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Vehicle fault diagnostics and management system

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Abstract :This project is a kind of advanced automatic identification technology, and is more and more widely used in the fields of transportation and logistics. It looks over the main functions with like Vehicle management, Vehicle Speed limit and Control .This system starts with authentication process to keep itself secure. Here we connect sensors to the STM32 board which in turn is connected to the car through Ethernet cable, as Ethernet in capable of sending large amounts of data at high speeds. This technology involved clearly shows how a careful combination of software and hardware can produce an extremely cost-effective solution to a problem.

1. Introduction

This project's main aim is to develop an Interface and a DoIP gateway device that provides fault diagnostics and management services over Ethernet and TCP/IP allowing the vehicle to be connected directly to a test tool that is available on the local network (LAN) or on the Internet (IOT). The vehicle is now directly accessible to any PC with an Ethernet LAN interface. When connected to the internet it offers the benefit of accessing the advanced services provided by the vehicle manufacturer in real-time. There is no need of additional external devices to read the diagnostic data. Here the vehicle indicates faults and the manufacturer can access it from a computer and inform the user about the fault and how it must be handled. Ethernet has now days become the backbone for the manufacturers. Additionally the device is capable of transmitting real-time video to provide a visual feedback of the vehicle behaviour when the diagnostic operations are carried out. This eliminates the need for the technician to be physically present near the vehicle.

In DoIP networked connection, the device acts as a web server and provides diagnostic data live on the browser web page along with a live video stream that captures the inside of the vehicle. This enables the service person to carry out actions on the vehicle remotely from an internet connected device. A car is made up of a variety of subsystems that may communicate with one another but have very different requirements for the data transport that they use. At present CAN, LIN and Flex ray are the widely used automotive networking protocols addressing the needs of these different sub-systems. Each protocol has its own strength and weakness. The car manufacturers now see Ethernet as a backbone network to provide more layered network architecture and reduce this conglomeration of protocols. It also meets the higher bandwidth needs of the automotive networks of today and future. This system can be used in real time to help assist a car user who has no knowledge about the vehicle.

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It can also be used to control the speed and brake of the vehicle, view the status of vehicle like chassis vibration, fuel pressure, percentage of accelerator pedal and brake pedal pressed and vehicle on/off status. So, this project will be the latest development by using Internet of things (IOT).

2. Related Works

In 2015, Alexander P J and N. Radhakrishnan [1], proposed the way to program the microcontrollers remotely from any location. Yunmin Kim, Mingyu Lee, and Tae-Jin Lee [2] have given the ideal on how to communicate between one vehicle and another using wireless access and they also gave the idea on how to maintain a gateway using MAC protocols. Jin Ho Kim, Suk-Hyun Seo, Nguyen TienHai, Bo Mu Cheon, Young Seo Lee, and Jae WookJeon [4] CAN and Flex ray were used to send and receive data or commands, now here Ethernet which provides more than 100 times the bandwidth, which the CAN and flex ray are not capable of. So, this was how the Ethernet become the backbone of the many industries as well as the project. Young Seo Lee, Jin Ho Kim, and Jae WookJeon [4] here the idea is to create an interface like DoIP to interact and send or receive commands through Ethernet between the hardware and the software. It uses ecu's. Woongsoo Na, Nhu-Ngoc Dao, and Sungrae Cho [5] proposed with the LTE network where a Wi-Fi hotspot is created and from the vehicle the information status is sent to the user through the service provider and the use of mobile phones is also possible.

3. Proposed Work

In this rapid growing industry with increasing development of technology leading to production of new kinds of systems. Here I have just monitored the module car with sensors fixed to it and connected through Ethernet cable. It can be viewed from a webpage and also controlled. This paper helps the vehicle production companies to improve their service provide to the customer much more in a better way. It has two modules out of which one is software and the other one is hardware.

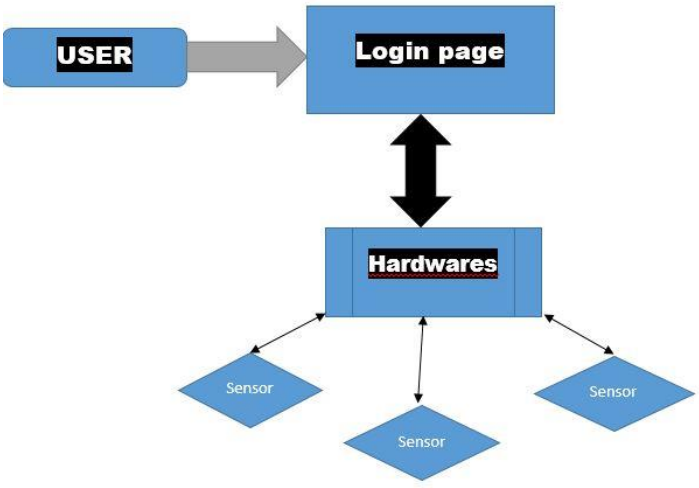

Fig1. The process module View

(i) Software:

This module starts with an authentication page to keep the vehicle safe. In the first page in-vehicle camera is the live camera feed. In the second page which is also called diagnostics controller where the speed limits, brake, light on/off, clear errors and update gas software. In the final page we have the Diagnostics status where all information can be seen. In the controller page there are options to do various operations like to clear error codes and to change speed limits and give brake pressure.

(ii) Hardware:

Here we have the main board STM32F429 which is cortex-M4 its connected to a camera, gas sensor, accelerator sensor, brake sensor, mems accelerometer sensor and it is connected with light and battery, drive motor circuit, Pressure sensor Which is all powered by Usb cable and Ethernet is connected to the computer through which the output is received.

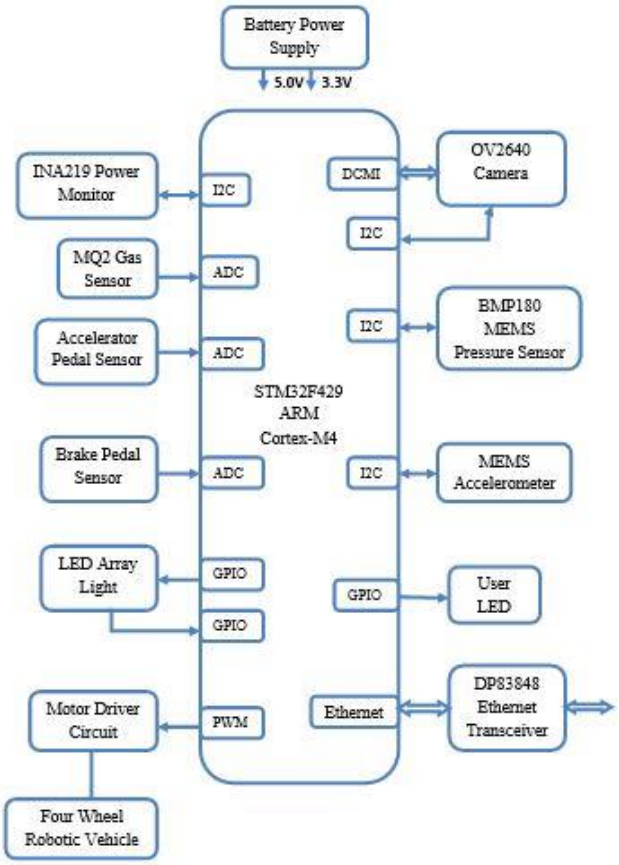

Fig2. STM board with sensors connected.

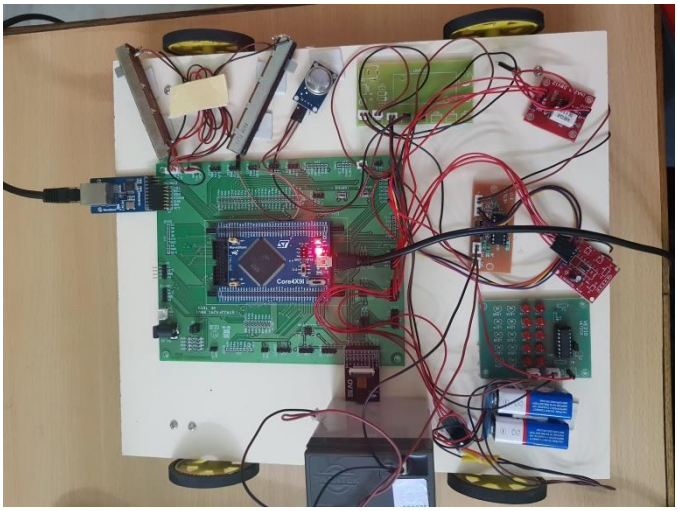

Fig.3 Module of a car with sensors attached

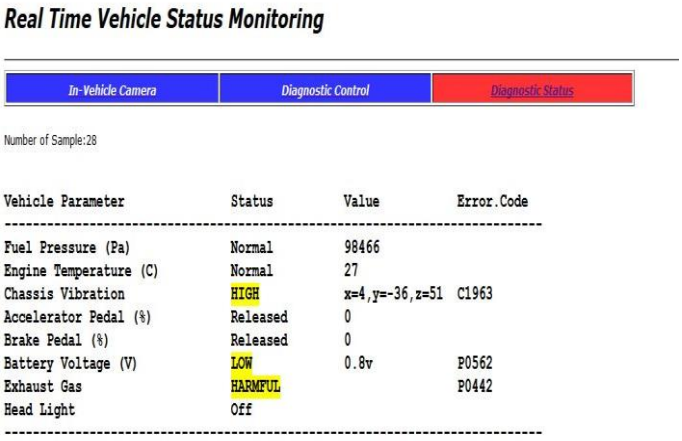

Fig4. Screenshot of webpage from Pc

Microcontrollers Used:

A project of this sort needs a very capable microcontroller with large amount of RAM memory. Thus STM32F429 from STMicroelectronics is chosen as the main MCU, which is one of the powerful microcontrollers currently available in the market. This is an ARM Cortex-M4 based microcontroller that can run up to 180 MHz. It has got 2MB of Flash memory and 256 KB RAM memory. More importantly it has got a DCMI (Digital Camera Interface) peripheral to interface with cameras.

Video Streaming:

The device is able to stream a clear live video feed. When request is made by the user, the onboard microcontroller captures the JPEG images from the camera using the built-in DCMI peripheral and starts to stream it over the web in Motion-JPEG format, a widely used video streaming

format, at an acceptable rate between 10 and 15fps. The image resolution is fixed at either 470 x 272 or 640 x 480. The microcontroller has a large RAM memory area, about 256KB, which is a must for this kind of application.

Webserver:

The device acts as a tiny web server responding to the user requests through HTTP application layer protocol. Here the web browser on the mobile device acts the client. Upon receiving the request from the client, the web server running on the device serves the HTML webpage and returns the respond messages to the client over a dedicated TCP/IP connection. The web pages are stored in the non-volatile section of the microcontroller memory area. The device uses the LwIP. open source TCP/IP protocol stack for its internet connectivity.

Embedded RTOS:

A real time operating system is necessary to handle the timely events and other multitasking requirements of the project. Here Free RTOS is chosen to provide us with this ability. Free RTOS is the market leading real time operating system in the world.

4. Conclusion

Thus, this project might help to maintain a vehicle from anywhere and also it can be used by anyone who has no knowledge about the vehicle and help them maintain the vehicle in a better way. The login page or the authentication was provide in order to keep the vehicle safe from hackers or strangers. The camera was provided in order to view the faults occurring lively from anywhere. If we need we can take this to a higher level by maintaining a database for each vehicle. But
to get to know the status of the vehicle open the webpage and login and view the status and also control certain options provided.

References

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