A Research Proposal on

LOW-RESOURCE EDGE AI FOR PRECISION AGRICULTURE

Submitted by
Kaushal Khatiwada
Roll No: 13

Submitted to
Prof. Dr. Ramesh Kumar Joshi
School of Mathematical Science
Kirtipur, Kathmandu, Nepal

INTRODUCTION

Precision agriculture is a modern, automated farming approach that utilizes advanced technologies to optimize resource use, improve productivity, quality, profitability, and sustainability in agricultural production. It involves the collection and analysis of data related to soil conditions, crop health, weather patterns, and more to make informed decisions that enhance farming efficiency.

Low Resource Edge AI refers to the deployment of AI (Artificial Intelligence) models on edge devices with limited resources such as processing power, storage, network bandwidth, electricity, and memory. (Raspberry Pi, Arduino, smartphones, and wearable devices.)

By integrating Edge AI into precision agriculture, farmers can process data locally on these resource-constrained devices, enabling real-time monitoring and decision-making. This approach enhances farm practices by optimizing crop yields, facilitates livestock monitoring, and allowing immediate responses to environmental changes, thereby improving productivity and increasing overall profitability for farmers.

PROBLEM STATEMENT

- Limited Connectivity and latency in rural areas
- Due to Resource Constraints on developing AI models
- High cost to deploy AI models
- Requires real-time decision making
- Lack of sufficient data for forecasting and prediction

OBJECTIVES

- To develop efficient AI models that can run on low-power edge devices
- To promote accessibility in remote by providing offline-capable system
- To enable real-time, on-device decision making on edge devices
- To provide energy and cost-efficient system
- To improve sustainability and productivity using data-driven insights

LITERATURE REVIEW

Edge-AI for Agriculture: Lightweight Vision Models for Disease Detection in Resource-Limited Settings

Harsh Joshi
B.K. Birla College of Arts, Science and Commerce, Kalyan
joshiharsh0506@gmail.com

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Abstract

This research paper presents the development of a lightweight and efficient computer vision pipeline aimed at assisting farmers in detecting orange diseases using minimal resources. The proposed system integrates advanced object detection, classification, and segmentation models, optimized for deployment on edge devices, ensuring functionality in resource-limited environments. The study evaluates the performance of

IoT-Based Low-Cost Automated Irrigation System for Smart Farming

Tajim Md. Niamat Ullah Akhund, Nishat Tasnim Newaz, Zahura Zaman, Atia Sultana, Alistair Barros, and Md Whaiduzzaman

Abstract In this research, we present a low-cost intelligent irrigation system for farming. Nowadays, farming is shifted to automated and remote monitoring and management systems integrated with Cloud, Fog, and IoT networks. Our developed prototype can measure water level, temperature, and humidity with a hardware sensor and micro-controller unit. We use different sensors to take different readings and values to decide to turn on or off the motor. We provide essential algorithm and

LITERATURE REVIEW

The Internet of Things (IOT) in Agriculture Monitoring

Alia Rifat, Prince Patel, B. Shoban Babu

ABSTRACT

Regardless of how the public perceives agriculture, the reality is that today's agriculture industry is more data-driven, precise, and sophisticated than ever before. The rapid rise of Internet-of-Things (IoT)-based technologies has transformed practically every industry, including "smart agriculture," which has moved away from statistical to quantitative techniques. Smart agriculture allows for more efficient fertilizer use and less water waste. The goal of the smart agribusiness research is to create a dynamic and emotionally supportive farm management network. IoT is being used in agriculture to learn about the agricultural field by using sensors for field monitoring and control. Sensors are used to acquire a better understanding of the crop field for monitoring, field control, and other applications. We'll look at how

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A. Rifat*
Hobby Research Associate, Dhaka, Bangladesh.
(e-mail: jodhyy@gmail.com)
P. Patel
Charotar University of Science and Technology Gujarat, India.

Edge AI in Smart Agriculture: Enabling Low-Latency, Data-Driven Crop Management

CHARLES JAMES

DATE:29/08/2024

Abstract

The integration of Edge Artificial Intelligence (Edge AI) into smart agriculture marks a transformative step in the evolution of modern farming practices. Edge AI, which involves processing data locally on edge devices rather than relying on centralized cloud computing, enables real-time decision-making and low-latency responses critical to precision agriculture. This research delves into the application of Edge AI technologies in crop management, emphasizing the role of real-time analytics, localized data processing, and intelligent automation in enhancing agricultural productivity and sustainability. The paper explores the current landscape, technological enablers,

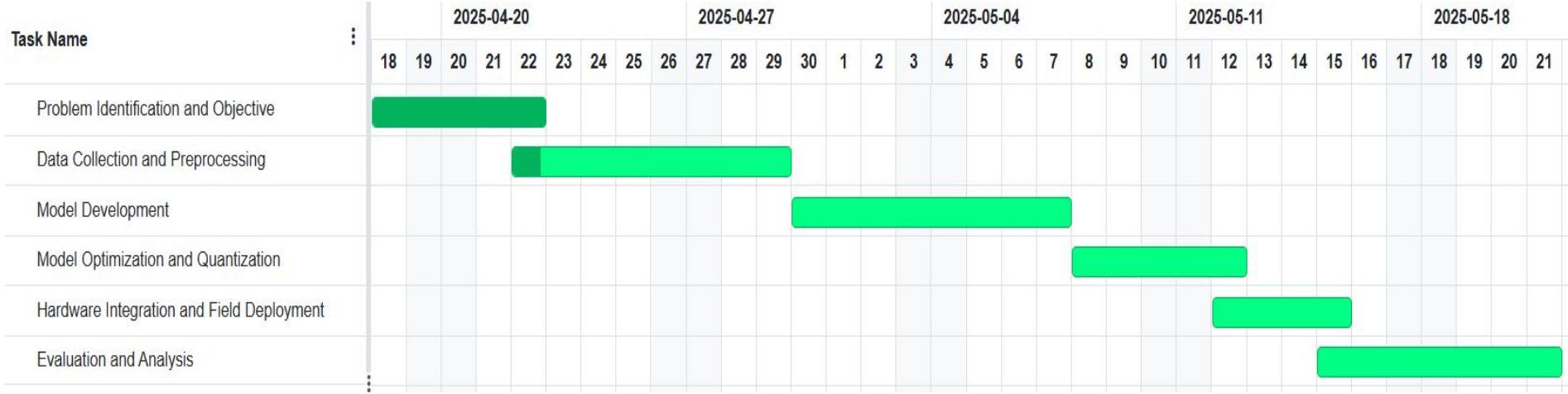
METHODOLOGY

1. **Problem Identification and Objectives**: Identification of resource limit
2. **Data Collection and Preprocessing**: Using sensors like soil moisture, crop health and drone
3. **Model Development and Optimization**: Using TinyML and Pruning, Quantization techniques
4. **Hardware Integration**: Integrate AI models with edge hardware like Raspberry Pi
5. **Field Deployment & testing**: Deploy in agriculture field and test functionality
6. **Evaluation and Analysis**: Evaluate using accuracy, latency, energy consumption and usability

EXPECTED OUTCOMES

- Optimized Resource utilization
- Increased accessibility for farmers
- Enhanced real-time decision-making
- Improved crop monitoring and disease detection
- Energy-efficient operation
- Empowerment through data-driven insights

WORKING SCHEDULES



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