TEAM G-FORCE OMOTEC INDIA

POWER-BOT FOR CROP CARE AND FRIENDLY, PRODUCTIVE FARMING.

BY,

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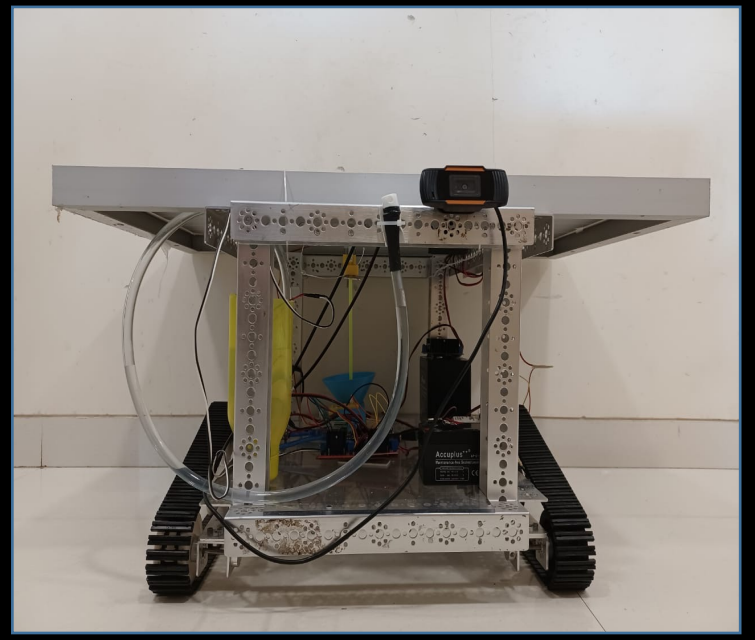


AIM

ENVIRONMENT

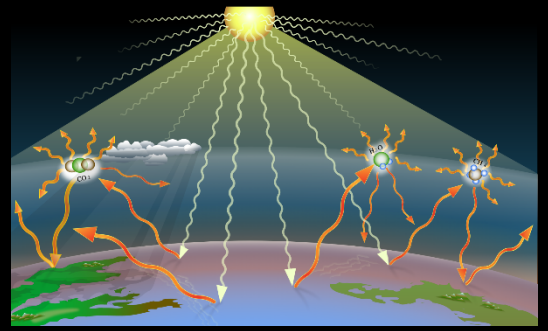
- Increasing the rate of crop productivity.
- Decreasing the rate of pollution and soil degradation.
- Takes care of soil moisture and maintains pH levels.

COST

- Using renewable energy with an agricultural purpose to help the environment and the community in a cost effective and advanced way.

FARMING

- Since climate change is the biggest problem currently we aim to reduce the amount of greenhouse gases emissions farming produces every year.
- Making it easier for unskilled farmers.



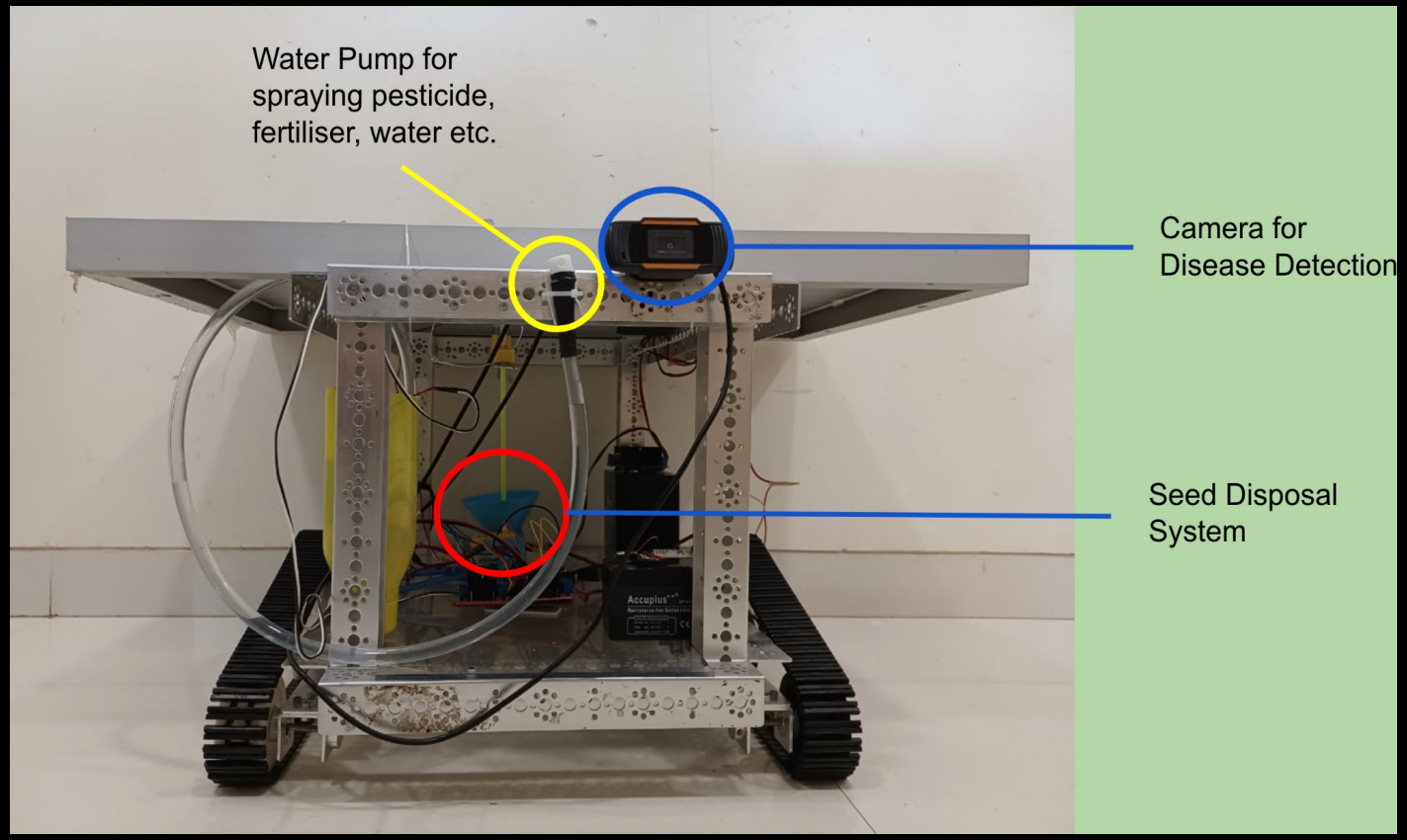
MOTIVATION

- The amount of emissions produced by the industry
- The lack of supply of power to the field of agriculture
- The extreme cost of current renewable energy
- Revolutionizing agricultural development by autonomous technology
- Agriculture consists 18% GDP of India. Out of this 49% is related to the farming industry.

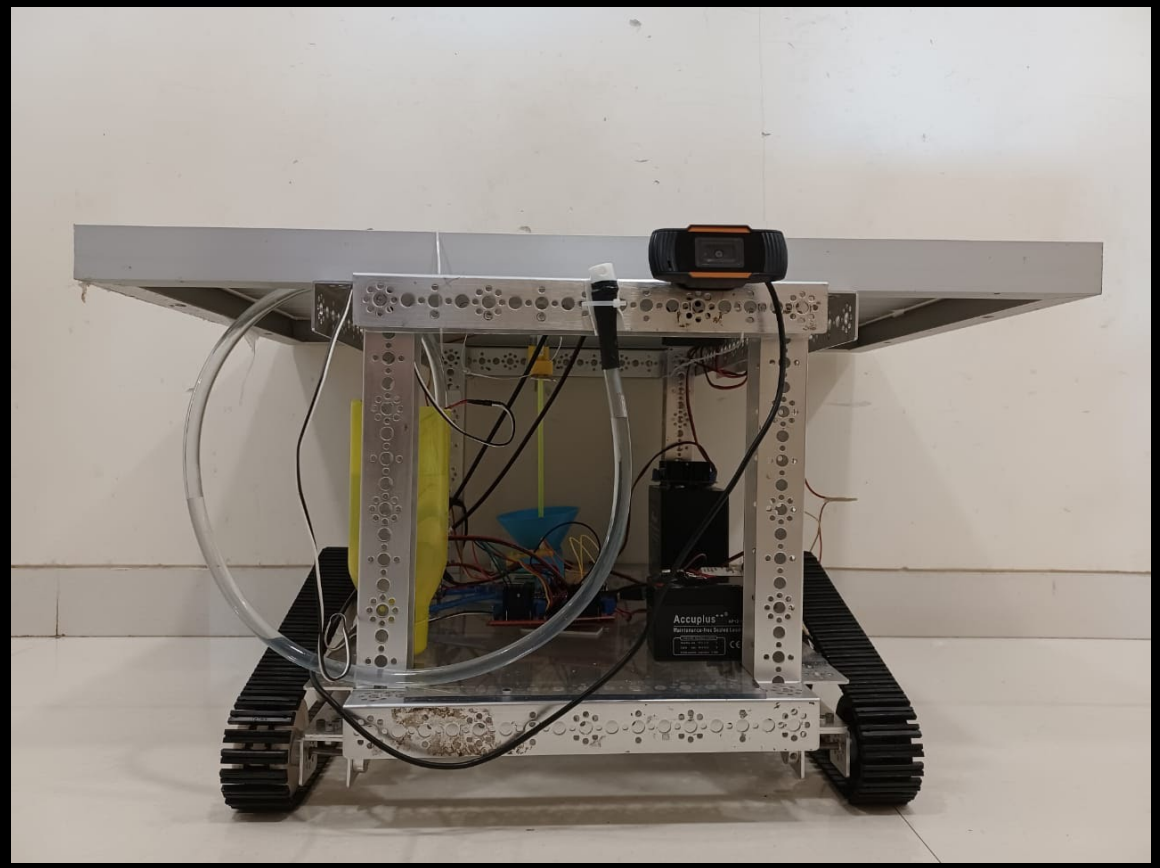
TECHNOLOGY

Different Functions of our robot:

- ❑ Planting seeds and depositing fertilizer.
- ❑ Spraying Fertilizer(liquid)+water.
- ❑ Disease Detection on plant leaves.
- ❑ Detection for soil parameters.

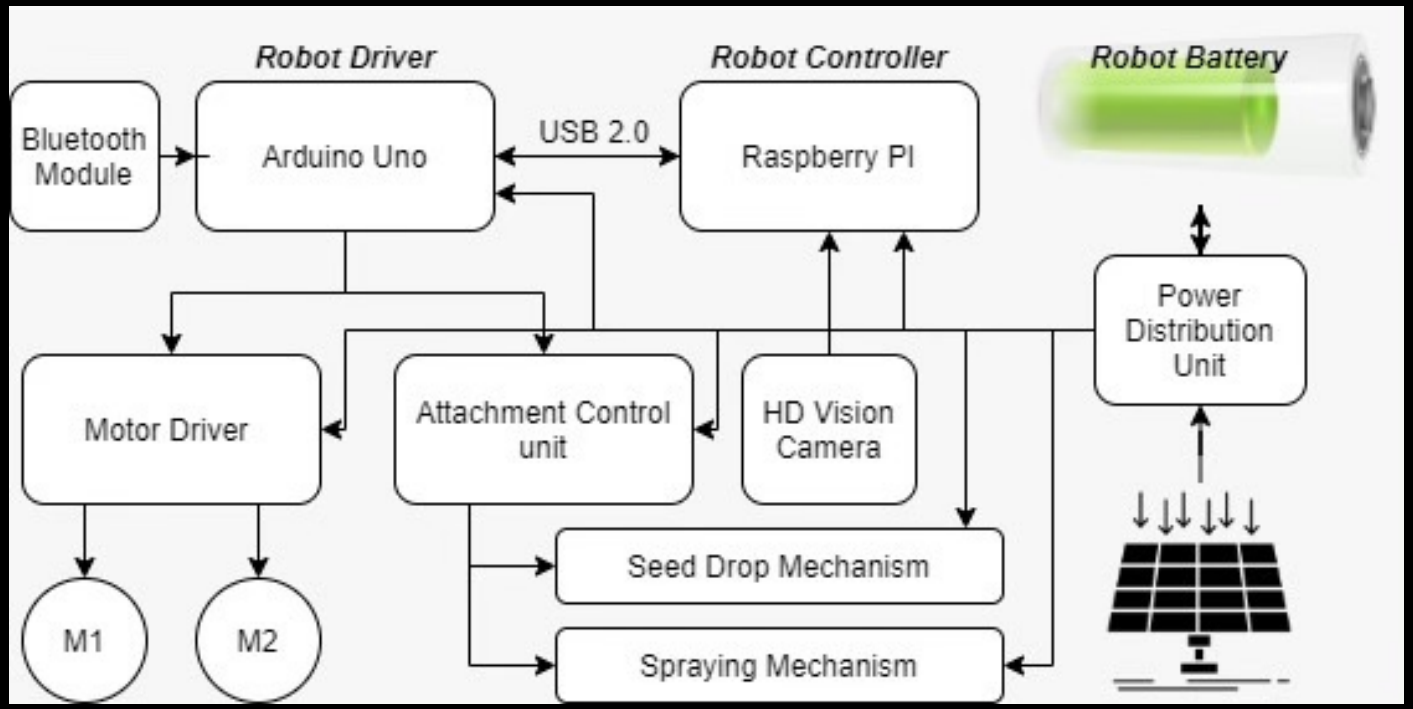


FEATURES OF ROBOT



- It removes all need for manual labor.
- It sprays water along with fertilizer at the same time
- It plants the seed in the ground thus removing the need to till the solid
- It can detect diseases and immediately spray it with pesticide
- We can add as many function as we want by attaching the required attachment and programming it with the Arduino.
- It can work fully in rough terrain, it's tough body makes it durable
- It works on Solar Panel so it utilizes renewable energy in farms, where renewable energy is hardly utilized.

PROPOSED SOLUTION



- Robot battery- Li-ON 11.1 volt 2.2A
- HD vision camera- Digital webcam
- Attachment control unit- custom design circuit.

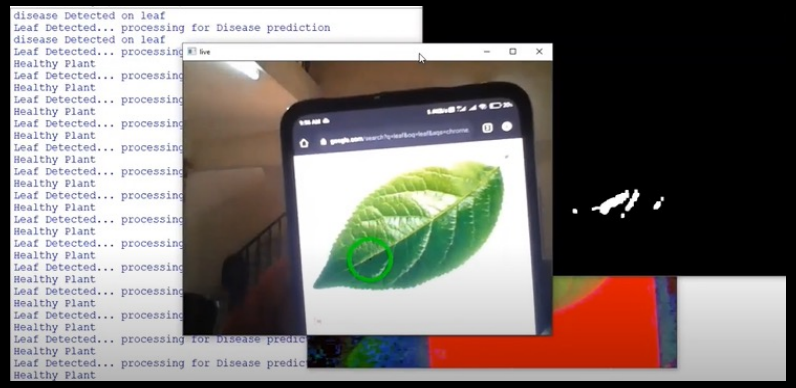
- The Bluetooth module is using a HC-05.
- The robot driver is coded with Arduino Nano which is connected to the robot controller which is coded with raspberry pi using a USB 2.0.
- The power distribution unit is a bug and boost program which increases the current when its low and decreases the current when its high according to one's need.
- The major power source were using in solar energy.
- The seed dropping mechanism is powered by a BO motor and a 3D printed gear, The spraying mechanism is powered by a pump motor.
- The motor driver is an L298N with M1 and M2 being DC motors.

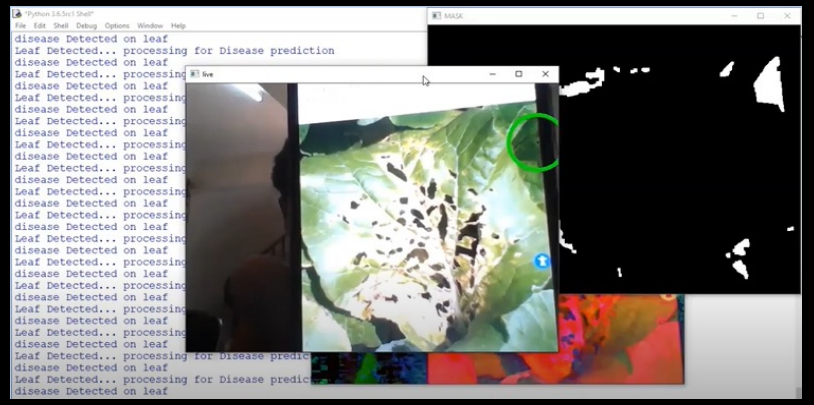
AI PROGRAMING

```python
import cv2
import numpy as np
import pickle

import serial
import time

lastdata = ["mk"]

ser = serial.Serial('/dev/ttyACM0', 9600, timeout = 1)
ser.flush()

hog = cv2.HOGDescriptor()
clf = pickle.load(open('./model/neural.model', 'rb'))
print("Model Loaded Sucessfully..")

cam  = cv2.VideoCapture(0)

#l = np.array([10, 122, 129], dtype="uint8")
#u = np.array([86,255,255], dtype="uint8")

l = np.array([30, 70, 60], dtype="uint8")
u = np.array([90,220,125], dtype="uint8")


def dataSend(data, ldata):
    if (data != ldata):
        ser.write(data.encode('utf-8'))
        line = ser.readline().decode('utf-8').rstrip()
        print("Command:",data, "\tRecord:",lastdata[0], "\tReceivedAction:",line)
        return data

def predict(img):
    img = cv2.resize(img, (150, 150))
    h = hog.compute(img)
    fet = np.array(h)
    fet = np.reshape(fet, [1, 124740])

    print(clf.predict(fet)[0])

    if (clf.predict(fet)[0] == 1 or clf.predict(fet)[0] == 2 or clf.predict(fet)[0] == 3):
        #print('disease Detected on leaf')
        return True
    else:
        #print('Healthy Plant')
        return False
```

```python

def leafCheck(img):
    hsv = cv2.cvtColor(img, cv2.COLOR_BGR2HSV)
    #cv2.imwrite("hsvimage.png", hsv)
    cv2.imshow("HSV", hsv)
    kernel = np.ones((5,5), np.uint8)
    mask = cv2.inRange(hsv, l, u)
    mask = cv2.morphologyEx(mask, cv2.MORPH_OPEN, kernel)
    mask = cv2.morphologyEx(mask, cv2.MORPH_CLOSE, kernel)

    cv2.imshow("MASK", mask)

    cnt, hry = cv2.findContours(mask, 1,2)

    if len(cnt) > 0:
        #print(len(cnt))
        c = max(cnt, key = cv2.contourArea)
        ((x,y), r) = cv2.minEnclosingCircle(c)
        return x,y,r, True
    else:
        return None, None, None, False


userInput = input("Enter the Start Key:")

while True:
    _, img = cam.read()
    if userInput == "P": # start the Robot
        lastdata[0] = dataSend("F", lastdata[0])
        time.sleep(0.15)
        #img = cv2.imread("./images/test5.jpg")
        k = cv2.waitKey(27) & 0xFF
        x,y,r,decision = leafCheck(img)
        if decision == True:
            print("Leaf Detected... processing for Disease prediction")
            result = predict(img)
            cv2.circle(img, (int(x), int(y)), int(r), (0,255,0), 5)
            if result == True:
                cv2.putText(img, "Diseases Detected", (int(x), int(y)), 5, int(r*0.01), (0,0,0), 2)
                lastdata[0] = dataSend("A", lastdata[0])
                time.sleep(1.9)
            else:
                cv2.putText(img, "Healty Leaf", (int(x), int(y)), 5, int(r*0.01), (0,0,0), 2)
        else:
            print("No leaf detected Detected")
```

```python

    elif userInput == 'D':
        lastdata[0] = dataSend("1", lastdata[0])
        time.sleep(2.5)

    cv2.imshow("live", img)
    if k == ord('q'):
        break

lastdata[0] = dataSend("S", lastdata[0])
lastdata[0] = dataSend("Y", lastdata[0])
lastdata[0] = dataSend("0", lastdata[0])
cam.release()
cv2.destroyAllWindows()
```





The code is created in python 3.6.5 Environment which uses OpenCV and Keras engine libraries to detect the disease on plat.
This code according to robot sensory prediction sends serial message to robot drive unit.
The Keras model is trained on 4 nos of different disease listed below.
Healthy, Bacterial Leaf Blast, Heist, Fungi.

BOT DRIVE PROGRAMING

ROBOTDRIVE_arduino_code | FUN

```
int m01 = 2;
int m02 = 3;
int m11 = 4;
int m12 = 5;

int p1 = 6;
int p2 = 7;
int p3 = 8;
int p4 = 9;

void setup() {
  pinMode(m01, OUTPUT);
  pinMode(m02, OUTPUT);
  pinMode(m11, OUTPUT);
  pinMode(m12, OUTPUT);
  pinMode(p1, OUTPUT);
  pinMode(p2, OUTPUT);
  pinMode(p3, OUTPUT);
  pinMode(p4, OUTPUT);
  Serial.begin(9600);
}

void loop() {
  if (Serial.available()){
    char Data = Serial.read();
    //Serial.println("Received Char="+String(Data));
    if ((Data == 'F') or (Data == 'f')) {
      forward();
    }
    else if ((Data == 'A') or (Data == 'a')){
      specialForward();
    }
    else if ((Data == 'B') or (Data == 'b')){
      backward();
    }
    else if ((Data == 'L') or (Data == 'l')){
      left();
    }
    else if ((Data == 'R') or (Data == 'r')){
      right();
    }
    else if ((Data == 'S') or (Data == 's')){
      stopm();
    }
    if ((Data == 'X') or (Data == 'x')){
      pumpon();
    }
    else if ((Data == 'Y') or (Data == 'y')){
      pumpoff();
    }
    if ((Data == '1') or (Data == '1')){
      seedDropOn();delay(100);
      forward(); delay(1000);
      right();   delay(100);
      forward(); delay(1000);
      left();    delay(100);
      stopm(); seedDropOff(); delay(100)
    }
    else if ((Data == '0') or (Data == '0')){
      seedDropOff();
    }
  }
}
```

ROBOTDRIVE_arduino_code | FUN §

```
void pumpon(){
  Serial.println("pump on");digitalWrite(p1, HIGH);digitalWrite(p2, LOW);
}
void seedDropOn(){
  Serial.println("Seed Drop On");digitalWrite(p3, HIGH);digitalWrite(p4, LOW);
}
void seedDropOff(){
  Serial.println("Seed Drop off");digitalWrite(p3, LOW);digitalWrite(p4, LOW);
}
void pumpoff(){
  Serial.println("pump off");digitalWrite(p1, LOW);digitalWrite(p2, LOW);
}
void specialForward(){
  pumpon();stopm();delay(1500);forward();delay(200);stopm();pumpoff();delay(200);
}
void forward(){
  Serial.println("forward");digitalWrite(m01, HIGH);digitalWrite(m02, LOW);digitalWrite(m11, HIGH);digitalWrite(m12, LOW);
}
void backward(){
  Serial.println("backward");digitalWrite(m01, LOW);digitalWrite(m02, HIGH);digitalWrite(m11, LOW);digitalWrite(m12, HIGH);
}
void left(){
  Serial.println("left turn");digitalWrite(m01, HIGH);digitalWrite(m02, LOW);digitalWrite(m11, HIGH);digitalWrite(m12, HIGH);
}
```

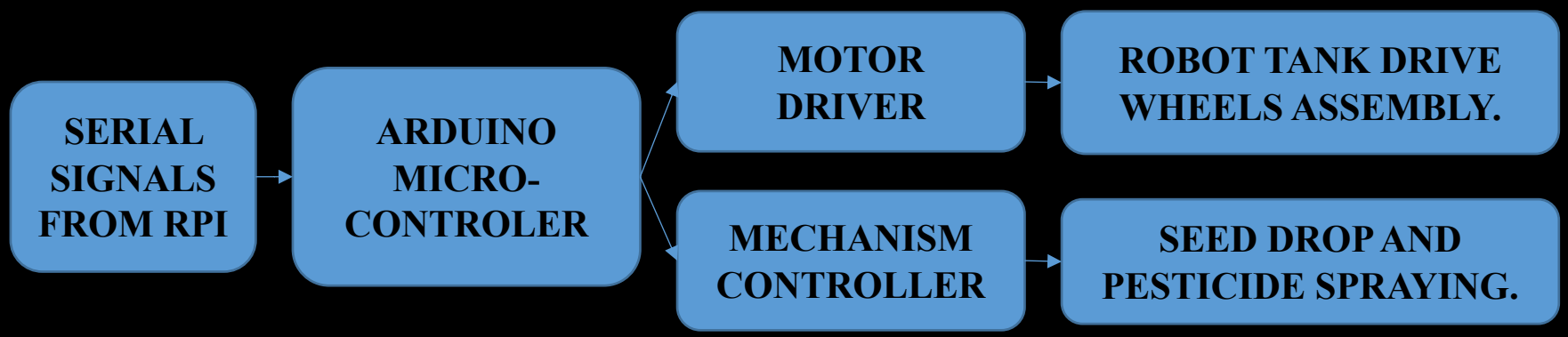
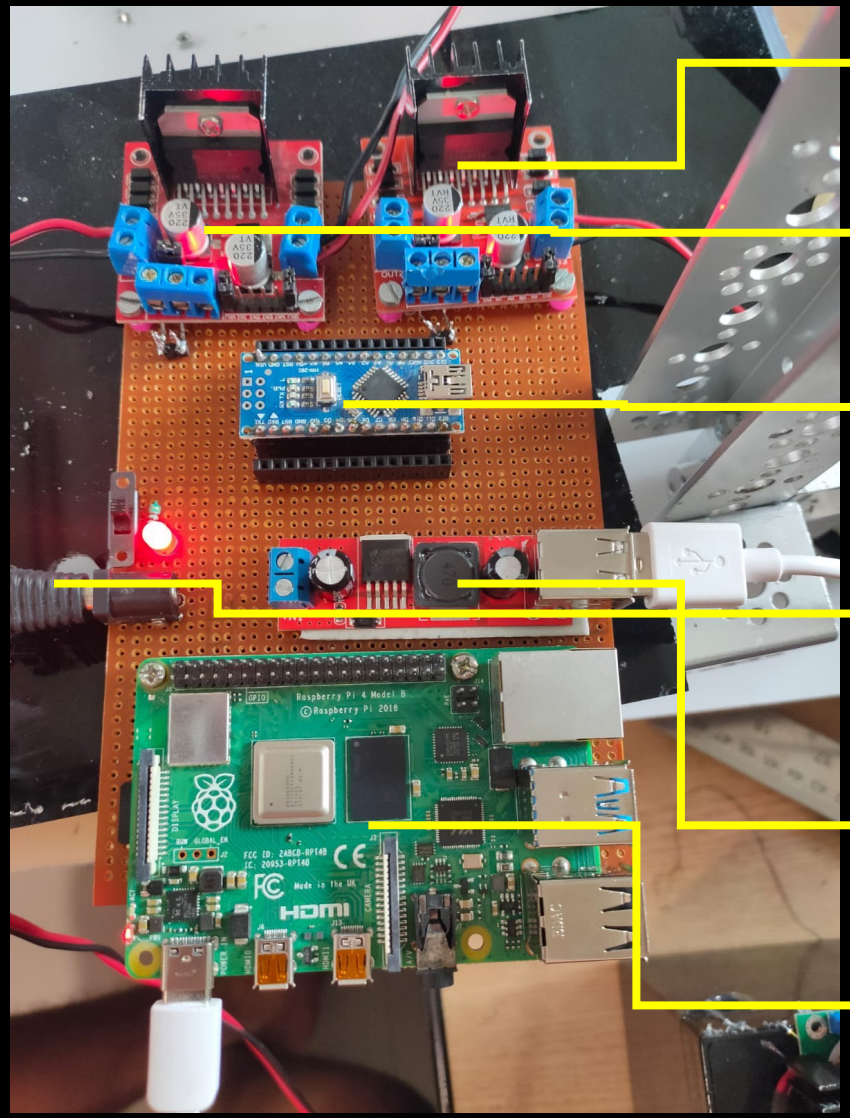


Fig: Signal Flow Block Diagram

BOT CIRCUIT'S



- MOTOR DRIVER FOR TANK DRIVE CONTROL
- MOTOR DRIVER FOR MECHANISM'S CONTROL
- ARDUINO NANO MICROCONTROLLER
- DC JACK POWER FROM BATTERY AND POWER DISTRIBUTION UNIT
- BUCK CONVERTOR 5V 2A
- AI PROCESSOR (RASPBERRY PI 4)

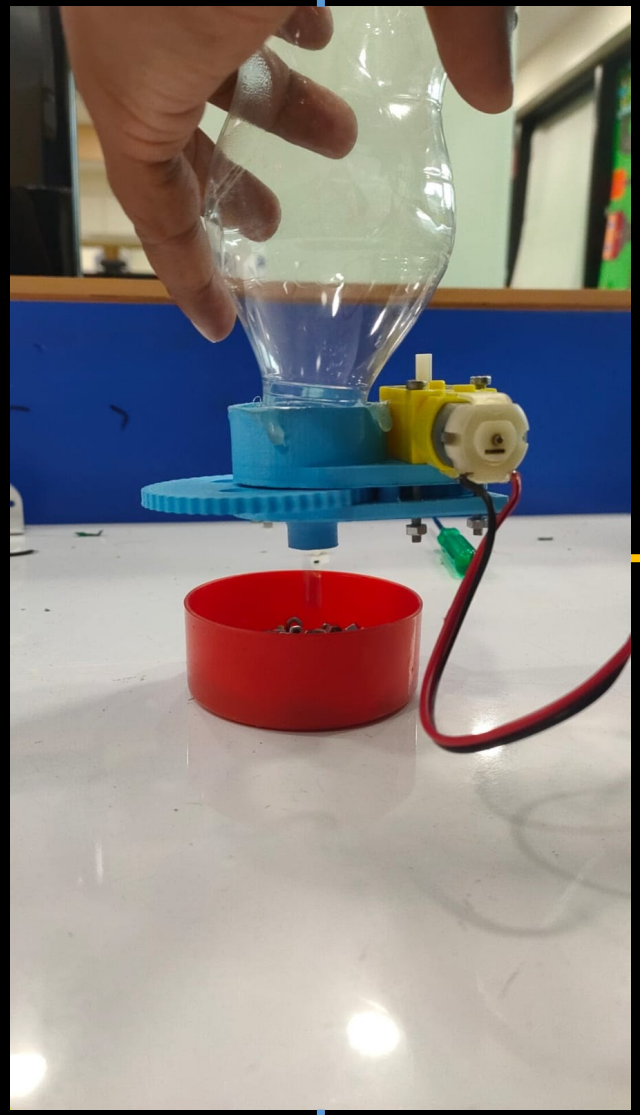
We have used raspberry Pi for its small storage and its ML capability. We will need for our leaf detection and computing other data.

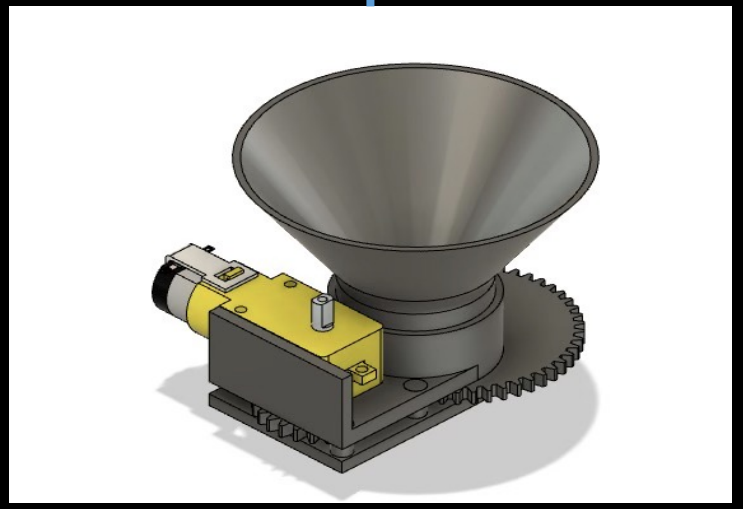
We will have 2 motor drivers for the motors of the wheels along with the water pump and seed disposal system.

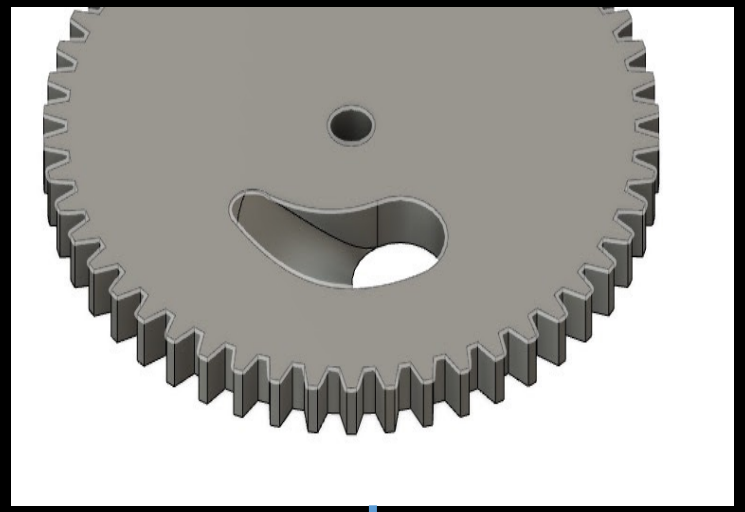
We will use a Bluetooth receiver to receive and send data via Bluetooth as wireless communication is the most efficient.

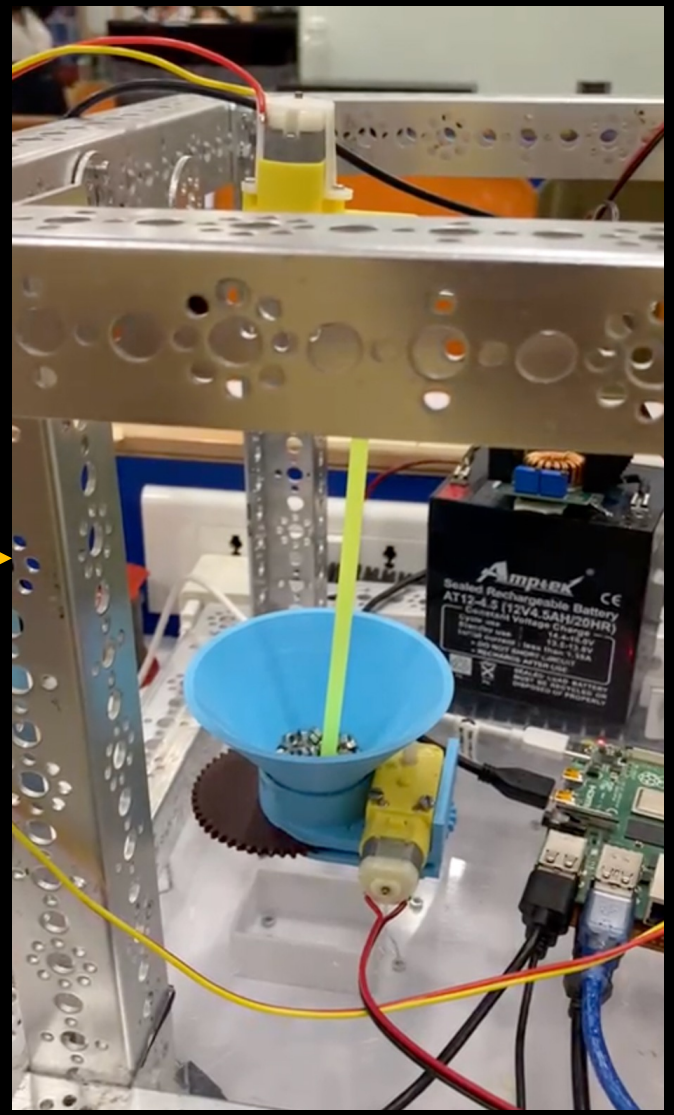
This will all be powered by solar panel, thus removing all the need exhaustible energy.

BOT- SEED DROP MECHANISM

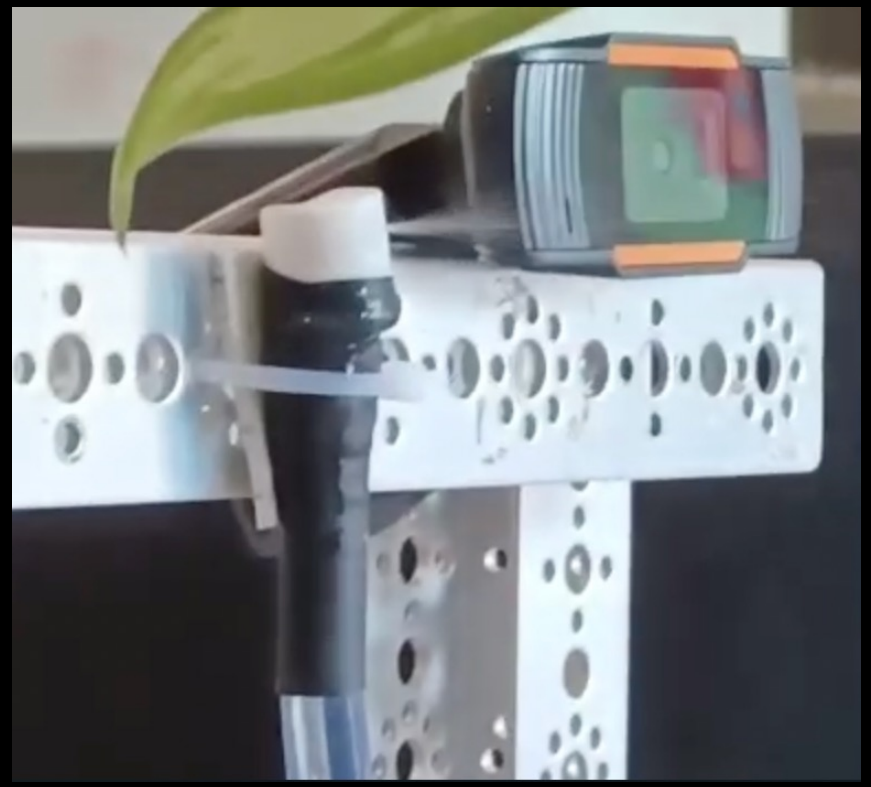








BOT- SPRAYING MECHANISM



Water Pump System

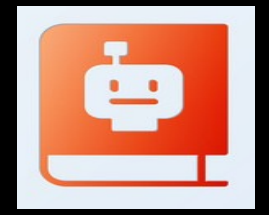
- We are using a water pump system to pump water, insecticide, any other important fertilizing material.
- In this system we connect a pump to the water supply and once the camera detects the leaf, it starts spraying.

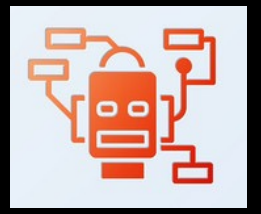
REFILLABLE PESTICIDE TANK

SPRAYER NOZZEL

BOT- ADVANTAGES

- It is a fully autonomous robot designed specifically for efficient farming.
- Uses renewable energy source i.e solar, can store the same power in battery for future use.
- Cost effective in terms of farming labor cost.
- Ability generate report for each plant health for entire farm.
- Versatile, rigid, multi-terrain capabilities.
- Fully AI powered, and easy to use.
- Simple user interface as like smart-phone.
- Manual and Auto mode Supported.





FUTURE SCOPE

These autonomous robots throughout the entire world, and revolutionizing agriculture and ensuring that renewable energy becomes the new norm in the largest industry i.e. primary services.

THANK YOU