SOLAR POWERED AUTO IRRIGATION SYSTEM

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ABSTRACT

Agriculture plays a vital role in the Indian economy, over 70 percent of the rural households depend on agriculture, agriculture is one manually from ages,as the world is trending into new technologies and implementations it is a necessary goal to trend up with agriculture also, we have proposed a smart agriculture monitoring and prediction of crop based on sensors, they are capable of providing information about agriculture fields, also we will be using pre trained Ai model is used to predict crop. This smart agriculture using system is powered by Microcontroller, it consists of temperature sensor, moisture sensor and humidity sensor, when the agriculture monitoring system starts and it checks the temperature, humidity and moisture level, meanwhile the collected sensor data is applied to model which will predict the crop, this all is displayed on the LCD display module. In recent days, the world's population is presumed around 7.3 billion and will be expected to grow to 2.0 billion in the next 40 years, hitting at 9.5 to 10.0 billion by 2050. Global population growth has affected food shortfall and the high water requirement problem; it is a worldwide scale. With the world's population increasing, farmers need to upturn food production, minimize water use and make rational use of natural resources while protecting the environment. Moreover, traditional farming techniques do not allow them to do it. The emergence of improvements in the agricultural sector as the notion of precision agriculture stands up to the rising food requirements of the world's population. It leans on the practice of more selective resources like water, seeds, fertilizers, and other necessary things to equate productivity with environmental interests. Precision agriculture is collected field information and technology in agricultural processing systems by affording precision methods to attain optimum and sustainable profits improving their abilities to adapt to the environments around them. Precision, crop quality, over the agriculture domain and the quality of the crops and reduce negative environmental impacts onthe agriculture sector.

INTRODUCTION

Agriculture is very important because it produces food and feed whichis necessity to animals and human b1eings. It fulfills the basic need of billions of people. It is one of the major contributors to the country's GDP and economic growth. Hence, it is widely practiced in India.

Agriculture sector requires more workforce than any other sectors, nowadays there is huge decrease in the agricultural work-force. So, we need to fill that huge gap by making advances in agriculture with the help of technology. Thus, agricultural advancement results gaining more profit by the farmers gas big data analytics techniques are used to analyze data sets of temperature, humidity, rainfall and soil which are collected from the meteorological department. This type of required analysis is performed by using specific software tools, many of them available as open source. By using this tools and techniques the system will have information, by this processed information the system will take better decisions. Thus, ensuring better results. Agriculture is a key economic driver. It is a key to healthy biosphere. People depend on a wide range of agricultural products in almost all aspects of life. Farmers need to cope with climate change, and meet rising demands for more food of higher food quality. In order to escalate the yield and growth of crops, the farmer needs to be aware of the climatic conditions, hence aiding its decision of growing the suitable crop, under those factors. IoT based Smart Farming improves the entire Agriculture system by monitoring the fieldin real-time. It keeps various factors like humidity, temperature, soil etc. under check and gives a crystal clear real-time observation. Machine learning in agriculture is used to improve the productivity and quality of the crops in the agriculture sector.

Real Time Systems:

Innovation is more important in modern agriculture than ever before. The industry as a whole is facing huge challenges, from rising costs of supplies, a shortage of labor, and changes in consumer preferences for transparency and sustainability. There is increasing recognition from agriculture corporations that solutions are needed for these challenges. In the last 10 years, agriculture technology has seen a huge growth in investment, with in the last 5 years and $1.9 billion in the last year alone. Major technology innovations in the space have focused around areas such as indoor vertical farming, automation and robotics, livestock technology, modern greenhouse practices, precision agriculture and artificial intelligence, and block chain. Indoor vertical farming can increase crop yields, overcome limited land area, and even reduce farming's impact on the environment by cutting down distance traveled in the supply chain. Indoor vertical farming can be defined as the practice of growing produce stacked one above another in a closed andcontrolled environment. By using growing shelves mounted vertically, itsignificantly reduces the amount of land space needed to grow plants compared to traditional farming methods.

Motivation

While rise in the population of country results in increasing food demand. For that farmers needs to understand smart and developed farming techniques to overcome the result which was given by old and local techniques. So the main motivation is to develop a easy and farmer friendly techniques for smart farming.

Problem Statement:

We need to understand the features and characteristics of different soil types to know which crops grow better in certain soil types. Machine

learning techniques can be helpful in this case. Here we can use clustering technique to group data, and then classified the data by the order of soil and places with Random Tree algorithm. Then use apriority Mining process to create an association rule to get suitable crops for the specific soil.

Aim of the Project:

The main goal of smart agriculture is to achieve greater food self-sufficiency and revenues by compensating for environmental risks of crop failures and increasing overall yield quality. Aims to tackle three main objectives: sustainably increasing agricultural productivity and incomes; adapting and building resilience to climate change; and reducing and/or removing greenhouse gas emissions.

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PROPOSED WORK:

Agriculture plays a vital role in the Indian economy, over 70 percent of the rural households depend on agriculture, agriculture is one manually from ages, as the world is trending into new technologies and implementations it is a necessary goal to trend up with agriculture also, we have proposed a smart agriculture monitoring and prediction of crop based on sensors, they are capable of providing information about agriculture fields, also we will be using pre trained Ai model is used to predict crop. This smart agriculture using system is powered by Microcontroller, it consists of temperature sensor, moisture sensor and humidity sensor The emergence of improvements in the agricultural sector as the notion of precision agriculture stands up to the rising food requirements of the world's population. It leans on the practice of more selective resources like water, seeds, fertilizers, and other necessary things to equate productivity with environmental interests. Precision agriculture is collected field information and technology in agricultural processing systems by affording precision methods to attain optimum and sustainable profits improving their abilities to adapt to the environments around them. Precision, crop quality, over the agriculture domain and the quality of the crops and reduce negative environmental impacts on the agriculture sector.

LIMITATIONS:

- Rural part of most of the developing countries does not fulfill this requirement.
- The smart farming based equipment require farmers to understand and learn the use of technology.
- Farmer wants to know how to use equipment very sensitive device.

PROJECT DESCRIPTION:

BLOCK DIAGRAM (HEAD UNIT):

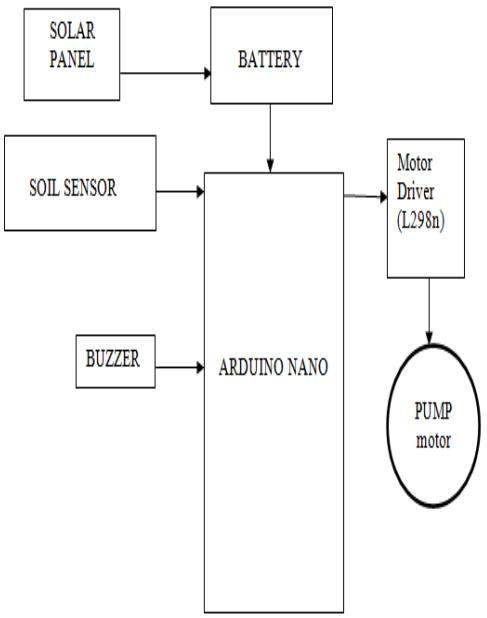

Fig 1: block diagram of head unit

WORKING PRINCIPLE:

This project uses Arduino Nano to control the motor. The Arduino Board is programmed using the Arduino IDE software. Soil sensor measures the level of moisture in the soil and calculates the average moisture value and sends the signal to the arduino if watering is required. The water pump supplies water to the plants until the desired moisture level is reached. The rechargeable battery that supplies required power source is recharged via Solar panel. A Soil sensor is used for sensing the soil condition to know whether the soil is wet or dry, and the input signals are then sent to the microcontroller, which controls the whole circuit. Whenever the soil condition is dry, the microcontroller sends command to relay and the motor gets switched on and supplies water to the field. And if the soil gets wet, motor gets switched off.

Soil moisture sensor module:

Soil moisture sensor is used to detect the moisture of the soil. It measures the volumetric content of water inside the soil and gives us the moisture level as output. The module has both digital and analog outputs and a potentiometer to adjust the threshold level.

Moisture Sensor:

The moisture sensor consists of two probes that are used to detect moisture in the soil**.** The moisture sensor probes are coated with immersion gold that protects Nickel from oxidation. These two probes are used to pass thecurrent through the soil and then the sensor reads the resistance to get the moisture values.

How to Use Soil Moisture Sensor Module:

The moisture sensor module consists of four pins i.e. VCC, GND, DO, and AO. The Digital out pins connected to the output pin of the LM393 comparator IC while the analog pin is connected to the Moisture sensor. The internal Circuit diagram of the Moisture sensor module is given below.

Using a Moisture sensor module with a microcontroller is very easy. Connect the Analog/Digital Output pin of the module to the Analog/Digital pin of the Microcontroller. Connect VCC and GND pins to the 5V and GND pins ofthe Microcontroller. After that insert the probe inside the soil. When there is more water present in the soil, it will conduct more electricity which means resistance will be low and the moisture level will be high.

The Soil Moisture Sensor is used to measure the volumetric water content of the soil. This makes it ideal for performing experiments in courses such as soil science, agricultural science, environmental science, horticulture, botany, and biology. Use the Soil Moisture Sensor to:

Vernier products are designed for educational use. Our products are not designed nor are they recommended for any industrial, medical, or commercial process such as life support, patient diagnosis, control of a manufacturing process, or industrial testing of any kind.

The project presents a prediction of the crop according to suitable crop type and field monitoring. For future work, we can use a higher level ofthe processor so that it can work more efficiently. Also, we can use different sensors like Temperature sensors,

Rain sensors, etc.

SCHEMATIC CIRCUIT DIAGRAM:

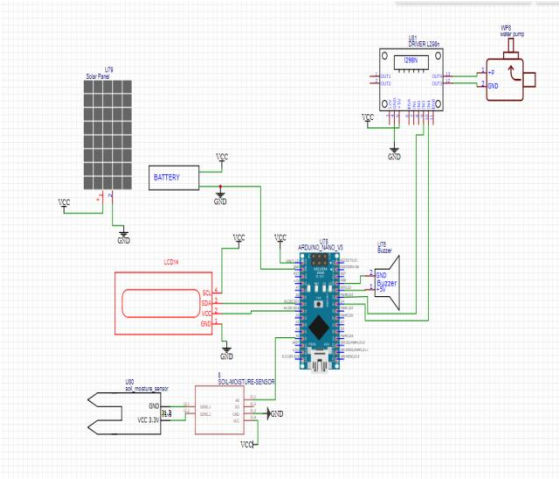

Fig 2 - circuit diagram

Arduino Nano Pinout Configuration:

Arduino Nano Technical Specifications:

Microcontroller	ATmega328P – 8-bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage for Vin pin	7-12V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (2 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz
Communication	IIC, SPI, USART

Other Arduino Boards

Arduino UNO, Arduino Pro Mini, Arduino Mega, Arduino Due, Arduino MKR1000 Wi-Fi Board, Arduino Leonardo

Difference between Arduino UNO and Arduino Nano:

The **Arduino Nano** is very much similar to the Arduino UNO. They use the same Processor (Atmega328p) and hence they both can share the same program. One big difference between both is the size. UNO is twice as big as Nano and hence occupies more space on your project. Also, Nano is breadboard friendly while Uno is not. To program an Uno, you need a Regular USB cable; whereas for Nano, you will need a mini USB cable.

Understanding Arduino Nano

The Arduino board is designed in such a way that it is very easy for beginners to get started with microcontrollers. This board especially is breadboard friendly, and that's why it is very easy to handle the connections. Let's start with powering the Board.

Powering you Arduino Nano:

There are total three ways by which you can power your Nano.

USB Jack: Connect the mini USB jack to a phone charger or computer through a cable and it will draw power required for the board to function

Vin Pin: The Vin pin can be supplied with an unregulated 6-12V to power the board. The on-board voltage regulator regulates it to +5V.

+5V Pin: If you have a regulated +5V

supply then you can directly provide this o the +5V pin of the Arduino.

Input/output:

There are total 14 digital Pins and 8 Analog pins on your Nano board. The digital pins can be used to interface sensors by using them as input pins or drive loads by using them as output pins. A simple function like **pinMode()** and **digitalWrite()** can be used to control their operation. The operating voltage is 0V and 5V for digital pins. The analog pins can measure analog voltage from 0V to 5V using any of the 8 Analog pins using a simple function like **analogRead().**

These pins apart from serving their purpose, can also be used for special purposes, which are discussed below:

- **Serial Pins 0 (Rx) and 1 (Tx):** Rx and Tx pins are used to receive and transmit TTL serial data. They are connected with the corresponding ATmega328P USB to TTL serial chip.
- **External Interrupt Pins 2 and 3:** These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- **PWM Pins 3, 5, 6, 9 and 11:** These pins provide an 8-bit PWM output by using **analogWrite()** function.
- **SPI Pins 10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK):** These pins are used for SPI communication.
- **In-built LED Pin 13:** This pin is connected with a built-in LED. When pin 13 is HIGH – LED is on and when pin 13 is LOW, it is off.
- **I2C A4 (SDA) and A5 (SCA):** Used for IIC communication using Wire library.
- **AREF:** Used to provide reference voltage for analog inputs with **analogReference()** function.
- **Reset Pin:** Making this pin LOW, resets the microcontroller.

Arduino IDE Introduction:

The bar appearing on the top is called Menu Bar that comes with five different options as follows.

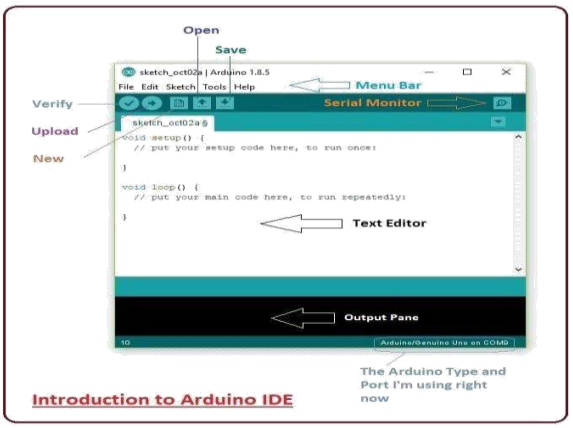

Fig 3 : Menu Bar of Arduino IDE

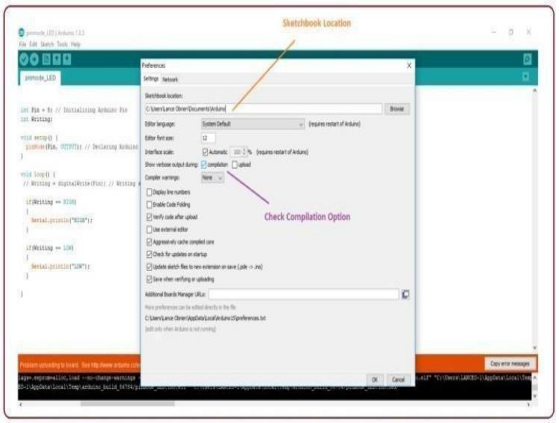

Fig 4: File Description

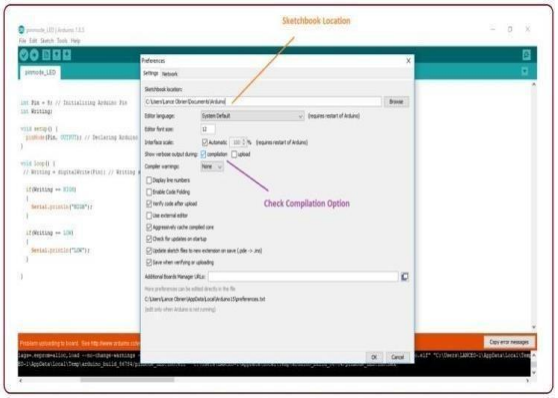

Fig 5: Compilation Screen

As you go to the preference section and check the compilation section, the Output Pane will show the code compilation as you click the upload button And at the end of compilation, it will show you the hex file it has generated for the recent sketch that will send to the Arduino Board for the specific task you aim to achieve.

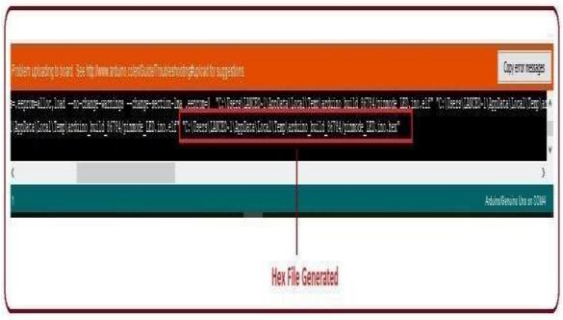

Fig 6- For Compiling And Programming

Tools Description:

Mainly used for testing projects. The Programmer section in this panel is used for burning a boot loader to the new microcontroller.

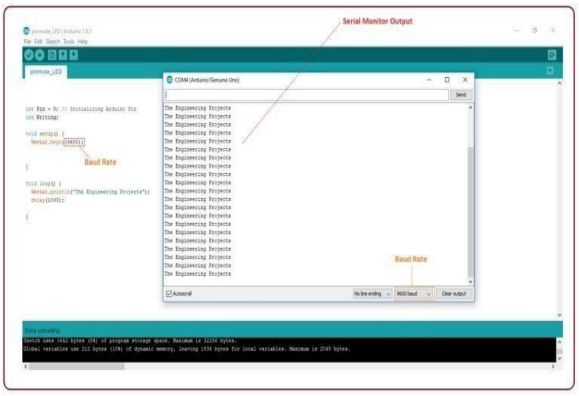

Figure 7- connecting to board

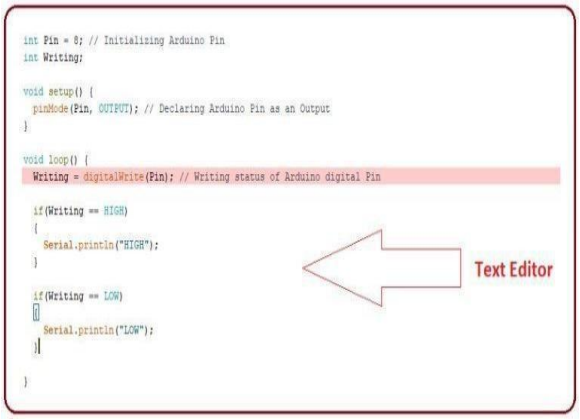

Fig 8: Text Editor on Code

The main screen below the Menu board is known as a simple text editor used for writing the registrations.

The bottom of the main screen is described as an Output Pane that mainly highlights the compilation status of the running code: the memory used by the code, and errors occurred in the program. You need to fix those errors before you intend to upload the hex file into your Arduino Module.

Fig 9- Output window

More or less, Arduino C language works similar to the regular C language used for any embedded system microcontroller, however, there are some dedicated libraries used for calling and executing specific functions of the board.

Libraries:

Libraries are very useful for adding the extra functionality into the Arduino Module. There is a list of libraries you can add by clicking the Sketch button in the

menu bar. And going to Include Library the Arduino environment can be extended through the use of libraries, just like most programming platforms. Libraries provide extra functionality for use insketches, e.g., working with hardware or manipulating data. To use a library in a sketch, select it from Sketch > Import Library.

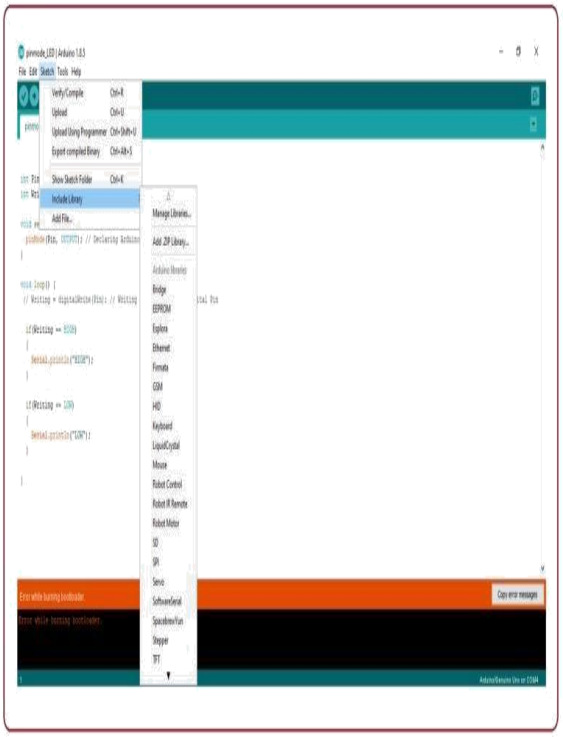

Fig 10- Arduino IDE Library

As you click the Include Library and add the respective library it will on the top of the sketch with #include sign. Suppose, I Include the EEPROM library, it will appear on the text editor.

Making Pins Input or Output:

The digital Read and digital Write commands are used for addressing and making the Arduino pins as an input and output respectively.

These commands are text sensitive i.e., you need to write them downthe exact way they are given like digital Write starting with small "d" and write with capital ."W" Writing it down with Digital write or digital write won't be calling or addressing any function.

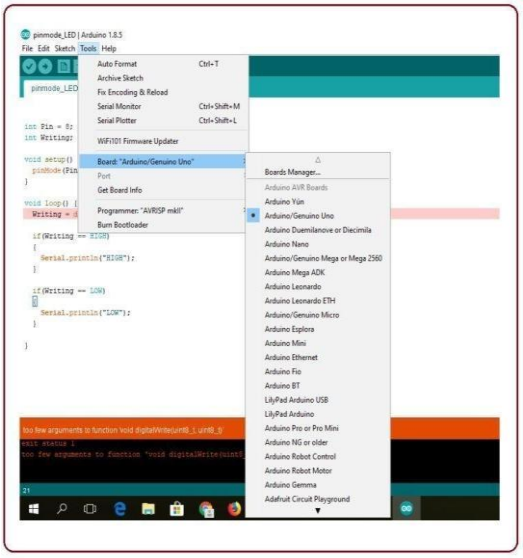

Fig 11- Arduino Tools

Just go to the "Board" section and select the board you aim to work on. Similarly, COM1, COM2, COM4, COM5, COM7 higher are reserved for the serial and USB board. You can look for the USB serial device in the port section of the Windows Device Manager.

WORKING:

Here the project we successfully executed the output and the whole procedure is working as per the results. The results of the project are shown below.

Fig 12- Project Development Kit

CONCLUSION

Agriculture plays a vital role in the Indian economy, over 70 percent of the rural households depend on agriculture, agriculture is one manually from ages, as the world is trending into new technologies and implementations it is a necessary goal to trend up with agriculture also, we have proposed a smart agriculture monitoring and prediction of crop based on sensors, they are capable of providing information about agriculture fields, also we will be using pre trained Ai model is used to predict crop. With the world's population increasing, farmers need to upturn food production, minimize water use and make rational use of natural resources while protecting the environment. The emergence of improvements in the agricultural sector as the notion of precision agriculture stands up to the rising food requirements of the world's population. However, this is lacking in the usage of Machine Learning techniques. So farmers in our country

- should know new techniques of Machine Learning. We have proposed a system for the problem of predicting the suitable crop according to the soil type.This technique
- will be helpful to a farmer in getting higher income from the crops. These techniques help solve problems faced by farmers. In this project, we will use a
- Temperature sensor, Humidity sensor, Moisture sensor, and a pre-trained machine- learning model which contains 1 lakh combination and the microcontroller will find the value received from the sensors and the combinations in the pre
- trained model and displays the output on the LCD module which will be very accurate. By using this project we will predict the exact crop from 1 lakh combination of data which have been trained to the machine learning model

. By cultivating the crop which is predicted, we will get the good crop yield and this will be very useful to the farmer.

Future Scope:

The system uses supervised and unsupervised Machine learning algorithms and gives the best result based on accuracy. Thus the system will help to reduce the difficulties faced by the farmers and stop them from attempting suicide. In the future, soil testing can be automated by using IoT which will help in real-time data acquisition and better, analytics of crop cultivation, and production. Precision farming will have an edge over traditional farming and will increase the profit for farmers. Also, the farm produce could be sold on this web application which will remove the brokers of crops andwill help farmers to get a good price for the crop.

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