3 GOOD HEALTH AND WELL-BEING | 12 RESPONSIBLE CONSUMPTION AND PRODUCTION | 2 ZERO HUNGER

# S-SMS

## (SUSTAINABLE-SOIL MONITORING SYSTEM)

### BACKGROUND

WITH THE EXPONENTIAL POPULATION GROWTH, THE DEMAND FOR "GREEN" GOODS INCREASES WHILE PRODUCTIVE LAND DECREASES. CURRENT AGRICULTURE LAND PRODUCE WILL BECOME INSUFFICIENT WITH TIME WITHOUT INORGANIC /HARMFUL CHEMICALS. SO HOW CAN WE SOLVE THIS PROBLEM?

### OUR VISION

WE SOLVE THIS PROBLEM BY GOING VERTICAL.WE ASPIRE TO CREATE A DIVERSE SOLUTION WHICH CAN REVOLUTIONIZE THE GREEN INDUSTRY. CREATING STACKED STRUCTURES CAN SAVE SPACE AND MAKE A CONTROLLED ENVIRONMENT WHICH INCREASES VERSATILITY. PHYSICAL LABOUR REDUCES AND INDEPENDANCY GROWS

### APPLICATIONS

VERTICAL FARMING: GROWING PLANTS IN VERTICAL STACKS.
HYDROPONICS: COMPLETE REMOVAL OF SOIL FROM SSMS.
RESEARCH: CONTROLLED ENVIRONMENT ENABLES EASIER RESEARCH ON FLORA.
CONVENTIONAL AGRICULTURE: USE OF PRODUCED DATABASE INCREASES EFFICIENCY

### N — NITROGEN

IT'S CRUCIAL FOR CHLOROPHYLL, WHICH ALLOWS PLANTS TO CARRY OUT PHOTOSYNTH -ESIS. NITROGEN IS ALSO A MAJOR COMPONENT IN AMINO ACIDS, THE BASE OF PROTEINS. NITROGREN ALSO AIDS IN THE COMPOUNDS THAT LET FOR STORAGE AND USE OF ENERGY.

### P — PHOSPHORUS

-PHOSPHORUS ENCOURAGE THE GROWTH OF ROOTS.
-PROMOTES FLOWERING.
-IS NECESSARY FOR DNA.
-IMPORTANT FOR ENERGY TRANSFER IN PLANTS
-IT HELPS IN THE CONVERSION OF SUGARS AND STARCHES.

### K — POTASSIUM

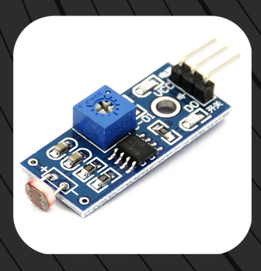
-IT'S OFTEN REFFERED TO AS THE "VALUE ELEMENT", BECAUSE OF ITS CONTRIBUTION TO MANY OF THE FEATURES WE CONNECT WITH QUALITY, SUCH AS FIGURE, COLOR, AND EVEN TASTE.
-IT PROVIDES STRENGTH AND IMMUNITY FROM SEVERAL DISEASES

### COMPONENTS

5V NPK SENSOR (READING IN mg/kg)

CAPACITIVE MOISTURE SENSOR (READING IN %)

ARDUINO UNO (MICRO-CONTROLLER)



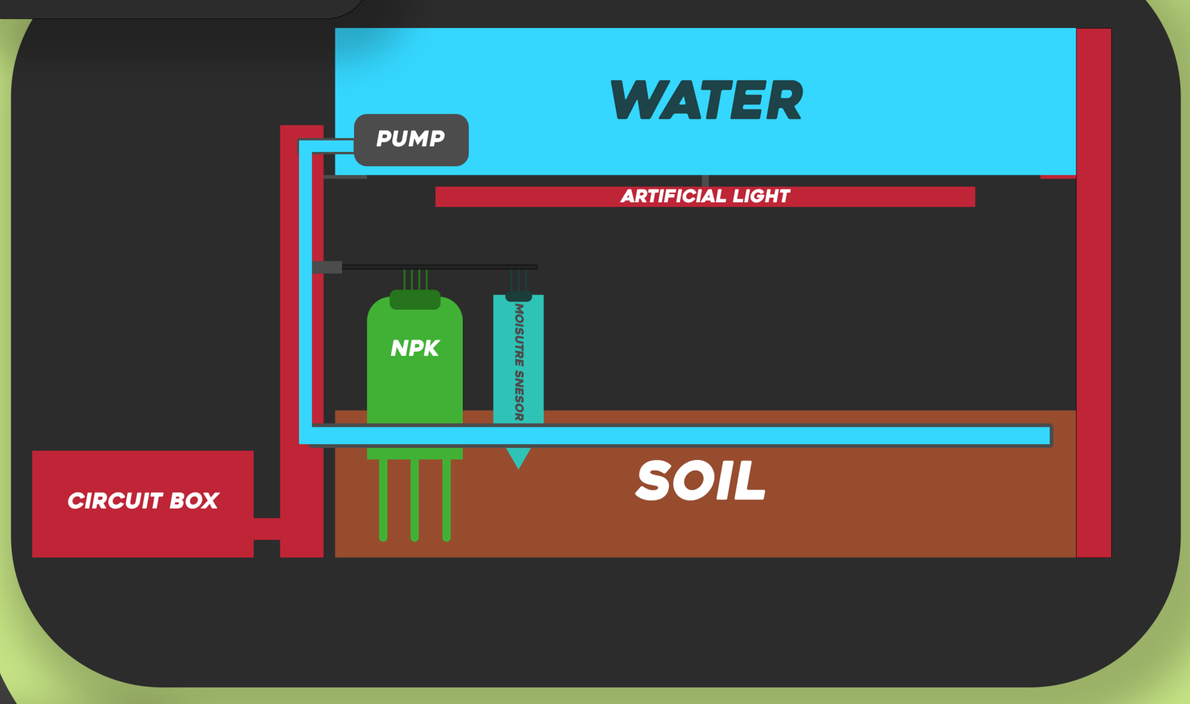
LDR (TOGGLE SENSOR)

PUMP (ACTUATOR)

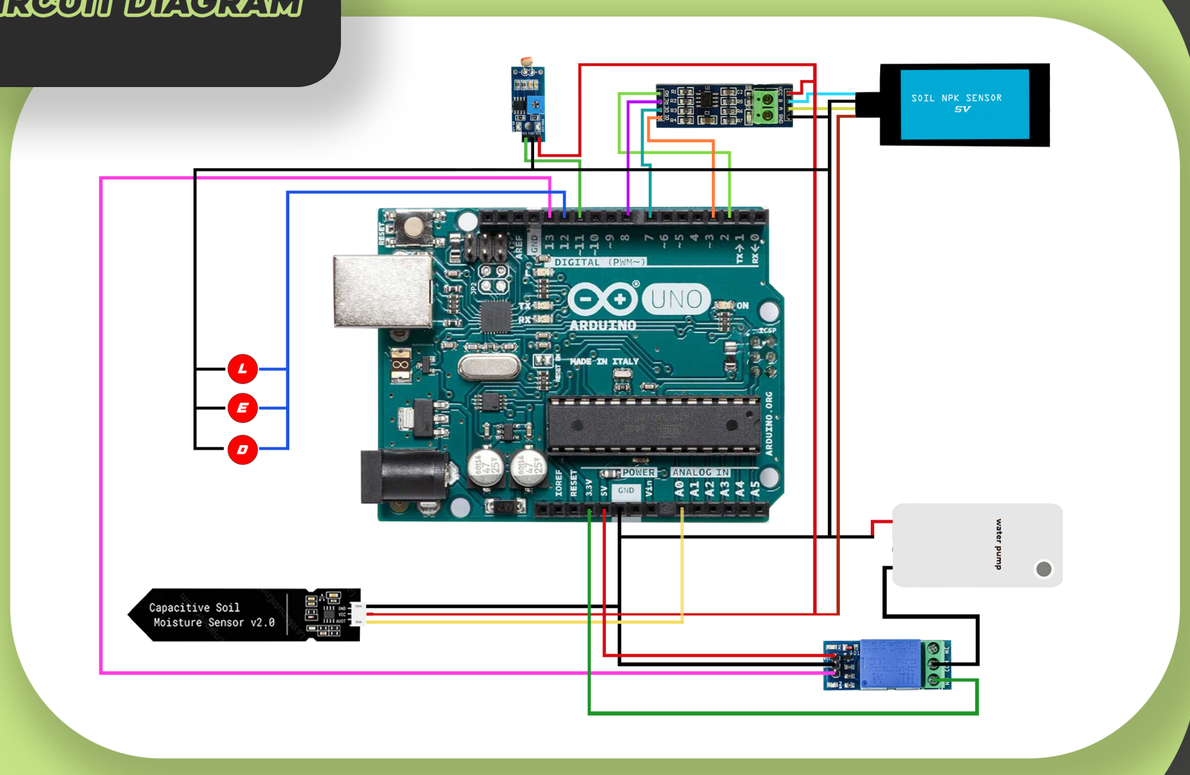
### WORKING

THE S-SMS IS SMALL SCALE APPROACH TO EMULATE FARM FIELDS AND OTHER AGRICULTUR -AL PRACTICES IN A SMALL SPACE. SEVERAL FACTORS LIKE NUTRIENTS, MOISTURE, LIGHT INTENSITY CAN BE ALTERED TO SPECIFIC PROPORTIONS ACCORDING TO DEMAND. RAIN WATER HARVESTING IS ALSO INCORPORATED INTO THE PROJECT FOR WATER SUPPLY.

### MODEL DIAGRAM




### CIRCUIT DIAGRAM




THE TEAM

ARYAMAN KAPREKAR - SHARATH - DIVIT VERMA - SWAYAM SRITAM KUMAR

**NPK Values for different soils from in and around MIT campus**

*Sandy Soil: Location: MIT ground
Nitrogen: 7 mg/kg
Phosphorus: 3 mg/kg
Potassium: 4 mg/kg
Moisture: 32%

Garden Soil: Location: in front of Block14, MIT hostels
Nitrogen: 54 mg/kg
Phosphorus: 23 mg/kg
Potassium: 36 mg/kg
Moisture: 62%

Regular Grass Soil: Location: MIT football ground
Nitrogen: 32 mg/kg
Phosphorus: 14 mg/kg
Potassium: 16 mg/kg
Moisture: 54%

Swampy Soil: Location: Beside Campus Store
Nitrogen: 29 mg/kg
Phosphorus: 9 mg/kg
Potassium: 12 mg/kg
Moisture: 81%

*Silica Soil: Location: near Block 9, MIT hostels
Nitrogen: 5 mg/kg
Phosphorus: 1 mg/kg
Potassium: 1 mg/kg
Moisture: 45%

(*For a few soil samples moisture amount is higher than normal as more water was added to read npk as NPK sensor detects ions)

**Soils of India and their N,P,K,%moisture requirements**

| Soil Type | Crops That Can Be Grown | N (mg/kg) | P (mg/kg) | K (mg/kg) | Moisture (%) |
|---|---|---|---|---|---|
| Alluvial Soil | Rice, Wheat, Sugarcane | 75-200 | 10-20 | 20-100 | 30-50 |
| Black Soil | Cotton, Soybeans, Wheat | 80-300 | 10-30 | 30-300 | 30-50 |
| Red Soil | Groundnuts, Millets | 30-90 | 5-15 | 10-100 | 20-40 |
| Laterite Soil | Cashew, Rubber, Tea | 20-150 | 5-15 | 10-70 | 20-40 |
| Mountain Soil | Apples, Potatoes, Barley | 20-100 | 5-15 | 20-100 | 60-80 |
| Desert Soil | Pearl Millet, Guar | 10-50 | 5-15 | 10-50 | 10-30 |

Please note that these values are approximate and can vary depending on specific regions within India. Soil conditions may differ, and the nutrient and moisture requirements of crops can also be influenced by local factors and the crop varieties being cultivated. It's important to conduct soil tests and consult local agricultural experts for more precise recommendations in your specific area. Information from Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs)

**Financial gain of this project:**

1. **Optimized Fertilizer Application:** Savings can range from INR 5,000 to INR 20,000 per acre per year, depending on factors like the type of crop, soil conditions, and previous fertilizer usage.
2. **Water Savings:** Water savings can range from INR 2,000 to INR 10,000 per acre per year, depending on the region's water costs and the efficiency of water use.
3. **Reduced Pest Control Costs:** Savings can vary from INR 3,000 to INR 15,000 per acre per year, based on the intensity of pest infestations and the effectiveness of control measures.
4. **Labor Efficiency:** Labor cost savings can range from INR 10,000 to INR 50,000 per year, depending on the size of the farm, automation level, and labor costs.
5. **Energy Efficiency:** Energy savings might vary from INR 5,000 to INR 20,000 per year, depending on the energy requirements and cost of energy.
6. **Lower Risk Management Costs:** Savings in crop insurance premiums can range from INR 5,000 to INR 20,000 per year per acre, depending on the level of coverage and risk profile.

**Few Attachments for the project to suit specific needs**

1. **Ultrasonic Sensor:** Check level of rainwater reservoir
2. **GSM:** Notify when water level is exceeding capacity
3. **pH sensor:** Checking pH as pH of soil can alter the nutrients plant gets
4. **Solenoid Valve:** Actuator to add/maintain npk fertilizer according to plant
5. **Wifi Module(ESP):** To collect survey data and transmit to medium distances
6. **Carbon Sensor(NearInfrared Spectroscopy):** To check organic matter (humus) in soil
7. **Electro Conductivity Sensor:** To calculate ion movements in soil
8. **UV light:** to simulate sunlight in closed confined space
9. **Video Camera:** To check the progress of growth and observe the patterns of plant
10. **App:** Weather, Soil and Plant related database can display recommendations to domestic/Farmer users