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Vehicle Tracking System with Anti-theft Security and Parental Control

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Abstract: It stays vital to have security systems these days to safeguard from losing vehicle or from unauthorized access. The huge objective is to make a security structure for all of the vehicles. Splendid vehicle global positioning system is expected for following the advancement of the vehicle equipped with arranged structure for any area at whatever point. Henceforth, guaranteeing the security on the off chance that it is lost or unauthorized access. In this Project/Paper, the global positioning system includes fundamental module like Microcontroller board Raspberry pi 4, GPS module neo 6m, GSM module 800A, Fingerprint sensor R307, and so on. The overall finding plan GPS and overall plan for cell transmission-GSM headways are the most broadly perceived procedures used for following the vehicles. The GPS module is used to get the region information i.e., geographical information where the vehicle is organized at that particular time. The limit of the GSM module (or Wi-Fi) is moving the data and upgrading the information. The vehicle location is obtained through web application. The fingerprint sensor is utilized to validate driver or user to safeguard vehicle from theft. The microcontroller board-raspberry pi 4 gets the location, organizes from the API and imparts the information to the client. The user can get to the location utilizing google maps in the web application. The client can track vehicle location, driver details and speed from their own place significantly quicker. The system gives the constant vehicle location and nonstop observation of the vehicle and improvement cost is less.

Index Terms **- Antitheft security, Vehicle tracing, Raspberry Pi, GPS, Live Location, IOT, Security, GSM, Parental control.**

I. INTRODUCTION

As the theft cases of vehicles are rising day by day, it has turned into a significant exploration theme. The proposed model gives hostile to anti-theft security by checking the driver's identity through fingerprint scanning. Parental control is accomplished by observing the speed and live location of the vehicle utilizing GPS and GSM innovations. Monitoring the ignition of the vehicle will likewise be told to the administrator board and history of journey is put away on the server side for future examination. In this proposed system, different procedures had been done. For the capacity purposes, the memory was put away straightforwardly on the hardware by the past researchers, many ways to deal with distinguish the movement time were utilized, similar to cost label coordinating, number plate coordinating and some more. Yet, the most recent advancements like GPS are acquainted with tackle this issue. In our undertaking, we have utilized raspberry pi which is multiple times quicker than Arduino. Along these way, the clock speed execution will thusly increase. In a study, [1] states that Considering the spike rate in the wrong doing in regards to vehicles during transportation, and, surprisingly, the most recent reports by protection relationship of the Malaysian board affirms approx. 60 vehicles are stolen consistently. The system stores information on server that can be utilized to ascertain distance went by the vehicle and stores in the data set for additional investigation. The data should be visible persistently or on the interest. An estimation which predicts the beginning and end time is in like manner used. In 2019, Mohammed Hazim Alkawaz set forth a vehicle following and detailing framework utilizing strong calculation. In this system, raspberry pi is utilized. The issue of monitoring taken vehicle was settled in this system. [2] In 2020, Bernard Akindade Adarmola set forth vehicle global positioning framework utilizing arduino microcontroller. The GPS GSM based global positioning system for vehicle was developed in view of ideal material thought. [1] In 2019, Kunpeng Dai carried out Multiple Vehicle Tracking Based on Labeled Multiple Bernoulli Filter Using Pre-Clustered Laser Range Finder Data involving Raspberry Pi as mainboard. [2] In our proposed system [11] The Smart Vehicle Monitoring and Tracking System (SVMTS). In the event of any robbery, the proprietor will have full command over the following of the live location of their vehicles utilizing GPS through web application.

II. LITERATURE REVIEW

A system was created in [14], utilizing GPS and GSM technology. The system is microcontroller based that comprises of GPS, GSM, Atmega microcontroller MAX 232, 16x2 LCD and programming part is utilized for connecting every one of the necessary modules and a web application is additionally evolved at the client side. The GPS satellite gives the specific place of the gadget which is arranged in the vehicle. This gadget is thusly which is associated with the neighbourhood GSM specialist co-op by means of a GSM network as it has SIM card present in it consequently the GPS boundaries which the gadget has are ship off the following server. There is a reality of significant expense as the gadgets they use are exorbitant and there is greater intricacy in incorporation of those gadgets in a straightforward box. A. Al-Mazloum et al. [15] implemented a SMS based global positioning system for

tracking children's location. Parent's telephone sends SMS to children's telephone mentioning an area data. Then kid's telephone answers with GPS information and in the wake of getting the information, the parent's telephone shows the location on map. Albeit the system was great for SMS based tracking, it doesn't give online area global positioning system utilizing application programming since it utilized no devoted server. There is a system engineering as in [16], planned in view of client-server. In server side, it contains a GPRS, a web and a SMS server alongside information base to store client subtleties and information. For client, a container contains a GPS tracker and a GSM modem. Whenever clients demand location from the web or application subsequent to enrolling and signing into the web server a SMS solicitation will be shipped off the GSM modem in client gadget. It requires web availability on the two sides of client and server which isn't helpful in ac condition where there is no web network available at any of the server or client sides. Likewise, the association between the server and client should be compelled by both server and client. Sonia C.V et al. [17] fostered an android application to follow smart phones. It has SMS based GPS framework using GPS data. It didn't integrate internet global positioning system with which one can observe the area without utilizing SMS administration. KuanYew Tan, and KokSheik Wong [18] executed a grounds vehicle global positioning system with the assistance of WiFi closeness technique and GPS information. They utilized a site and web server to transfer the data there, and show the tracking data on map. The system is extremely valuable however it requests a functioning information network for a client to see the guide and know transport area. There is no technique to get transport area from an information network less gadget. SJ Lee et al. [19] showed a coordinated system with microcontroller and cell phone for ceaseless tracking of a vehicle. Microcontroller is puts on the vehicle of interest and afterward it sends location information to the server. A user can get the vehicle area from the server in his smartphone. The framework is very capable and showed a promising outcome. However, as it needs GSM/GPRS module and GPS module alongside other equipment for executing the system, it adds extra expense. Md. Marufi Rahman et al. [20] designed an Arduino based vehicle GPS framework. It needs Arduino, GPS and GSM module to be placed on the vehicle. The location information got from the system was utilized to show location on google map. It doesn't require web association, aside from showing google map. Ulhas Patil et al. [21] talked about a vehicle location tacking system that utilizes a few sensors to recognize a mishap. Whenever mishap happens, it sends the vehicle location to closest police headquarters and emergency vehicle administration numbers. It utilizes GPS, GSM module, Renesas microcontroller and RF encoder/decoder. Humaid Alshamsi et al. [22] developed an ongoing vehicle global positioning system utilizing GSM, GPS with Arduino. Location data is fetched and put away in memory card. To get the vehicle location, on ought to send a SMS to the GSM module. The system then answers with the latitude and longitude of the vehicle. Dongjiang Li et al. [23] brought a vehicle remote checking system in light of Android. The system includes ARM9 core processor, GPRS module, GPS module and sensors. Information gathered by GPS and sensors are transferred to a server. Android telephone associates with the server through web and bring data to track the vehicle.

III. TECHNOLOGY USED

3.1 GPS: [2] The Global Positioning System is satellite navigation system. The Global Positioning System (GPS) is a worldwide radio navigation framework worked from the 24-satellite heavenly body and its auxiliaries.
Used Module: NEO-6M GPS: [7] this is a complete GPS module in light of NEO-6M. This unit utilizes cutting edge innovation to give the best location data and incorporates a huge 25 x 25mm inherent GPS radio wire with a UARTTTL attachment. The battery is also recharged so you can get the GPS lock quickly.

3.2 GSM: [2] GSM stands for Global System for Mobile Communication. GSM is an open and advanced portable innovation utilized for versatile correspondences. It utilizes 4 distinct groups of 850 MHz, 900 MHz, 1800 MHz and 1900 MHz. It uses a combination of FDMA and TDMA
Used Module: SIM 800A GSM Module:-

3.3 Raspberry pi: It is a small device capable of doing all task which computer can do. Raspberry Pi 4 Model B is the most recent item in the well-known Raspberry Pi scope of PCs. It offers momentous speeds up, media execution, memory, and network contrasted with the earlier age Raspberry Pi 3 Model B+, while holding in reverse similarity and comparative power utilization. For the end client, Raspberry Pi 4 Model B gives work area execution similar to passage level x86 PC frameworks.

3.4 Optical Finger print scanner: Optical Scanner are the normal kinds of fingerprint scanner that utilization a LED light to enlighten the finger. The sensor recognizes and makes the unique finger picture by deciding the light and dim regions made by the finger impression edges.
Used Model: R307 Fingerprint scanner.

3.5 Other components used: Motor Driver LM, 16X2 LED display, Buck Converter, Buzzer, LED bulbs, etc.

IV. SYSTEM DESCRIPTION

The proposed system contains three modules. The first module is web portal on which all information will display like current vehicle location, speed of the vehicle, Driver information, History of the journey. This module will function as a client module.
The second module is server module which consist actual hardware part of the system. The components like GPS, GSM are present in this module. It has two small modules. The first is a live location module. It will show the location of a particular vehicle and its recorded time on Google Map. The second is a mail alert. It will provide location details to the client side.
The Third module is authentication module, this is security module which authenticate the authorized user with the help of fingerprint scanner.

The proposed system is designed such as one can easily track his/her vehicle from anywhere anytime. The system provides a bunch of features such as anti-theft security, parental control, live vehicle tracking, history of the journey and few more. These features are not limited, they are to be extended in future.

The proposed system has few very useful modules, firstly, the anti-theft security which will secure vehicle from theft or any misuse. It has fingerprint scanner, unless and until user is not verified by providing his or her fingerprint scanning, he/she will not be able to start the vehicle and if multiple attempts are done to verify identity and system cannot verify the user, an alert email will be sent to the owner of the user.

Another module, which is parental control will provide parent's command on the vehicle. They can set the speed limit and can observe the activities, speed of vehicle and location from anywhere. In case of violation of the above mentioned facility, system will send an alert email to the parent.

The main module of the proposed system is to track live location of the vehicle. System provides live location as well as the history of the journey. History of journey will provide the data for future analysis for business use and in case of any misuse. These are not the limited modules of the proposed system, it has many more that have implemented and to be implemented.

V. ALGORITHMS

5.1 Haversine Formula: In proposed system (Vehicle tracking system with anti-theft security and parental control), We have calculated the speed of vehicle for parental control. To ascertain the speed of vehicle we work out the distance between two geographical directions and the time expected to cover that distance is determined. To work out the distance between to organize that is latitude and longitude, we utilize the Haversine formula. Haversine formula is utilized to ascertain the distance between two earths coordinates. System provides the speed of the vehicle. For this, is uses haversine formula to calculate distance and then calculate the speed of the vehicle using following formula:

```
$dlong = $LongitudeTo - $LongitudeFrom;
$dlati = $LatitudeTo - $LatitudeFrom;
$val = pow ( sin ( $dlati /2 ), 2 )+cos ($LatitudeFrom) * cos ( $LatitudeTo) *pow(sin($dlong/2),2);
$res = 2 * asin(sqrt($val));
$radius = 3958.756;
$result = ($res*$radius*1.60934)/0.0001388889;
```

In above mentioned formulas, $val gives the distance between two earth (GPS coordinates) points. After calculating the distance between the two points, $result formula gives the speed of the vehicle.

5.2 Google Map API: Google provides an API for map to show the location. We used this APIs to show the live location on the map, also to show the vehicle history. This API is free to use for development purpose and after that we can add billing to it for commercial use.

5.3 Pubnub API: We have used an API called PubNub to transfer data from hardware to the server or web application. While tracking vehicle location, we need to push the live location of the vehicle continuously. For this task, we have used an api called pubnub which provides the functionality to push the live data from hardware to web application and server.
Pubnub use the mechanism of publisher/subscriber. It does not required any server involvement to communicate. This will provide or send the message or data immediately to the end user which is subscriber.

5.4 Pyfingerprint library: We provide the anti-theft security by authenticating the user. For this purpose we have used the python fingerprint library call Pyfingerprint which helps to provide fingerprint authentication. By using this library we can store the finger print data and later we can verify the user to access the vehicle. This library is very fast in the performance and provides great accuracy.

VI. IMPLEMENTATION

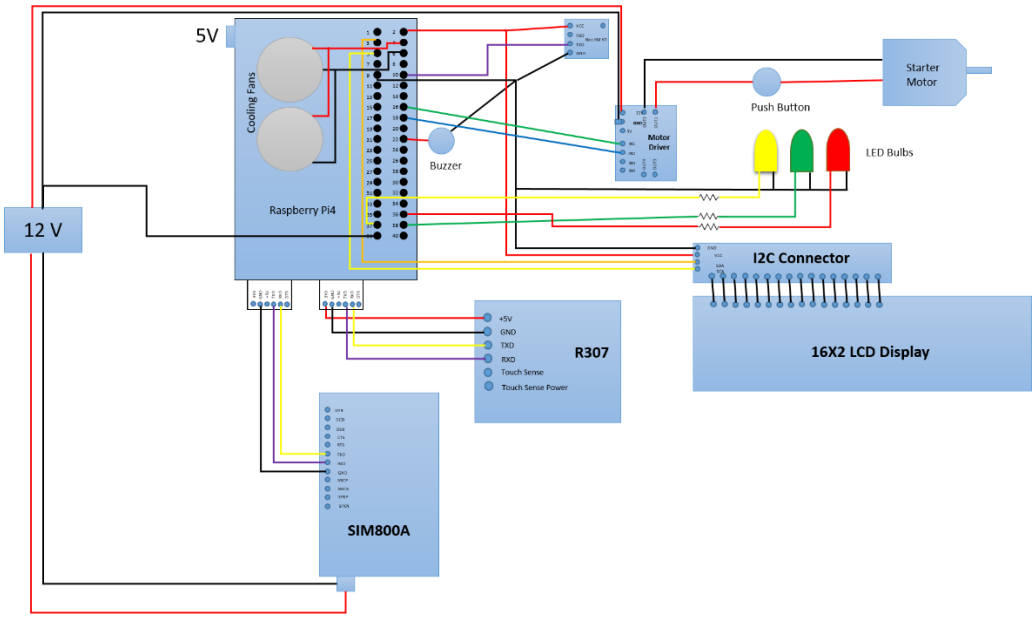


Fig (a). Circuit Diagram

Above fig (a) shows the circuit/ connectivity of hardware components used in proposed system. System requires 12V current supply for motor driver and the GSM module SIM800A to function properly and Raspberry pi 4 requires 5V current supply to work properly. The current supply will be given from vehicle battery which is 12V in power. As raspberry pi 4 requires 5V current supply, step down buck converter is used to convert 12V supply to 5V supply. As shown in above circuit diagram I2C converter is used for serial interfacing of 16X2 LCD display with raspberry pi 4.

Every one of the components are associated with one another with the jumper wires. As displayed in figure we utilize external 12C connector to interface LCD display to the raspberry pi. The GSM 800A module and R307 fingerprint sensor are associated with raspberry pi through the USB port.

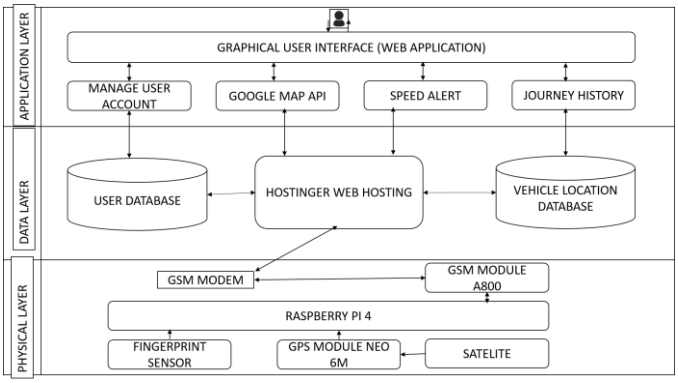


Fig (b). Architecture

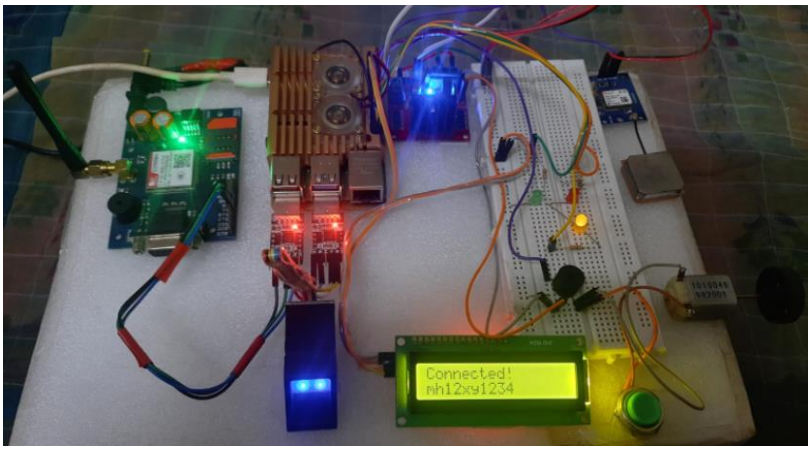
In proposed system, we have used three tier architecture as shown in above fig (b). Physical layer consists of all the hardware components which are installed in vehicle. We programmed the hardware such a way that it can communicate with our server which is in data link/data layer. In data layer we have shared hosting provided by hostinger where our web application, user database and vehicle location database is stored. In third layer, which is application layer. In this layer our user interface (web application) is accessible.

When user wants to track his/her vehicle, he simply get in touch with user interface (web application) and request for the location. The request goes to the server and server fetches the vehicle location details from the physical layer which is our hardware components installed in vehicle. In this manner our system interaction happens in three tire model.

VII. DEPLOYMENT

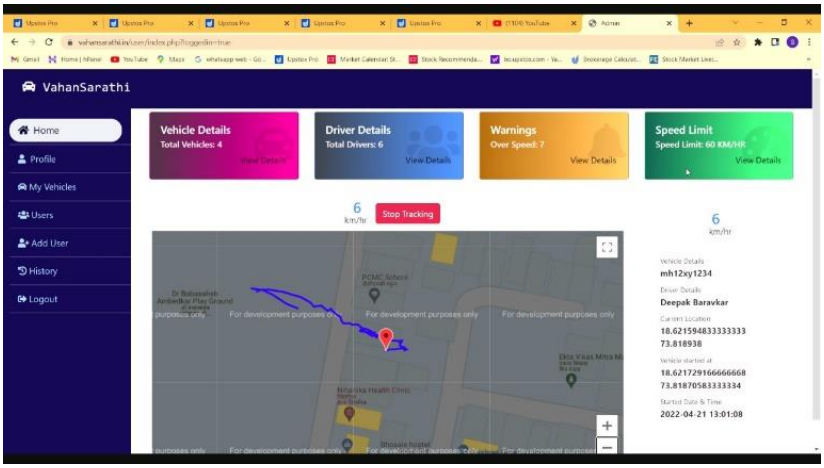
Proposed system is divided in two parts, hardware and software. System's hardware is deployed or installed in vehicle with integration of vehicle system and the software part, which is our web application is deployed on a live server to access the system world widely. We used shared hosting provided by cloud service provider- Hostinger. We can now access the system from anywhere and from any device which has access of internet service and internet browser. To access the service provided by our proposed system we used domain name-www.vahansarathi.in.

VIII. RESULT



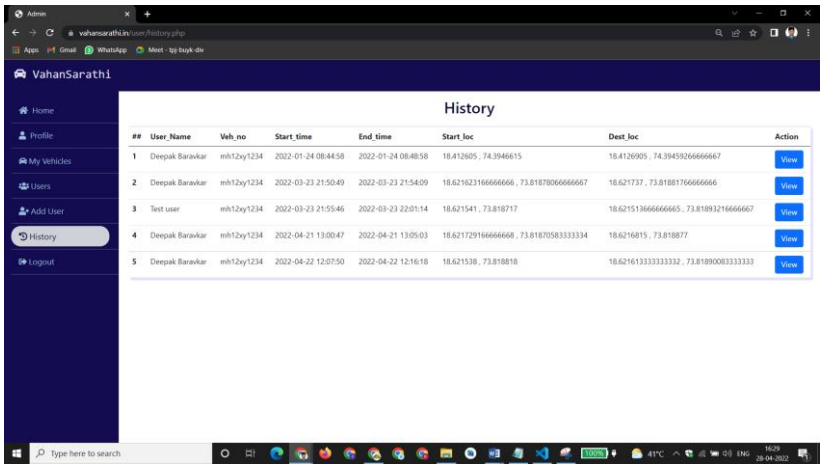
Img(a): Hardware connection

In above image img(a), the hardware connection of our system is shown. All the required components are connected with the reference of the circuit diagram shown in Fig (a). The Hardware is working properly and gives the expected results with greater accuracy.



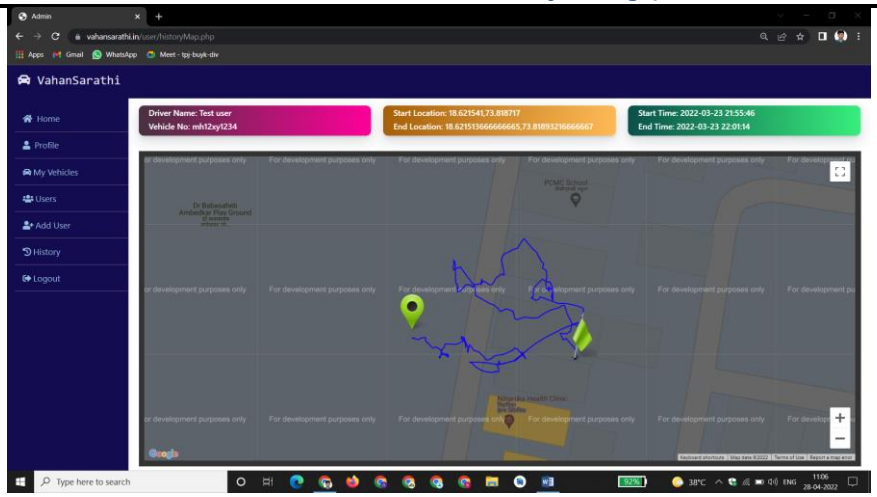
Img (b). Live Tracking

In above snippet img(b), we can see the live result of vehicle tracking. Live location of the vehicle is shown on the map. Also the details like current location, vehicle start location, driver location, etc. details are shown in same window as shown above snippet.



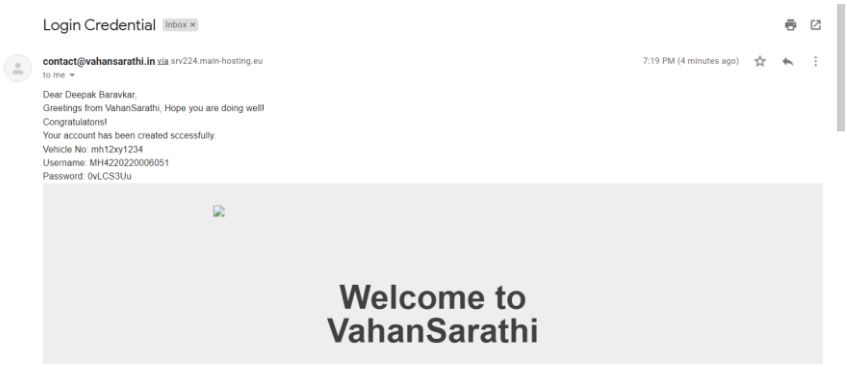
Img (c): History List

In above snippet img(c), there is a list of total journeys of particular vehicle. It shows the basic details of journey such as vehicle number, driver name, start and end location and the date and time of that particular journey. We can also see the exact route of the journey by clicking on the view button shown in above snippet.



Img(d): History

When clicked on the view button in the snippet img(c), we can see the exact route of the journey as shown in the above snippet img(d). This window also consists of basic details of the vehicle. We can see the route of the previous journey on the google map whit the starting and destination pointers.



Img(e): Email Notification

Above snapshot shows the email received after adding the new user to the system. It contains the login credentials of the user. The email notification for the speed limit and unauthorized access is also sent to the user same as above.

IX. ACCURACY

Module	Accuracy
Location Data	95%
Fingerprint Scanning	92%
Speed Calculation	98%

X. CONCLUSION

In this project we have developed an advanced vehicle tracking system with anti-theft security and parental control. The system mainly uses the some IOT devices like raspberry pi 4, fingerprint sensor R307, GPS module, GSM module, motor driver, LCD display, buck converter, I2C converter, etc. The system requires and database to be stored on database server to keep data safe from the loss in case of any misshape with hardware. The user interface is our web application which is hosted on web server so we can access the details from anywhere in the world. The system is working properly and gives the proper results with maximum accuracy. This system can be extended with bunch of quality features, As we are using raspberry pi 4, we can developed a complete vehicle system with it and we hope, in future we will work to extend our system.

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