

Enhanced Maize Cultivation: IoT Based Precision Agriculture System

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Abstract—Maize is a vital staple crop that requires precise nutrient management to achieve optimal growth and yield. Traditional agricultural practices often lead to inefficient resource utilization and increased environmental degradation. We propose an innovative system to improve maize cultivation in response to challenges. Our system employs an autonomous rover with a camera and dew nodes, which have soil sensors to monitor soil temperature, pH, NPK levels, and moisture content. The rover collects and transmits these data, monitors air temperature and humidity, and displays them on an LCD screen. The rover and dew nodes communicate through a wireless internet-independent system. The data collected are analyzed using machine learning models to predict soil health, providing actionable insights to farmers for efficient fertilizer application. Our system offers significant advantages, including improved resource efficiency and crop yield through precise, data-driven management.

Index Terms—Precision Agriculture, Internet of Things (IoT), Machine Learning, Maize Cultivation, Crop Management

I. INTRODUCTION

Maize is a fundamental staple crop critical to global food security, which requires effective nutri-

ent management for optimal growth and productivity. However, traditional agricultural practices often result in inefficient use of resources and increased environmental degradation, further exacerbating the challenges facing maize cultivation. Recent NASA projections indicate a potential 24% decline in maize yields due to various environmental stressors, highlighting the urgent need for innovative solutions [1]. To address these issues, we developed an advanced system that integrates an autonomous rover and a network of dew nodes [9] to monitor and manage soil health and irrigation efficiently. The rover, equipped with a camera and obstacle avoidance technology, navigates through the maize fields, collecting data from dew nodes at strategic intervals. These dew nodes have sensors to measure soil temperature, pH, nitrogen, phosphorus, potassium (NPK) and moisture levels. This data is then transmitted to an onboard server and analyzed using machine learning models to provide actionable information to farmers. In addition, the system automates irrigation based on real-time soil moisture readings, ensuring optimal water use. Using modern technology, our system offers significant advantages over traditional practices, including improved resource efficiency, reduced environmental impact, and improved crop

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