Phase 4: Smart Water Management Based on IOT.

Development Part 2:

Smart Water Management:

This IOT-based project involves building a smart water management system that can remotely monitor a particular liquid's level and prevent it from overflowing. This project holds immense value for the industrial sector that uses large volumes of fluids in its day-to-day operations. Apart from detecting a liquid's level, this monitoring system can also be used to track the usage of specific chemicals and to detect leaks in pipelines.

The system is fitted with ultrasonic, conductive, and float sensors. A Wi-Fi module helps connect the system to the Internet and facilitates data transmission. Four ultrasonic sensors help transmit the data on the liquid level and alert the user on the same.

Benefits of smart water management System-

- **Allows to access fluid level**
- **Temperature monitoring**
- **Updates**
- **Alarms**
- **Automatic On/ OFF pumps**
- **Level Control**

Features of smart water management System-

- **Remotely monitor liquid levels**
- **Access fluid level information**
- **Buzzer/ Trigger Alarms**
- **Wi-Fi Modem**
- **Display levels of liquid.**

Web Development Based on IOT:

1. Improved Efficiency and Productivity

One of the primary advantages of IOT projects is the ability to streamline processes and optimize resource usage. Businesses can monitor and manage operations in real time by deploying IOT-enabled sensors and devices. This leads to enhanced efficiency, reduced downtime, and improved overall productivity. For instance, in manufacturing, IOT sensors can track production lines, identifying bottlenecks and potential failures, allowing for timely maintenance and minimal disruptions.

2. Enhanced Data Collection and Analysis

IOT projects generate vast amounts of data from connected devices and sensors. This data offers valuable insights into operations, customer behavior, and equipment performance. Businesses can make informed decisions, identify trends, and predict outcomes through data analysis, leading to better planning and resource allocation.

3. Cost Savings and Resource Management

Optimizing resource usage not only improves efficiency but also leads to cost savings. IOT projects help organizations monitor energy consumption, water usage, and other resources, allowing for better control and conservation. Smart grids, for instance, can adjust energy distribution based on real-time demand, reducing waste and cutting costs for both providers and consumers.

4. Remote Monitoring and Control

IOT projects enable remote monitoring and control of devices and systems, offering convenience and safety. For example, IOT-enabled medical devices can transmit patient data to healthcare providers, enabling remote monitoring and timely intervention. Similarly, farmers can remotely monitor crops and irrigation systems in agriculture, optimizing agricultural practices and minimizing manual labor.

5. Enhanced Customer Experience

IOT applications can potentially revolutionize the customer experience by providing personalized and connected services. Smart homes with IOT devices offer seamless automation and control, enhancing comfort and convenience for residents. Retailers can leverage IOT data to offer personalized recommendations and targeted marketing, increasing customer satisfaction and loyalty.

6. Predictive Maintenance

One of the most significant advantages of IOT projects is predictive maintenance. By continuously monitoring the condition of equipment and machinery, businesses can predict when maintenance is needed before a breakdown occurs. This approach reduces downtime, extends the lifespan of assets, and minimizes maintenance costs.

7. Safety and Security

IOT projects ideas can significantly improve safety in various environments. In industrial settings, IOT sensors can monitor workplace conditions, detect potential hazards, and ensure safety regulations compliance. Smart cities can use IOT to monitor traffic and public spaces, enhancing security and emergency response capabilities.

8. Sustainable and Eco-Friendly Solutions

IOT projects contribute to sustainability efforts by promoting smart and eco-friendly practices. Smart buildings can optimize energy consumption based on occupancy levels, reducing carbon footprints. IOT-enabled waste management systems can also improve recycling efforts and reduce waste generation.

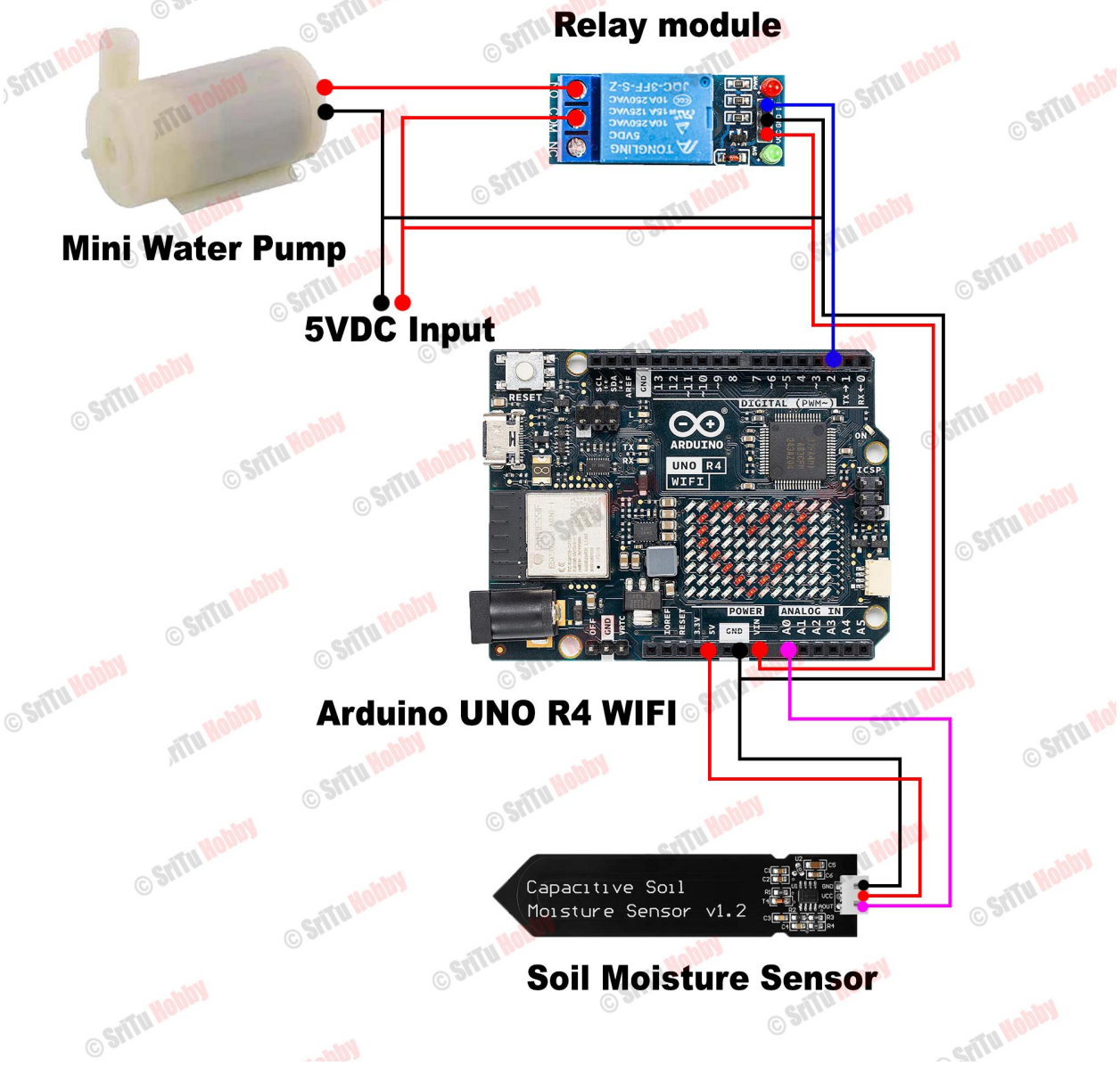
9. Innovation and Competitiveness

Organizations that embrace IOT projects ideas gain a competitive edge by offering innovative solutions and services. IOT-driven insights and data analytics open new opportunities for businesses to differentiate themselves in the market and adapt to evolving customer needs.

10. Transforming Industries and Creating Smart Cities

They are instrumental in transforming industries and creating smart cities. IOT enables remote patient monitoring and telemedicine in healthcare, revolutionizing healthcare delivery. IOT-based precision farming techniques enhance crop yields while minimizing resource usage in agriculture. For transportation, IOT applications improve logistics and public transportation efficiency, reducing congestion and carbon emissions in smart cities.

.Circuit Diagram:



Working explanation:

Firstly, identify these components.

1.Arduino UNO R4 Wifi

The UNO R4 WiFi is part of the first UNO series of **32-bit development boards**, being previously based on 8-bit AVR microcontrollers. There are thousands of guides, tutorials, and books written about the UNO board, where the UNO R4
WiFi continues its legacy.

2.Soil Moisture Sensor

This is Soil Moisture Meter, Soil Humidity Sensor, Water Sensor, Soil Hygrometer for **Ardunio**. With this module, you can tell when your plants need watering by how moist the soil is in your pot, garden, or yard. The two probes on the sensor act as variable resistors. Use it in a home automated watering system, hook it up to IoT, or just use it to find out when your plant needs a little love. Installing this sensor and its PCB will have you on your way to growing a green thumb!

3.5v Relay module

This 1-channel 5V control Single-Pole Double-Throw (SPDT) High-level trigger AC power relay board can be controlled directly via a microcontroller and switch up to 10A at 250 VAC. The inputs of 1 Channel 5V Relay Module are isolated to protect any delicate control circuitry.
The default state of the relay when the power is off for COM (Power) to be connected to NC (Normally Closed). This is the equivalent of setting the relay board IN pin to HIGH (has +5V sent to it).

*A wide range of microcontrollers such as **Arduino, AVR, PIC, ARM, etc** can be used to control this 5V relay module*

4.Mini Water Pump

Submersible Pumps are efficient for **pumping out septic tanks**. Fluid is transferred into hoses to storage tanks and taken to a treatment facility. Submersible pumps are often used to pump excess water from work sites or flooded basements on construction sites. They can also be used to pump slurries Submersible pumps are **centrifugal pumps whose hydraulic components (pump casing, impeller, diffuser element) are flooded by the fluid handled**. Usually, this type of pump is not fitted with a suction line. A submersible pump whose motor is arranged above the floor is referred to as a vertical shaft submersible pump

5.Mini Water Pipe

Transparent PVC Water pipe for 6v Submersible Water pump. Fits tightly on the 6v Submersible water pump that has a 6mm outer diameter. The pipe is slightly flexible and sturdy it is good for fitting it on the pump. Also because of it, the pipe won't get bent much and the water flow will be good without any unnecessary bend/blockage.

6.Jumper Wires

This is 20CM Dupont Wire Color Jumper Cable, 2.54mm 1P-1P Male to Female 40PCS. A very Flexible and easily detachable cable to the no. of wires according to your requirement. It has 1Pin male to the 1pin female header with both ends. Also, it is compatible with 2.54 mm mil spacing pin headers.
This cable is an electrical wire or group of them in a cable with a connector or pins at each end, which is normally for interconnecting the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

Individual Dupont Cables are fitted by inserting their “end connectors” into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

Mostly it is useful with Orange Pi, Banana Pi, Raspberry Pi, Arduino, and other mini pc and development board. It is very useful in the PCB project, pc motherboard, as well as Breadboard connections. Additionally, it allows you to plug and unplug easily for prototyping and can be used over and over again.

Then connect the relay module and soil moisture sensor to the Arduino UNO board.connect the Arduino board to the computer. And then, set up the Arduino Cloud. For that, follow the instructions below.go to the Arduino Cloud website and create a new account using your email. Then, log in to your account

- **Now, click the “Get started” button and select the IOT cloud.**
- **Then, add your device to the cloud. For that, download and install the Arduino agent program. At this time, please remove other USB devices. Now, you can see the Arduino UNO R4 WIFI board.**
- **Next, you can rename it as you like. Then, download the device ID and secret key PDF.**
- **Now, download the latest firmware and run it on your computer. At this time remove the other USB devices. (except Arduino UNO R4 WIFI board)**
- **OK, now click the “Things” tab and create two variables.**
- **Name — “relay” / boolean / Declaration — “bool relay”**
- **Name — “sensor” / Integer Number / Declaration — “int sensor” / Variable update policy — Periodically(1S)**

- Then, connect your device and enter your network details. Open the PDF for the secret key. (which you previously downloaded)
- Next, click the sketch tab and delete this code. And then, copy and paste the following code on this sketch.

Soil moisture related to water content which a factor that affects the plant growth. The process of watering plants is generally done manually regardless of the volume of water needed by plants. This re research discussed about an automated prototype and a system that have the function of watering plants based on the soil moisture level. The method used is prototyping which is suitable with the research purpose. The prototype and systems built with microcontroller, soil moisture sensors, relay and solenoid valve, which integrated with the IoT platform Blynk apps and Thingspeak. The process starts from the detection of soil moisture by the sensor. If soil moisture value is detected on 30% - 35%, then the device activates the watering function by opening the valve from the solenoid valve to drain water to the pipe. When the soil moisture detected more then 35% , the device stops the watering function. ThingSpeak IoT platform, used to display moisture percentage data in graphical form. Blynk apps provide notification features to the user's smartphone when the watering device is activated or deactivated. Based on the test scenario performed, it was found that the percentage of soil moisture with an initial value of 30% - 35% increased to 68.2%, after the watering process. Each component of the device and system has been tested and functioning according to the purpose, so the system has the potential to be used in the process of watering the plants automatically.Keywords: automatic watering system, microcontroller, soil moisture, sensor, IoT.

Code:

```
/*
  Sketch generated by the Arduino IoT Cloud Thing "Untitled"

https://create.arduino.cc/cloud/things/1ec5753c-648f-41d5-af31-9d5e97d6b133

  Arduino IoT Cloud Variables description
```

```
  The following variables are automatically generated and updated when
changes are made to the Thing

  int sensor;
  bool relay;

  Variables which are marked as READ/WRITE in the Cloud Thing will also
have functions
  which are called when their values are changed from the Dashboard.
  These functions are generated with the Thing and added at the end of
this sketch.
*/

#include "thingProperties.h"
#define relayPin 2
#define wet 210
#define dry 510


void setup() {
  // Initialize serial and wait for port to open:
  Serial.begin(9600);
  // This delay gives the chance to wait for a Serial Monitor without
blocking if none is found
  delay(1500);

  pinMode(relayPin,OUTPUT);
  digitalWrite(relayPin,HIGH);

  // Defined in thingProperties.h
  initProperties();

  // Connect to Arduino IoT Cloud
  ArduinoCloud.begin(ArduinoIoTPreferredConnection);

  /*
     The following function allows you to obtain more information
     related to the state of network and IoT Cloud connection and errors
     the higher number the more granular information you'll get.
     The default is 0 (only errors).
     Maximum is 4
 */
  setDebugMessageLevel(2);
  ArduinoCloud.printDebugInfo();
}

void loop() {
```

```
  ArduinoCloud.update();
  // Your code here
  onRelayChange() ;
  onSensorChange();
}

void onSensorChange()  {
  // Add your code here to act upon Sensor change
  sensor = analogRead(A0);
  sensor =  map(sensor,dry,wet,0,100);

}

void onRelayChange()  {
    if(relay){
    digitalWrite(relayPin,LOW);
  }else{
    digitalWrite(relayPin,HIGH);
  }
}
```