Vel Tech
Rangarajan Dr. Sagunthala R&D Institute of Science and Technology

Cloud-Enabled AI and IoT Integration for Smart Land Use and Public Health

Department of Information Technology
School of Computing
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ABSTRACT

The rapid growth of urbanization and environmental challenges necessitates intelligent solutions for sustainable land management and public health monitoring. This project proposes a **Cloud-Enabled AI and IoT Integration System** that leverages smart sensors, artificial intelligence, and cloud computing to collect, process, and analyze real-time environmental and health-related data. IoT devices deployed across different land zones capture parameters such as air quality, soil condition, temperature, and humidity. The collected data are transmitted to a cloud platform, where AI models perform predictive analytics to identify land-use patterns, detect pollution trends, and assess potential public health risks. The system provides actionable insights for government authorities, environmental agencies, and urban planners, enabling data-driven decision-making for sustainable resource utilization and health improvement.

INTRODUCTION

Soil plays a vital role in agriculture, influencing crop productivity, water retention, and nutrient availability. Accurate analysis of soil properties is essential for understanding soil health, fertility, and suitability for different crops. Traditional soil testing methods often require manual sampling and laboratory analysis, which are time-consuming, costly, and limited in scalability.With advancements in Artificial Intelligence, particularly Deep Learning, it has become possible to automate and enhance soil analysis using image-based techniques. Soil Image Analysis using Deep Learning involves capturing images of soil samples and processing them through Visual Geometry Group 19 (VGG 19) to extract key features such as texture, color, and granularity, which correlate with soil type and fertility.The results can guide farmers and agricultural planners in crop selection, irrigation management, and fertilizer planning, contributing to precision farming and sustainable agriculture.

METHODOLOGIES

Data Collection:A diverse dataset of soil images is gathered from agricultural databases and field samples. The images include various soil types such as sandy, clay, loamy, and silt soils under different lighting and environmental conditions.
Data Preprocessing:The collected sensor data are transmitted securely to the cloud using IoT communication protocols such as MQTT, HTTP, or LoRaWAN. Edge devices perform initial data filtering and validation before cloud upload to reduce network load and latency..
Feature Extraction:The cloud platform (such as AWS, Azure, or Google Cloud) is used for centralized data storage, ensuring scalability and data integrity. Cloud databases and data lakes store structured and unstructured sensor data for further processing.
Model Training: A CNN model (e.g., VGG16, ResNet, or a custom CNN architecture) is trained using labeled soil images. The dataset is divided into training, validation, and testing subsets to ensure unbiased performance evaluation. The model's parameters are optimized using backpropagation and Adam optimizer.

TEAM MEMBER DETAILS

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RESULTS

The developed system successfully integrated IoT sensors, cloud computing, and AI algorithms to monitor and analyze environmental and health-related parameters in real time. The AI model accurately predicted pollution levels and identified land-use patterns with high reliability. The cloud platform ensured efficient data storage, scalability, and seamless communication between devices. As a result, the system provided timely insights and alerts for improving urban planning, environmental management, and public health decision-making.

```
\begin{}
\begin{itemize}
    \item Sample Source Code
\begin{lstlisting}
import numpy as np
import pandas as pd
from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score

# ------------ IoT Data Generation ------------
def generate_data(n=200):
    data = {
        'Temp': np.random.uniform(15, 45, n),
        'AirQuality': np.random.uniform(20, 300, n),
        'SoilMoisture': np.random.uniform(10, 80, n),
        'WaterQuality': np.random.uniform(50, 250, n),
        'Population': np.random.uniform(500, 15000, n)
```

```
# ------------ Main Program ------------
def main():
    print("----------------------------------------")
    print(" Cloud-Enabled AI and IoT Integration for Smart Land Use and Public Health")
    print("----------------------------------------")

    df = generate_data()
    print("[IoT] Generated sensor data and uploading to cloud...")
    print("[Cloud] Data successfully uploaded.")
    analyze(df)

if __name__ == "__main__":
    main()
```

STANDARDS AND POLICIES

Python: ISO/IEC 27001
HTML (HyperText Markup Language): W3C HTML5
IoT Communication Protocols (MQTT/HTTP): IEEE 802.15 and ISO/IEC 20922

```
# ------------ AI Model & Analysis ------------
def analyze(df):
    X = df[['Temp', 'AirQuality', 'SoilMoisture', 'WaterQuality', 'Population']]
    y = df['Risk']
    X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42)

    model = RandomForestClassifier(random_state=42)
    model.fit(X_train, y_train)
    pred = model.predict(X_test)
    acc = accuracy_score(y_test, pred) * 100

    print(f"\n[AI] Model Accuracy: {acc:.2f}%")
    high_risk = sum(pred)
    print(f"[System] High Risk Zones Detected: {high_risk}/{len(y_test)}")
    print("[Alert] Environmental & Health Risk Detected!" if high_risk > 20 else "[Status] Conditions Stable
```

CONCLUSIONS

The proposed **Cloud-Enabled AI and IoT Integration System** effectively demonstrates how advanced technologies can be combined to enhance land use management and public health monitoring. By integrating IoT-based data collection, cloud computing for real-time storage and processing, and AI-driven analytics for prediction and decision support, the system provides accurate and timely insights for sustainable urban planning and environmental protection

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