# Lab Manual: Smart Agriculture Network for Precision Farming


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# 1 Objective

The objective of this project is to design and implement a Smart Agriculture Network tailored to Precision Farming in Pakistan. The project involves setting up IoT devices, configuring routing protocols, and integrating automation for resource optimization.

# 2 Lab Overview

This lab manual guides you through:

1. Setting up and configuring routers using OSPF, RIP, and EIGRP.
2. Integrating IoT devices for precision farming.
3. Setting up a scalable and efficient communication network for data transfer between devices.
4. Testing and validating connectivity and performance using various tools.

# 3 Network Components

The network consists of several components:

- **HQ Router:** Responsible for central communication using OSPF.
- **Farm Routers:** Connected via RIP for legacy support.
- **Research Zone Router:** High-performance routing with EIGRP.
- **Switches:** For connecting IoT devices to the local network.
- **IoT Devices:** Includes several IoT devices for smart farming.

# 4 Step-by-Step Configuration

## 4.1 Configuring the HQ Router (OSPF Configuration)

The HQ router connects all zones using the OSPF routing protocol for scalable communication.

```
Router> enable
Router# configure terminal
Router(config)# router ospf 1
Router(config-router)# network 12.0.0.0 0.0.0.255 area 0
Router(config-router)# network 10.0.0.0 0.0.0.255 area 0
Router(config-router)# exit
Router(config)# end
```

Listing 1: **OSPF Configuration for HQ Router**

## 4.2 Configuring Farm Routers (RIP Configuration)

The farm routers support legacy systems and are configured with RIP.

```
Router> enable
Router# configure terminal
Router(config)# router rip
Router(config-router)# version 2
```

```
Router(config-router)# network 192.168.2.0
Router(config-router)# network 192.168.3.0
Router(config-router)# no auto-summary
Router(config-router)# exit
Router(config)# end
```

Listing 2: **RIP Configuration for Farm Routers**

### 4.3 Configuring Research Zone Router (EIGRP Configuration)

The research zone router is configured with EIGRP to optimize performance for data-heavy tasks.

```
Router> enable
Router# configure terminal
Router(config)# router eigrp 10
Router(config-router)# network 192.168.1.0 0.0.0.255
Router(config-router)# no auto-summary
Router(config-router)# exit
Router(config)# end
```

Listing 3: **EIGRP Configuration for Research Zone Router**

### 4.4 Redistributing Routing Protocols

To ensure communication between OSPF, RIP, and EIGRP, redistribute routing information.

```
Router> enable
Router# configure terminal
Router(config)# router ospf 1
Router(config-router)# redistribute rip subnets
Router(config-router)# redistribute eigrp 10 subnets
Router(config-router)# exit
Router(config)# router rip
Router(config-router)# redistribute ospf 1 metric 1
Router(config-router)# exit
Router(config)# router eigrp 10
Router(config-router)# redistribute ospf 1 metric 10000 100 255 1 1500
Router(config-router)# exit
Router(config)# end
```

Listing 4: **Routing Protocol Redistribution**

### 4.5 Configuring IoT Devices

Each IoT device is assigned a static IP and connected to the switch to monitor environmental parameters.

```
Device> enable
Device# configure terminal
Device(config)# ip address 192.168.2.X 255.255.255.0
Device(config)# exit
```

Listing 5: **IoT Device IP Configuration**

Verify IoT device connectivity:

```
Device> ping 192.168.2.1
```

Listing 6: **IoT Device Connectivity Test**

### 4.6 Automating the Irrigation System (IoT Integration)

The IoT devices are configured to automate irrigation based on soil moisture levels.

```
IoT-Sprinkler> enable
IoT-Sprinkler# configure terminal
IoT-Sprinkler(config)# activate irrigation based on sensor data
IoT-Sprinkler(config)# exit
```

Listing 7: **IoT Sprinkler Configuration**

## 5 Testing and Validation

### 5.1 Connectivity Tests

Verify the network setup and IoT device communication:

- Use `ping` to test connectivity between devices and routers.
- Check IoT device connectivity and data transfer.

### 5.2 Traffic Simulation

Use simulation mode in Cisco Packet Tracer to monitor network traffic and validate routing protocol performance.

### 5.3 IoT Device Performance Tests

Ensure that IoT devices respond to environmental changes and trigger automated systems like irrigation based on threshold values.

## 6 Network Diagram

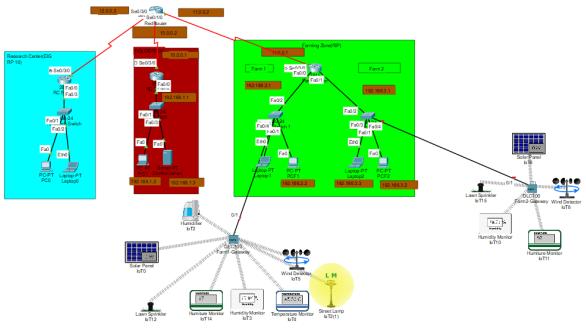

Figure 1: Smart Agriculture Network Diagram

## 7 Conclusion

This lab project successfully demonstrates the integration of IoT devices, routing protocols, and automation to create a Smart Agriculture Network. The network facilitates precision farming with real-time monitoring and optimized resource management.

## 8 Future Work

Future work involves:

- Integration of drones for aerial monitoring.
- Use of blockchain for tracking farming data.
- Enhanced automation using AI for predictive maintenance and resource management.