is used for agriculture [5], this usage shows that there is a certain level of water wastage majorly by practicing poor irrigation practices which strain water resources, especially in drought-prone regions. The lack of real-time soil and environmental data means farmers make decisions by guesswork rather than evidence thus resulting into under or over irrigation.

This project addresses this gap by designing an intelligent irrigation system using soil moisture and temperature sensors. The system automatically irrigates crops only when necessary and in right proportions, reducing water wastage and ensuring healthier plant growth. Such a system can support SDG 2: Zero hunger by improving crop yields, reducing resource wastage, and making agriculture more sustainable.

2.2. SCOPE

Smart irrigation systems for rural farms in Uganda. Our system is developed to maintain agricultural sustainability in Uganda.

2.3. STAKEHOLDERS

The key stakeholders in this project are farmers, local communities, the government, and researchers. Each plays a role in the adoption, use, and scaling of intelligent irrigation systems to achieve SDG 2: Zero Hunger.

2.4. CURRENT GAPS

Farmers lack real-time monitoring tools, so farming decisions like irrigation are based on guesswork rather than soil and environment data.

Traditional irrigation methods are inefficient, often wasting water through over-irrigation or stressing crops through under-irrigation.

Many farmers, especially in developing regions, lack access to modern technology, sustainable farming techniques, and the necessary infrastructure to implement them [6].

3. WSN RELEVANCE

Wireless Sensor Networks (WSNs) are highly relevant to solving the challenges in farming because they enable real-time data collection and automated decision–making. Soil moisture sensors provide accurate information on root-zone water availability, while temperature and humidity sensors help compute atmospheric demand. This data is transmitted through low-power wireless nodes to a gateway, which then controls irrigation pumps.

By combining field conditions with environmental factors, the WSN ensures irrigation happens only when needed and at the correct rate. This not only saves water and energy but also improves crop yields and reduces stress on natural resources.

WSNs are scalable, low-cost, and adaptable for rural areas, making them a sustainable solution aligned with SDG 2: Zero Hunger.

4. FEASIBILITY CHECK

4.1. BUDGET

ITEM	Quantity	Unit Cost(UGX)	Total (UGX)
Arduino Uno board	1	85,000	85,000
Capacitive soil moisture sensor	1	60,000	60,000
Temperature and humidity sensors.	1	10,000	10,000
Water pump	1	30,000	30,000
SUM			185,000

4.2. EQUIPMENT AVAILABILITY

Most of the equipment needed to run this project is available in the Soroti University laboratory.

4.2.1. Hardware requirements

- Arduino Uno: The brain of the system, processes sensor data and controls the pump.
- Soil Moisture Sensor: Detects soil dryness and provides data to trigger irrigation.
- DHT22/DHT211 Temperature and humidity sensor; Adds context for decision-making useful for data analysis and crop stress monitoring.
- Breadboard and Jumper Wires: Allow easy circuit assembly without soldering.
- Relay Module: Acts as a switch to safely control the pump using the microntroller.
- USB Power Bank: Powers the system reliably.
- Water Pump: Delivers the water to the plant when triggered.
- Plant Pot, Soil, Tubing, and Reservoir: Simulate real-world farming conditions in a small demo setup.

4.2.2. Software Requirements

- Arduino IDE: Platform to write and upload code to the microntroller.
- Analog Input Functions: Convert soil sensor voltage into digital values the microcontroller can process.
- Cloud Tools (ThingsBoard): Visualize data remotely, show scalability of Wireless Sensor Network.
- LoRa Modules: Gateway uploads to the cloud over 4G or internet.

4.3. ETHICAL ISSUES

- Environmental Sustainability: This project contributes to sustainable resource use by conserving water as a valuable resource.
- Easy and Fair access: When doing full deployment of the system, it should be financially affordable and accessible to even small-scale farmers.

4.4. TIMELINE

Task	WK 1	WK 2	WK 3	WK 4	WK 5	WK 6	WK 7	WK 8
Research and defining the problem								
Gather Materials								
Assemble hardware								
Integrate the pump and relay								
Test prototype								
Data analysis and report preparation.								

5. CONCLUSION

This project proposal demonstrates the utilization of Wireless Sensor Networks to address one of the world's most pressing challenges; food insecurity. Merging soil temperature and moisture sensors with irrigation automation, the system promotes resource stewardship, saves resources, and enhances productivity. This directly supports Sustainable Development Goal (SDG) 2: Zero Hunger, sustaining agriculture and improving small holder livelihoods.

The feasibility study confirms not only that the project is affordable and within budget, but also implementable using commonly available equipment, as well as addressing ethical issues such as access fairness and environmental sustainability. With proper execution, this smart irrigation system is able to contribute significantly to the Ugandan agricultural productivity sector, offering a scalable model for the poor Ugandan population.

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