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Implementing an IoT based Remotely Controlled Antenna Positioning System

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Abstract*: wireless communication systems rely on antennas for signal reception. Proper placement of antennas is important to achieve successful wireless communication according to satellites / transmitters. Manual antenna changes are often risky in a way that usually results in unexpected accidents and can lead to death. To determine its position, the sensors are mounted on the antenna, and the motors change their position. Because the location of a transmitting station changes over time, antenna path must also be changed accordingly. This system will track the location of the antennas and provide new coordinates for the antenna positioning. Correctly position antenna is done by this system. We are therefore proposing an IOT based antenna positioning system that enables antennas to be placed remotely based on IOT. The paper explains how to implement the current and evolving technologies in Antenna Positioning. We can essentially use this device to place antennas respectively in the desired direction using IoT.

***Keywords* : IoT, GUI, Adafruit IO, Antennas.**

I. INTRODUCTION

The internet of things, "things" are the array of components that provide unique identifiers for mechanical and digital devices and the ability to transmit data without human interference over a network. Things are “combination of hardware, software, data and services”. Connection with satellite networks or other types of networks is very difficult or, if not necessary, in remote areas or in emergency situations. to overcome this problem Portable, inflatable antenna are developed. wireless communication systems operate on signal reception antennas. For efficient wireless communication the antennas must be properly positioned in the direction of the transmitter. positioning or tuning of Antenna is very important aspect in having regular satellite broadcast signals. The Antenna must be pointed at a precise angle to get the best possible signal. The Automatic Antenna Positioning system works primarily to identify the signal source. If the Antenna's location is manually adjusted, it becomes too difficult to adjust it to the optimum location.

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The signal may be of any kind, it will automatically recognise the presence of a particular signal and the antenna will remain stationary as long as the signal connection is formed. In this system, the antenna monitoring GUI system has developed by using IoT.

The device monitors the positions of the antenna and to position the antenna properly new coordinates are transmitted, the device positions the antenna properly. Device can be used to remotely position antennas to provide efficient wireless communication. This device also has advance communication to display the signal strength on the monitor/LCD panel. The receiving antennas may be mounted around the globe distance from each other. Our system permits positioning of the antenna over very long distances. The positions of the antennas is visible on the internet to the IoT GUI. So, to develop the antenna monitoring GUI system we use IOT. Because the position of the transmitting station changes over time even the position of the antenna should be changed accordingly.

Existing System and its disadvantages:

In existing system, tracking capability of a control system is critical. Antenna are controlled manually which is time consuming and accuracy was less. Place the antenna to the exact angle to obtain the full signal of a given frequency and it requires manual adjustment. Antennas are stationary and are not allowed to receive the signals which have gone the particular degree beyond the antenna is capable to receive the signal.

Disadvantages:

- Since the antennas are set manually, it is time consuming and less accurate.
- Number of antennae required is more.
- High cost.
- Antennas are inflexible and failed to receive the signals from all the direction

Proposed System and its advantages:

Hence, we propose an antenna positioning system which enables antennas to be placed remotely over IoT. Because the position of the transmitting station changes over time even the position of the antenna should be changed accordingly. This is used by measuring the degree of command from remote and input to drive the motor at the desired degree.

Advantages:

- Here we have used an IOT application to control the positioning of antenna around the globe.
- This device can identify different types of signals.
- We can increase the range of detection.

Objectives of the research article:

- Build a positioning antenna device that can be controlled from a remote location.

The primary aim of using an antenna is to transmit the signal from satellites and other transmitting sources.

– To position the antenna to the exact angle to receive maximum signal of a specific frequency, this proposed system helps to adjust the antenna position through a simple software.

– The location of the antenna, i.e. tuning, is very critical for having regular satellite transmission signals. The antenna has to be located at a proper angle to get the best signal possible. Remotely controlling software improves the advanced technology. And to maintain the desired position microcontroller is used to develop the motor.

II. SYSTEM REQUIREMENT SPECIFICATION

A. *Functional Requirements*

Functional specifications are the do's / don'ts statements for a program, i.e. they define how to respond to the inputs given and how to behave according to the situation. Often the specifications specifically state what cannot be done to the application depending on the conditions and circumstance. Such specifications should satisfy the specifications of the customer. That tells the machine what to do based on the situation, what not to do. These requirements directly specify functionality (features) of system by user directly.

This system will give the following characteristics.

–Framework offers tools for logging in.

–Device capable of determining the frequency of the signals. May increase the detection range.

You can use an IoT program here, so that we can monitor antenna positioning anywhere in the world.

B. *Non-Functional Requirements*

The non-functionality criteria specify how a system should be. This describes the system's consistency or characteristics of non-functionality specifications and also describes the user experience when performing the project.

C. *Availability*

Remotely Accessible and accessible at all times.

D. *Maintainability*

Location of the antenna will be retained, depending on the signal power.

E. *Performance*

–Quality is related to the intensity of the received signals, by giving the antenna angle at a given location.

F. *Security Requirements*

This system will request, authentication of the admin is required while antenna location is being set.

G. *Hardware Requirements:*

Microcontroller At mega 328: Uses an AVR based, low-power 8-bit CMOS microcontroller. It is an advanced RISC architecture, with 131 Powerful 32x 8 General Working Purposes Registers.

Accelerometer Sensor ADXL335: static (earth gravity) or dynamic acceleration is measured by using sensor accelerometer in all three axes. Accelerations are detected in x and y directions by using ADXL335 sensor

LCD: A 16* 2 thin panel monitor with liquid crystal (LCD) is used. To view the status of the output LCD display is used. Power Supply: The first and most important part of our project is power supply. For our project we need LCD, Atmega328, Accelerometer and Ethernet shield with+ 5V controlled power supply. And for motors it needs+ 12V supply.

IOT server: IoT servers can activate the IFTT server, i.e. send the packets ON OFF to the Mcuesp8266 Node

Servo Motor: Enables correct angular or liner position control, velocity, and acceleration.

H. *Software Requirements:*

Arduino IDE: The open-source Arduino Program (IDE) makes coding and uploading it to the board fast.

Embedded C: language that we use while coding our project.

Adafruit: Adafruit IO is a system uses information. By using the data, we can do programming

IO contains REST and MQTT APIs bundled in client libraries. On Rails, IO is based on Ruby, and Node.js.

Adafruit IO is on beta at the moment. If you are interested in entering the trial, head over to io.adafruit.com to sign up.

III. SYSTEM DESIGN

A. *System Architecture:*

Here is the system design will be performed based on the analysis and the specifications of the system found.

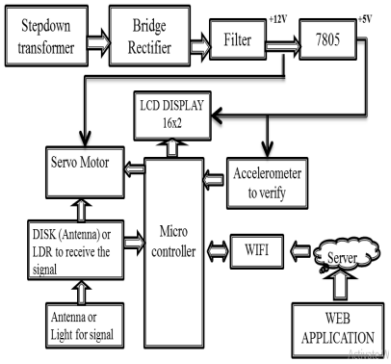

Figure. 1 Architecture of Antenna Positioning System

B. *Power Supply*

displays the circuit diagram of Dual power supply. The function of the individual circuit components is discussed below. The circuit is composed of the following points.

1.Transformer 2. Correction 3. Filter 4. Regulator

1. Transformer:

A step-down transformer is used, the purpose of which is to decrease the AC voltage from 230V to needed voltage depending on the need. Uses 12V-0-12V in this phase. The transformer output is 12V AC and is connected to the rectification diodes.

2. Rectifier Circuit: This uses diodes, which converts AC voltage into DC voltage. The rectifier circuit output isn't just DC. It also contains several AC components which are called ripples. Filter circuits are employed to eliminate these AC components. So the rectifier circuit output is fed to the (capacitor) filter circuit.

3. Filter Circuit: Filter circuit uses electrolytic condensers to isolate the AC components.

As we know the condenser does not require DC components to move through it because it provides strong reaction to the DC component. And gives less reaction to the AC component and all AC components can be bypasses to ground via the condensers.

4. Regulator:

The three terminal IC regulators 7812 & 7805 are used in this project to provide DC voltages for output. E.g. 7809, the number 78 is the positive regulator IC and 09 is the output voltage, i.e. output is 12V.

C. Servo Motor: R / C Servos are controlled by transmitting Pulse Width Signals (PWM) from an external electronic device which generates PWM signal values, such as a servo controller, servo driver module or R / C transmitter and receiver. Pulse Width Modulation or PWM signals being sent to the servo are converted by electronics within the servo into place values. The on-board electronics transforms the PWM signal to an electrical resistance value when the servo is directed to shift (Received a PWM signal), and the DC motor is turned on. The associated potentiometer rotates as the motor shifts and rotates too the electrical resistance value from the moving potentiometer is returned to the servo electronics until the potential meter value matches the location value from the transformed PWM signal received by the onboard servo electronics. The engine stops and waits for conversion of the next PWM signal input signal when the potentiometer value and the electronic servo signals suit.

D. *LCD Display*

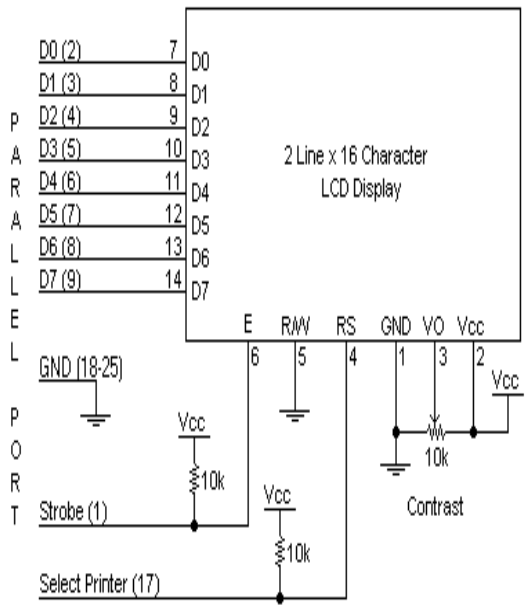

Fig 2:LCD Display

E. *Getting Started*

log into your Adafruit account and then head over to io.adafruit.com (http://adafru.it/fsU) and click on the „JOIN THE BETA LIST" button. We are slowly adding new beta users to help test Adafruit IO, and we will eventually open it up to everyone on the list.

Once you have been invited to the beta test, open up io.adafruit.com and you will be sent to a welcome dashboard.

F. *Flow chart:*

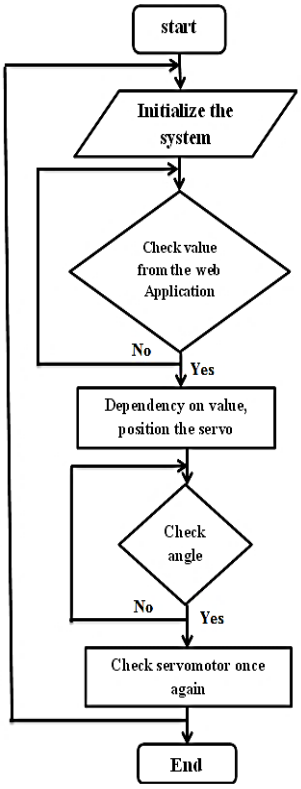

Fig 3:Flow Chart of the antenna positioning system.

G. *Sequence diagram:*

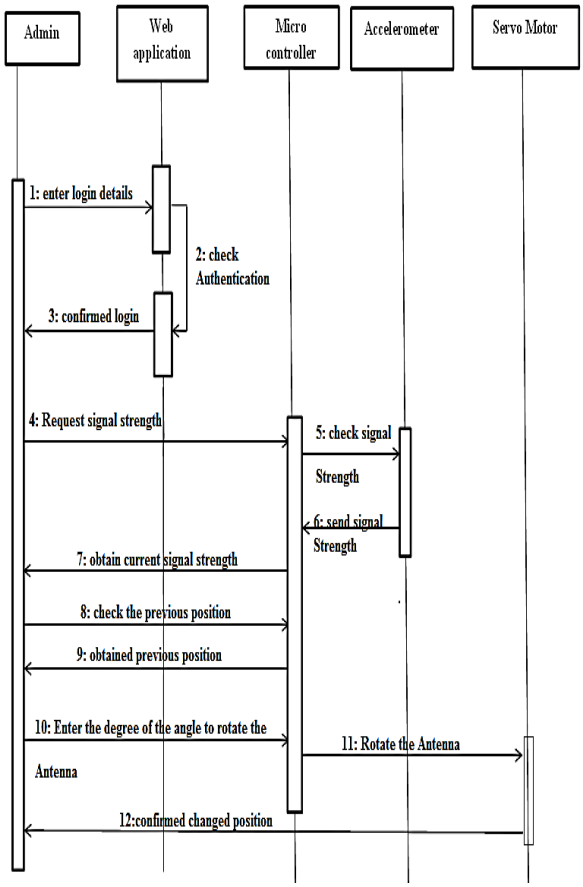

Fig 4: Sequence Diagram of antenna position system

H. *Use case diagram:*

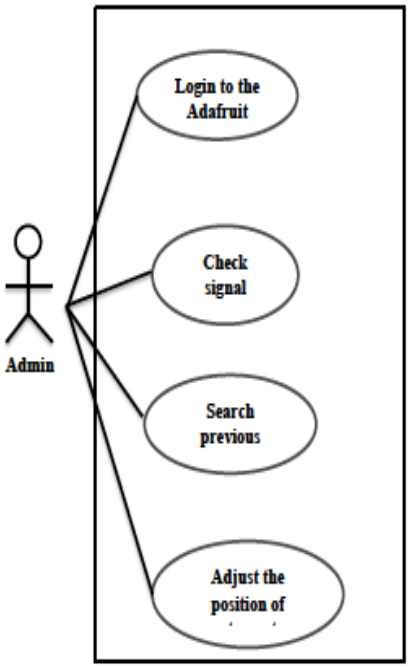

Fig 5:Use case diagram of antenna positioning system

I. *Activity Diagram:*

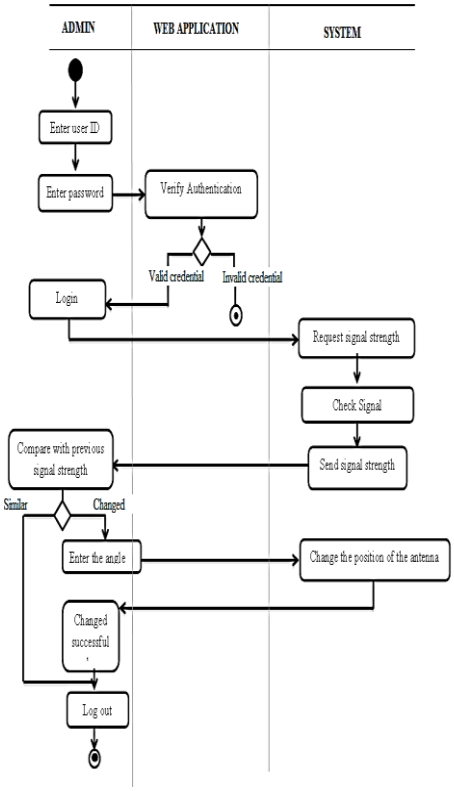

Fig 6: Activity Diagram

Activity diagram describes the workflow behaviour of the system. The diagram describes the state of the activities by showing the sequence of activities performed.

IV. RESULT AND DISCUSSION

In this paper, the positioning of the antenna device is based on an accurate measurement of the antenna's rotational velocity to determine its angular location and provide maximum signal strength to the user.

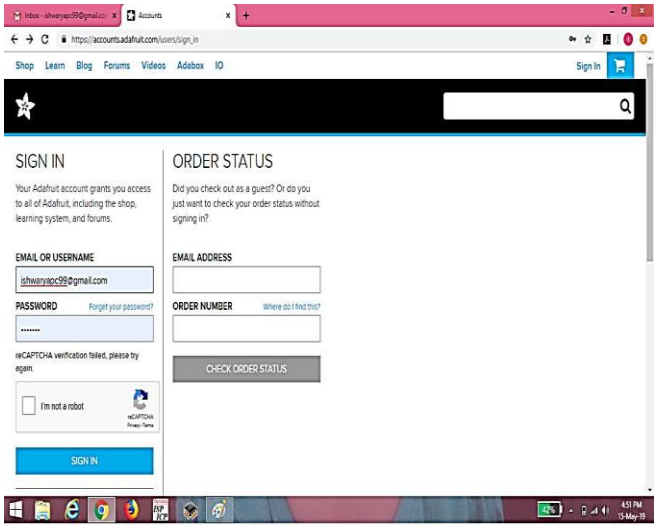

Fig 6:login page to web application.

The above figure shows the login page to our web application, Adafruit IO. Here the admin enters his/her username/email id and the password.

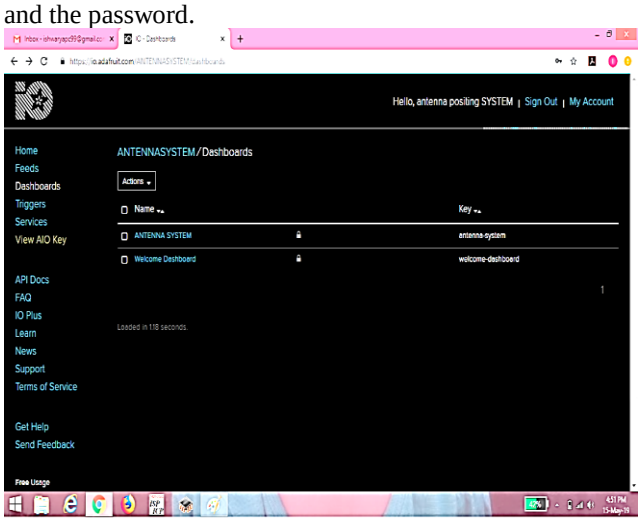

Fig 7: Home page of Adafruit IO

After logged in, the home page of the web application is as in the above figure. Here click on the Antenna System to access the position of the antenna.

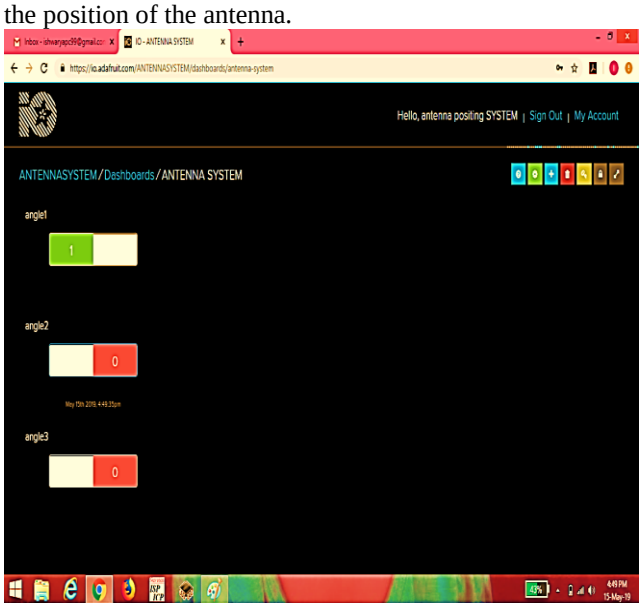

Fig 8 :that changes the antenna position

In the page shown above, the position of the antenna to be changed will be toggled by the admin.

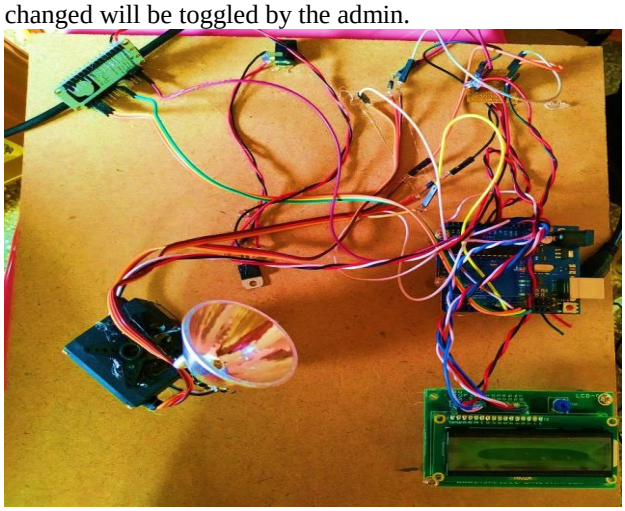

Fig 9: Hardware components of the Antenna Positioning system

The above figure shows the hardware setup of the Antenna positioning system. A positive continuity test allowed the circuit to be operated and therefore all components performed successfully as planned

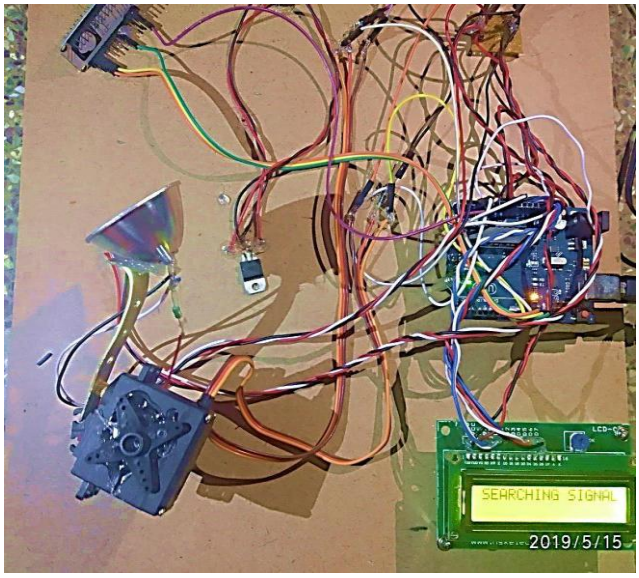

Fig 10: Antenna searching for the signal

The above figure shows the searching of the signal by the antenna.

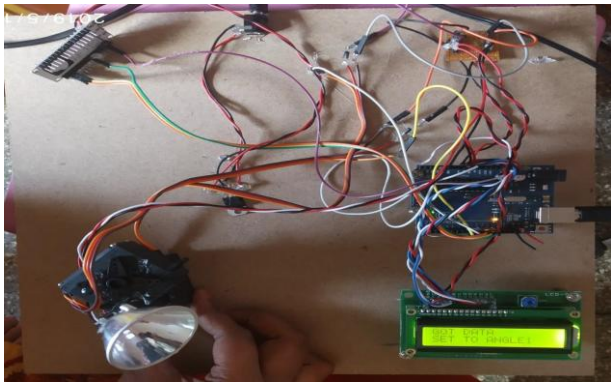

Fig 11: Antenna positioned at a particular angle

The above figure shows that, the signal is identified, and the antenna will be positioned at the particular angle.

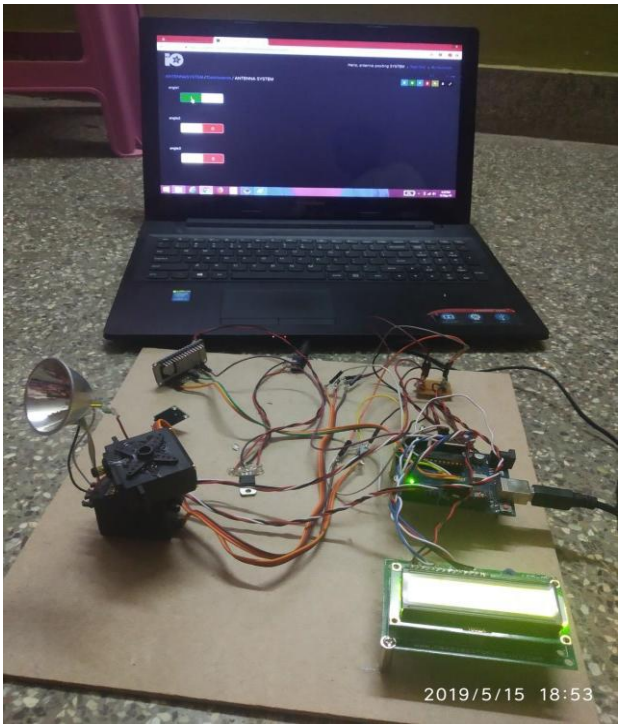

Fig 12: Overall view of the Antenna Positioning System

The above figure shows the entire system of our project.

V. CONCLUSION

Information technology plays a vital role in our daily lives like connected cars, smart cities, smart parking, e-commerce etc. IoT and microcontrollers are the most common and important technical concepts in every field of life. The IoT is used to build antenna monitoring system with the GUI. This system allows tracking of the location of the antenna as well as transmitting new coordinates so that the antenna is located correctly, and the motor positions the antenna. This method overcomes the drawbacks of the current system caused by misalignment due to a manual adjustment of antenna location. The paper provided is useful in remote areas. With more sophistications and advanced technologies this project can be built in future.

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