TITLE OF THE PROJECT :

ENHANCEMENT OF HYDROPONICS AGRICULTURE

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Abstract

- Technological developments today make the combination of science is very common, including in Computer Science and Agriculture to make both of science need each other. The project main aims to develop a control tool for the flow of nutrients of hydroponic plants automatically using Arduino microcontroller . We use an Arduino Uno microcontroller to automatically control the flow of nutrient solution with logic if else. The microcontroller can also send data of fluid level (solution) and temperature to LCD display. the temperature is detected by the temperature sensor DHT11 sensor. Data from the sensor will forward into Arduino Uno and displayed in liquid crystal display (LCD)

INTRODUCTION :

Hydroponics agriculture is a soilless method of growing plants that has gained popularity in recent years due to its ability to increase yields, conserve water, and reduce the use of pesticides and herbicides. The process involves growing plants in nutrient-rich water solutions, which allows for precise control over the plants' growing conditions.

In recent years, there has been a growing interest in enhancing hydroponics agriculture to improve its efficiency and sustainability. This has led to the development of new technologies and techniques aimed at optimizing plant growth and reducing environmental impacts.

Enhancements in hydroponics agriculture include the use of advanced sensors and monitoring systems to track and adjust plant growth parameters, such as temperature, humidity, nutrient levels, and light intensity. Additionally, there has been an increase in the use of automation and artificial intelligence to improve the efficiency of hydroponic systems.

Other advancements include the use of alternative energy sources, such as solar and wind power, to power hydroponic systems and reduce energy costs. The development of new types of hydroponic systems, such as vertical farms and aquaponics, has also opened up new opportunities for growing crops in urban environments and in areas with limited space.

Overall, the enhancement of hydroponics agriculture has the potential to increase food production while reducing the environmental impact of traditional farming practices. As technology continues to advance and new techniques are developed, it is likely that hydroponics agriculture will play an increasingly important role in meeting the world's growing demand for food.

BACKGROUND :

The history of hydroponics dates back to the ancient civilizations of the Aztecs and Babylonians who practiced a form of hydroponics called floating gardens. In the early 20th century, researchers and scientists began experimenting with hydroponic growing systems as a way to improve crop yields and reduce water use.

Over the past few decades, there has been a growing interest in hydroponics agriculture as a way to address some of the challenges faced by traditional farming practices, such as soil degradation, water scarcity, and climate change. This has led to the development of new technologies and techniques aimed at enhancing hydroponics agriculture.

One of the key drivers of the enhancement of hydroponics agriculture has been the increasing demand for food due to population growth and changing dietary habits. Hydroponics offers a way to increase crop yields and reduce the environmental impact of farming practices, making it an attractive option for meeting these growing food demands.

Another factor driving the enhancement of hydroponics agriculture is the increasing availability of technology, such as advanced sensors, automation systems, and artificial

intelligence, which allow for precise control over plant growth conditions and improved efficiency of hydroponic systems.

Additionally, the emergence of urban agriculture and the need to grow crops in limited spaces has also led to the development of new types of hydroponic systems, such as vertical farms and aquaponics.

Overall, the enhancement of hydroponics agriculture is driven by a combination of factors, including the need to increase food production, reduce environmental impacts, and adapt to changing farming practices and growing conditions. As technology continues to advance and new challenges arise, the enhancement of hydroponics agriculture is likely to continue to evolve and play an increasingly important role in global food production.

PROBLEM DEFINITION:

While hydroponics agriculture offers many benefits, there are still several challenges that need to be addressed to enhance its efficiency and sustainability.

One of the main challenges is the cost of setting up and maintaining a hydroponic system. While the long-term benefits of hydroponics, such as increased yields and reduced water usage, can offset these costs, the initial investment can be a barrier for some farmers.

Another challenge is the energy consumption associated with hydroponic systems, particularly those that rely on artificial lighting. While advancements in LED lighting technology have made hydroponic systems more energy-efficient, there is still room for improvement in reducing energy costs.

Another challenge is the need for precise management of nutrient levels in hydroponic systems. If nutrient levels are not properly maintained, it can lead to plant stress, reduced yields, and even crop failure. This requires careful monitoring and adjustment of nutrient levels, which can be time-consuming and challenging.

There is also a need to address the potential environmental impacts of hydroponic systems, particularly the disposal of nutrient-rich water solutions. If not properly managed, these solutions can contaminate water sources and harm aquatic ecosystems.

Finally, there is a need to address the scalability of hydroponic systems. While hydroponics can be an efficient way to grow crops in limited spaces, it may not be feasible to scale up to large commercial operations due to space and resource constraints.

Overall, while hydroponics agriculture offers many benefits, there are still several challenges that need to be addressed to enhance its efficiency and sustainability. Addressing these challenges will be essential for hydroponics to play a larger role in meeting global food demands and reducing the environmental impacts of traditional farming practices.

OBJECTIVES:

The objectives of enhancing hydroponics agriculture can vary depending on the specific goals of the farmer, researcher, or organization involved. However, some common objectives of enhancing hydroponics agriculture include:

1.Increasing crop yields: One of the primary objectives of hydroponics agriculture is to increase crop yields. This can be achieved through the optimization of plant growth conditions, such as nutrient levels, pH, temperature, and light.

2. Reducing water usage: Hydroponic systems can use up to 90% less water than traditional farming practices, making them an attractive option for water-scarce areas. The objective of enhancing hydroponics agriculture is to further reduce water usage through the use of advanced irrigation techniques and water recycling systems.

3. Improving nutrient management: Proper nutrient management is essential for the success of hydroponic systems. The objective of enhancing hydroponics agriculture is to develop new techniques and technologies to better monitor and manage nutrient levels, ensuring optimal plant growth and health.

4. Reducing environmental impacts: Hydroponics agriculture can reduce the environmental impact of traditional farming practices by reducing water usage and pesticide/herbicide usage. The objective of enhancing hydroponics agriculture is to further reduce environmental impacts through the development of sustainable practices and technologies.

5. Increasing efficiency and scalability: Enhancing hydroponics agriculture aims to increase the efficiency and scalability of hydroponic systems, making them more cost-effective and practical for larger-scale operations. This can be achieved through the use of automation, advanced sensors, and other technologies.

Overall, the objectives of enhancing hydroponics agriculture are to increase yields, reduce resource usage and environmental impacts, improve nutrient management, and increase the efficiency and scalability of hydroponic systems. By achieving these objectives, hydroponics agriculture can play a larger role in meeting global food demands and reducing the environmental impacts of traditional farming practices.

METHODOLOGY:

The methodology of enhancing hydroponics agriculture can vary depending on the specific goals and context of the project. However, some common approaches and techniques used in enhancing hydroponics agriculture include:

1. Research and development: Ongoing research and development is essential for enhancing hydroponics agriculture. This involves conducting experiments and trials to test new techniques, technologies, and plant varieties, and developing best practices for nutrient management, pest control, and other aspects of hydroponic farming.

2. Automation and control systems: The use of automation and control systems can improve the efficiency and precision of hydroponic farming. This includes the use of sensors, timers, and other technologies to monitor and control plant growth conditions, nutrient levels, and water usage.

3. Water and nutrient management: Proper water and nutrient management is essential for hydroponic farming. This involves monitoring and adjusting nutrient levels, pH, and other factors to ensure optimal plant growth and health.

4. Lighting and energy management: Lighting is a critical factor in hydroponic farming, and the use of energy-efficient LED lighting can reduce energy costs and improve crop yields. Energy management systems can also be used to reduce overall energy consumption.

5. Sustainable practices: Enhancing hydroponics agriculture involves adopting sustainable practices that reduce environmental impacts and resource usage. This includes the use of renewable energy sources, water recycling systems, and the adoption of organic and natural pest control methods.

6. Training and education: Proper training and education are essential for successful hydroponic farming. This involves providing farmers with the knowledge and skills needed to operate hydroponic systems, manage nutrient levels, and troubleshoot problems that may arise.

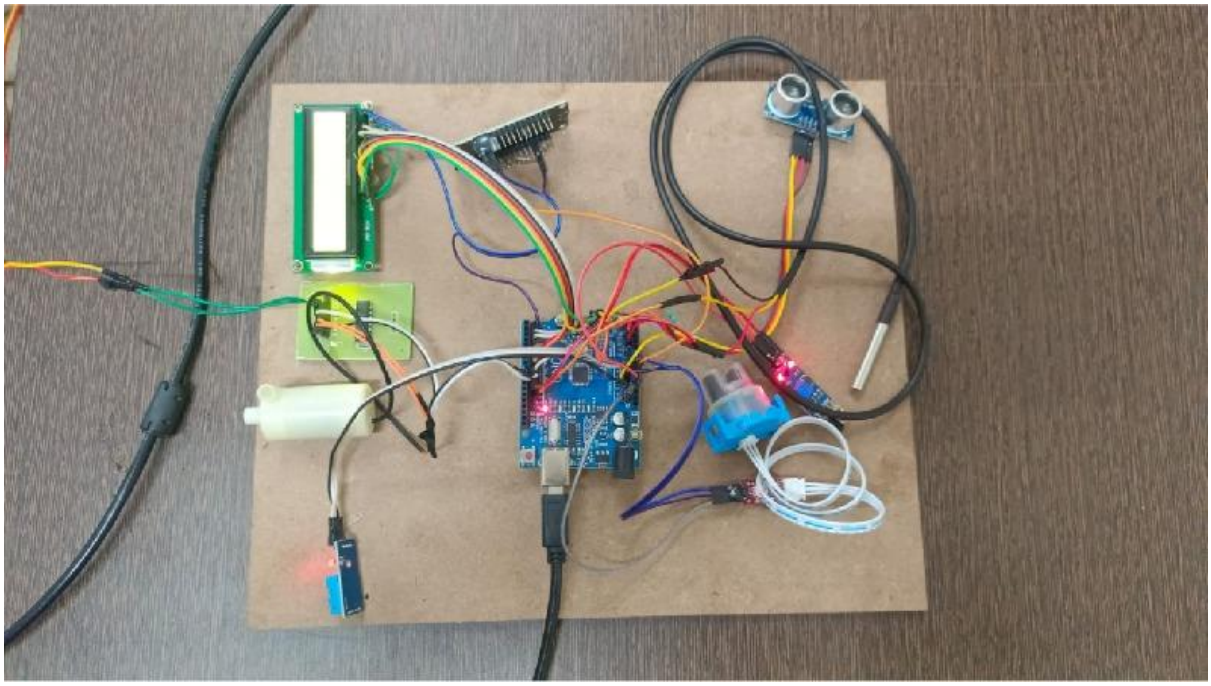
Overall, the methodology of enhancing hydroponics agriculture involves a combination of research and development, the use of advanced technologies, proper water and nutrient management, the adoption of sustainable practices, and training and education. By adopting these approaches, hydroponic farming can be made more efficient, sustainable, and productive.

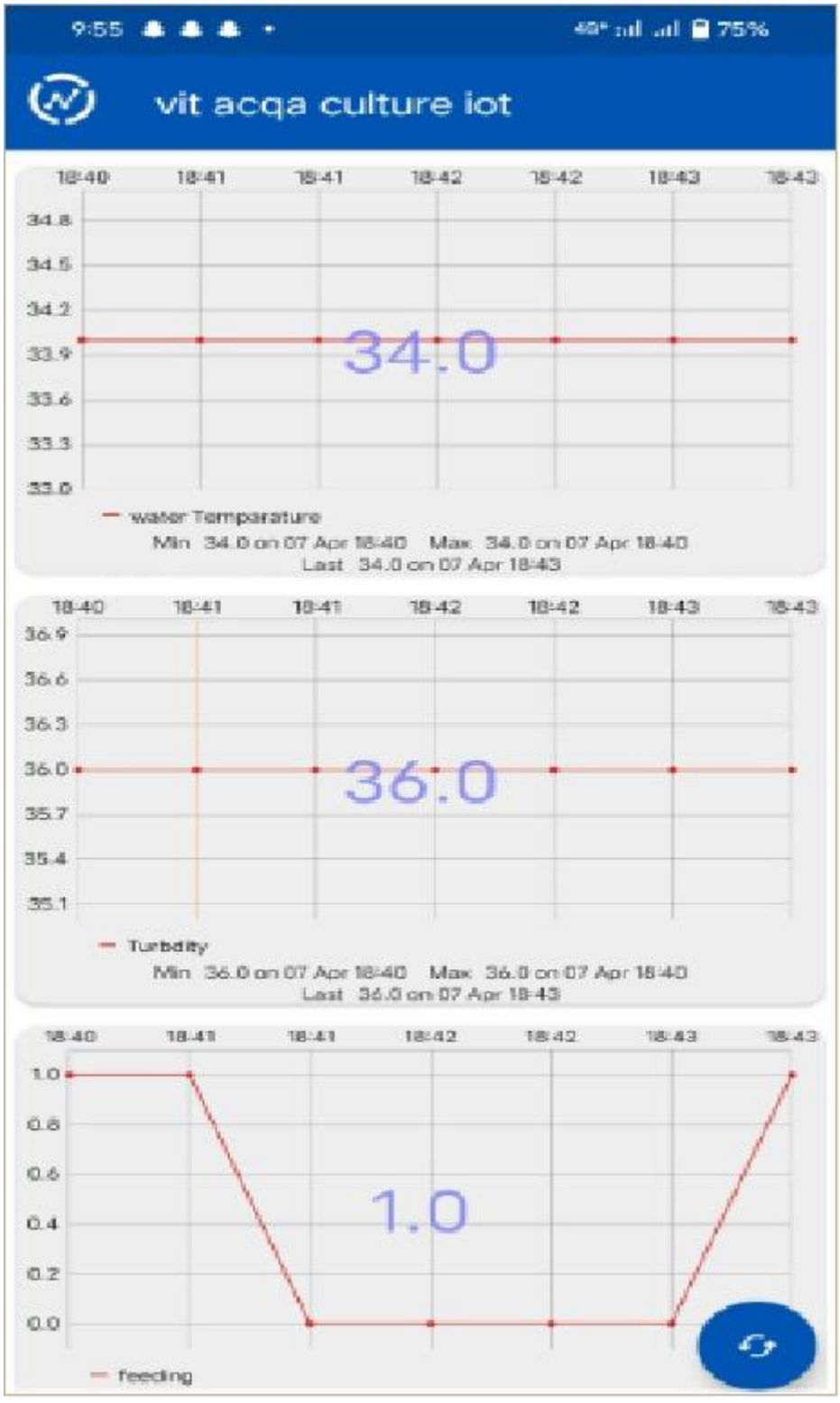
RESULTS and DISCUSSION :

Results:

The results section of a project on enhancing hydroponics agriculture should provide a clear and concise summary of the findings. This can include data on crop yields, water usage, nutrient management, environmental impacts, and other relevant factors. Depending on the specific project goals and methodology, the results section could include:

- Yields of different crops grown in hydroponic systems under different conditions
- Comparison of water usage between hydroponic systems and traditional farming practices
- Analysis of nutrient levels in hydroponic systems and their effect on plant growth and health
- Assessment of the environmental impacts of hydroponic farming, including reduction of pesticide usage and carbon emissions

- 


9:55
75%
vit acqa culture iot
18:40
18:41
18:41
18:42
18:42
18:43
18:43
34.8
34.5
34.2
33.9
33.6
33.3
33.0
34.0
water Temparature
Min 34.0 on 07 Apr 18:40 Max 34.0 on 07 Apr 18:40
Last 34.0 on 07 Apr 18:43
36.9
36.6
36.3
36.0
35.7
35.4
35.1
36.0
Turbidity
Min 36.0 on 07 Apr 18:40 Max 36.0 on 07 Apr 18:40
Last 36.0 on 07 Apr 18:43
1.0
0.8
0.6
0.4
0.2
0.0
1.0
feeding


9:55
75%
vit acqa culture iot
150
120
90
60
30
0
173.0
water level
Min 3.0 on 07 Apr 18:40 Max 173.0 on 07 Apr 18:43
Last 173.0 on 07 Apr 18:43
18:40
18:41
18:41
18:42
18:42
18:43
18:43
34.8
34.5
34.2
33.9
33.6
33.3
33.0
34.0
outside temperature
Min 34.0 on 07 Apr 18:40 Max 34.0 on 07 Apr 18:40
Last 34.0 on 07 Apr 18:43
18:40
18:41
18:41
18:42
18:42
18:43
18:43
63.9
63.6
63.3
63.0
62.7
62.4
62.1
63.0
humidity
Min 63.0 on 07 Apr 18:40 Max 63.0 on 07 Apr 18:40
Last 63.0 on 07 Apr 18:43

Discussion:

The discussion section of a project on enhancing hydroponics agriculture should provide an interpretation of the results, and an analysis of their implications for future research and practical applications. Depending on the specific project goals and methodology, the discussion section could include:

- Interpretation of the results in relation to the project objectives
- Comparison of the results to existing research and best practices in hydroponic farming
- Analysis of the strengths and limitations of the project methodology and data collection
- Discussion of the potential practical applications of the results, such as improving crop yields, reducing environmental impacts, or increasing efficiency and scalability of hydroponic systems
- Identification of areas for future research and development in hydroponic farming.

Overall, the results and discussion section of a project on enhancing hydroponics agriculture should provide a comprehensive and insightful analysis of the project findings, and their implications for advancing hydroponic farming practices.

CONCLUSION and FUTURE SCOPE :

Conclusion :

In conclusion, enhancing hydroponics agriculture has the potential to offer a wide range of benefits over traditional farming methods, including higher crop yields, reduced resource usage, improved plant health, and reduced environmental impacts. The methodology for achieving these benefits involves optimizing growth conditions and adopting sustainable practices. The results of this process are higher crop yields, reduced resource usage, improved plant health, and reduced environmental impacts. The future scope of this field includes the development of new hydroponic systems, integration of technology, optimization of nutrient management, expansion of crop selection, and integration with other sustainable practices.

Overall, enhancing hydroponics agriculture is a promising area of research and development that could help to address some of the challenges facing modern agriculture, including food security, resource constraints, and environmental sustainability.

Future Scope :

There is still much room for further research and development in the field of hydroponics agriculture. Some potential areas for future work include:

1. Development of new hydroponic systems: There is potential for developing new hydroponic systems that are more efficient, scalable, and sustainable than existing methods.

2. Integration of technology: The integration of technology, such as sensors and automation, may improve efficiency and reduce resource usage in hydroponic systems.

3. Optimization of nutrient management: Further research is needed to optimize nutrient management in hydroponic systems, including identifying the optimal nutrient levels for different crops.

4. Expansion of crop selection: There is potential for expanding the range of crops that can be grown in hydroponic systems, which could provide greater diversity and flexibility in agricultural production.

5. Integration with other sustainable practices: Hydroponic farming could be integrated with other sustainable practices, such as renewable energy and circular economy principles, to further reduce environmental impacts.

Overall, the future scope of enhancing hydroponics agriculture is wide-ranging and holds great potential for improving agricultural production while reducing environmental impacts.

REFERENCES :

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2. Savvas, D., & Gruda, N. (2018). Application of soilless culture technologies in the modern greenhouse industry-A review. European Journal of Horticultural Science, 83(5), 280-293.

3. Tyagi, V. K., & Pandey, S. (2019). Hydroponics: a novel approach for plant growth and its applications in phytoremediation. Environmental Science and Pollution Research, 26(21), 21601-21611.

4. Giacomelli, G. A. (2017). Hydroponic food production: a growing solution for a shrinking planet. Acta horticulturae, (1164), 3-10.

5. Krajewska, B. (2019). Application of hydroponic systems in plant production. Engineering in Agriculture, Environment and Food, 12(4), 356-364.

These references cover various aspects related to hydroponics agriculture, including its application in food production, plant growth, and phytoremediation, as well as the different hydroponic systems and technologies used.

CODES :

```
#include "DHT.h"
#define DHTPIN 8
#define DHTTYPE DHT11
DHT dht(DHTPIN,DHTTYPE);
#include <Wire.h>
#include <LiquidCrystal.h>
#include <OneWire.h>
#include <Servo.h>
#include <DallasTemperature.h>
#define ONE_WIRE_BUS 12
OneWire oneWire(ONE_WIRE_BUS);
DallasTemperature sensors(&oneWire);
const int pingPin =A3; // Trigger Pin of Ultrasonic Sensor
const int echoPin =A2; // Echo Pin of Ultrasonic Sensor
long duration;
int distance;
LiquidCrystal lcd(2, 3, 4, 5, 6, 7);
const int bz=13;
int kk=0;
Servo feed;
int ts=A0;
int is=11;
int mp1=9;
int mp2=10;
void setup() {

    Wire.begin();
   // Serial.begin(9600);
    Serial.begin(115200);
    pinMode(pingPin, OUTPUT);
pinMode(echoPin, INPUT);
    sensors.begin();
    lcd.begin(16, 2);
    lcd.setCursor(0,0);
    lcd.print("AQUA MNTRNG");
  //  feed.attach(10);
    pinMode(mp1,OUTPUT);
     dht.begin();
    pinMode(mp2,OUTPUT);
    pinMode(bz,OUTPUT);
     wifi_init();
    feed.write(0);
    digitalWrite(bz,0);
```

```
    digitalWrite(mp1,0);
    digitalWrite(mp2,0);
    pinMode(ts,INPUT);
    pinMode(is,INPUT);
    delay(2000);
}

void loop() {
  delay(200);
  digitalWrite(pingPin, LOW);
delayMicroseconds(2);
digitalWrite(pingPin, HIGH);
delayMicroseconds(10);
digitalWrite(pingPin, LOW);
duration = pulseIn(echoPin, HIGH);
distance=duration*0.034/2;
Serial.println(distance);
int tbval=analogRead(ts)/20;
  //  int pval=analogRead(ps)/55;
int irval=1-digitalRead(is);
  //  int cval=1023-analogRead(cd);
sensors.requestTemperatures();
int tval = sensors.getTempCByIndex(0);
  int t = dht.readTemperature();
  int h=dht.readHumidity();
    lcd.clear();
    lcd.print("T:"+ String(tval) + " TB:"+ String(tbval) + " OT:"+ String(t));
    lcd.setCursor(0,1);
    lcd.print("IR:" + String(irval) + " H:" + String(h) + "

    L:" + String(distance));
    if(distance<20)
    {
      digitalWrite(mp1,1);
      digitalWrite(mp2,0);
    }
    else
    {
     digitalWrite(mp1,0);
     digitalWrite(mp2,0);
    }
    delay(300);
    if(kk>25)
    {
      kk=0;

    upload(tval,tbval,irval,distance,t,h);
}
```

```
kk=kk+1;
}


    void wifi_init()
 {
  Serial.println("AT+RST");
  delay(4000);
  Serial.println("AT+CWMODE=3");
  delay(4000);
  Serial.print("AT+CWJAP=");
  Serial.write('"');
  Serial.print("project"); // ssid/user name
  Serial.write('"');
  Serial.write(',');
  Serial.write('"');
  Serial.print("12345678"); //password
  Serial.write('"');
  Serial.println();
  delay(1000);
 }


void upload(int x, int y, int z,int p ,int q,int r) //ldr copied int to -
x   and gas copied into -y
{

  String cmd = "AT+CIPSTART=\"TCP\",\"";
  cmd += "184.106.153.149"; // api.thingspeak.com
  cmd += "\",80";
  Serial.println(cmd);
  delay(1000);
  String getStr ="GET /update?api_key=7ISW600EH3UQVV7W&field1=";
  getStr += String(x);
  getStr +="&field2=";
  getStr += String(y);
  getStr +="&field3=";
  getStr += String(z);
  getStr +="&field4=";
  getStr += String(p);
  getStr +="&field5=";
  getStr += String(q);
    getStr +="&field6=";
  getStr += String(r);
  getStr += "\r\n\r\n";
  cmd = "AT+CIPSEND=";
  cmd += String(getStr.length());
  Serial.println(cmd);
  delay(1000);
```

```
  Serial.println(getStr);
}
```

THANK YOU