Robot Agriculture Monitoring System

an autonomous internet connected plant monitoring system

What is the Robot Agriculture Monitoring System?

Automated indoor agriculture monitoring system

Navigates a greenhouse, monitoring plants & environment conditions:

Air humidity

Temperature

Soil moisture levels

Photo of the plant

Information is packaged and sent to a botanist

Application of the RAMS

Reduce the frequency of human exposure to:

protected species

genebanks

protected cultivation zones

Increase monitoring and limit access to high security areas:

drug research labs

protected cultivation zones

Application of the RAMS

Top 150 prescription drugs:
118 based on natural sources
74% from plants

19 NA medicinal plants “at risk”
22 as “to watch”

At Risk Species:
Black cohosh, Goldenseal, Slippery elm

Design of the RAMS: Rail Car

System comprised of:

ESP32-Cam Microcontroller and Camera

DHT11 Temperature & Humidity Sensor

FC28 Soil Moisture Sensor

TCS230 colour sensor

Rail car system:

colour sensor detects demarcations on rail

Complicated set-up in new locations

Design of the RAMS: Autonomous Pathing

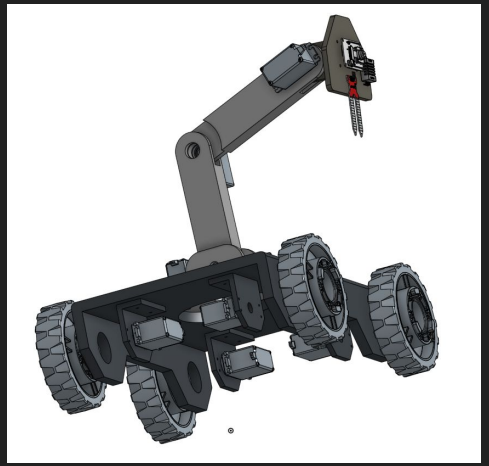
System comprised of:

ESP32-Cam Microcontroller and Camera

DHT11 Temperature & Humidity Sensor

FC28 Soil Moisture Sensor

TFmini Plus LiDAR Range Finder



Autonomous Pathing:

Environment/Path can be generated by:

LiDAR - 3D reconstruction

robot operator navigating path

Camera scans for QR Codes on plant basin

RAMS IOT Features

Web application allows users to:

control arm manipulator

scan QR Codes

maneuver robot base

view humidity and temperature levels

take moisture samples

```
  // Connect to server with the session config
  Serial.println("Connecting to SMTP");
  if(!smtp.connect(&session)) {
    Serial.println("Couldn't connect");
    sleep();
  }
  // Start sending Email and close the session
  Serial.println("Sending Mail");
  if(!MailClient.sendMail(&smtp, &message)) {
    Serial.println("Error sending Email, " + sm
    sleep();
  }
#endif
```

Information is packaged and sent via email

RAMS automatically sends immediate alerts from microcontroller

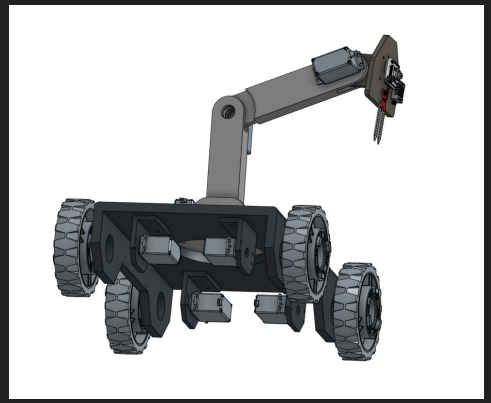
Pseudo Codes

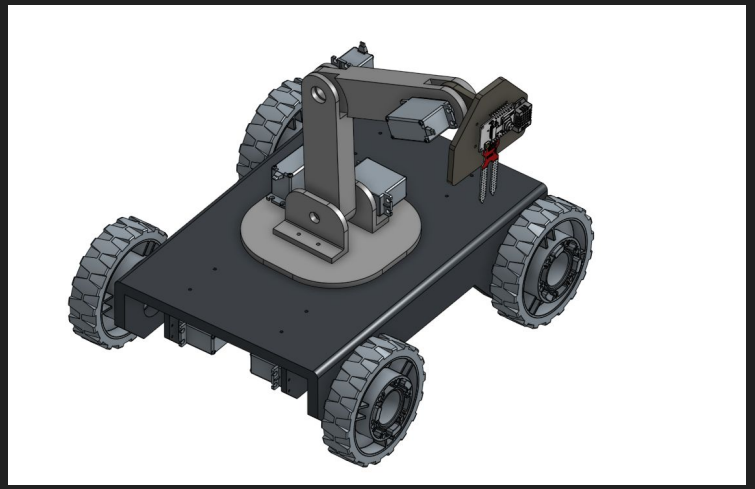
```
1 procedure connect_to_wifi(ssid, password) returns boolean:
2       WiFi.mode(WIFI_STA);
3       WiFi.begin(ssid, password);
4       while(WiFi.status !=  connected):
5               print('.');
6               delay(1000);
```

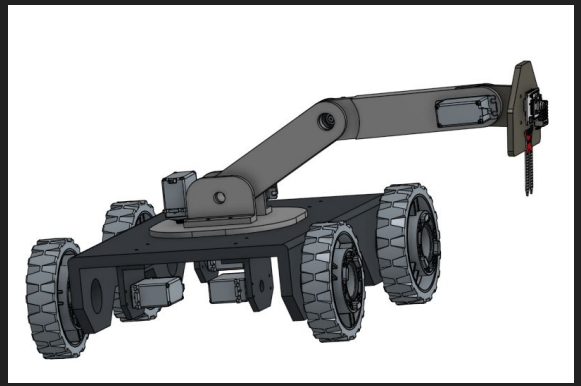
```
1  desired_w;
2  desired_h;
3  margin;
4  procedure move_into_position(w,h):
5       error_w = desired_w - w;
6       error_h = desired_h - h;
7       if(error_w > margin AND error_h > margin):
8               t = get_heading_to_goal();
9               turn(t);
10              while(error_w > margin OR error_h > margin):
11                      drive(low_speed);
12              drive(stop);
```

```
1  procedure send data()  returns boolean:
2       SMTP_Message message;
3       SMTP_Attachment attachment;
4       attachment.file.path(path_to_attachment);
5       message.addAttachment(attachment);
6       if(!smtp.connect(&session)):
7               print("couldn't connect to mail server");
8               return False;
9       if(!MailClient.sendMail(&smtp, &message)):
10              print("couldn't send email);
11              return False;
12      return True;
```

RAMS Model







Improvements

Servos depicted should be substituted

Need for motor driver

Drive style change to omnidirectional

Relocate turret motor

Wi-Fi antenna upgrade

Thank You for Your Time

feedback is appreciated