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IoT Based Connected Vehicle

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ABSTRACT

This paper presents the concept of connected vehicle by use of IoT. Providing various wireless connectivity for vehicles, enables the communication between vehicles and their internal and external environments. Such a connected vehicle solutions expected to be the next frontier for automotive revolution and the key to the evolution to next generation intelligent transportation systems. Moreover, connected vehicles are also the building blocks of emerging Internet of Vehicles (IoV).

Keywords: Connected vehicles, IoT (Internet of things), IoV (Internet of vehicle)

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I. INTRODUCTION

As an indispensable part of modern life, motor vehicles have continued to evolve since they were invented in the Second Industrial Revolution. Nowadays, people expect more than vehicle quality and reliability. The IoT (Internet of Things) is an ecosystem of technologies working together to create dynamic systems of physical devices and information, these systems may do several things like providing data, aggregated data to drive useful information and trends, presenting the information and trends to user in a timely manner on a range of platform, including web, mobile devices and desktop/laptops and changing the systems own behavior based on the derived information.

With the rapid development of information and communication technologies (ICT), equipping automobiles with wireless communication capabilities is expected to be the next frontier for automotive revolution. Connected vehicles on the go are proactive, cooperative, well-informed, and coordinated, and will pave the way for supporting various applications

With increasing intelligence, modern vehicles are equipped with more and more sensors, such as sensors for detecting road conditions and driver's fatigue, sensors for monitoring tyre pressure and water temperature in the cooling system, and advanced sensors for autonomous control. Connected vehicles refer to the wireless connectivity enabled vehicles that can communicate with their internal and external environment. It provides better monitoring of vehicle.

Extensive research activities and numerous industrial initiatives have paved the way for the coming era of connected vehicles. In this proposed work, wireless technologies and potential challenges are considered to provide vehicle-to-x connectivity. In particular, the challenges and review the state-of-the-art wireless solutions for vehicle to-sensor, vehicle-to-vehicle, vehicle-to-Internet, and vehicle-to road infrastructure connectivity.

Objective of the proposed work is to design and develop IoT based connected vehicle system for monitoring vehicle parameters from distance hub.

Literature review

Providing various wireless connectivity for vehicles, enables the communication between vehicles and their internal and external environments. Such a connected vehicle solutions expected to be the next frontier for automotive revolution and the key to the evolution to next generation intelligent transportation systems. Moreover, connected vehicles are also the building blocks of emerging Internet of Vehicles (IoV). Extensive research activities and

numerous industrial initiatives have paved the way for the coming era of connected vehicles.

Ning Lu, [1] et al. states that there are two immediate driving forces of bringing wireless connectivity to vehicles. The first one is the urgent need to improve efficiency and safety of road transportation systems. Growing urbanization yields an increasing population of vehicles in large cities, which is responsible for traffic congestion and the consequences in terms of huge economic cost and environmental problems.

Janani Gopalkrishnan Vikram,[2] et al. illustrated the complexity of the IoT can be seen in flexible and smart embedded system, and systems of systems, that collect data and often solve specific problems locally; or in algorithm needed to extract insight from the data and build systems that operate and adapt autonomously. The IoT system must be adaptive and simple.

Janani Gopalkrishnan Vikram [3] et al. shows the theory that, autonomous self driving cars might be decade away from mainstream use, but every automaker is focusing on smart connected cars and these are providing to be quite awesome and useful as well, the elite started looking at cars as a mobile device and begin evaluating models by the extent of connectivity, car management, security and social apps.

Bhumi Bhatt, et al. [4] presents the paper in which an automotive localization system using GPS and GSM are illustrated but every time the use of GSM and GPS is not reliable and it is a costly system and we can't monitor the vehicle continuously.

Methods:

Block Diagram:

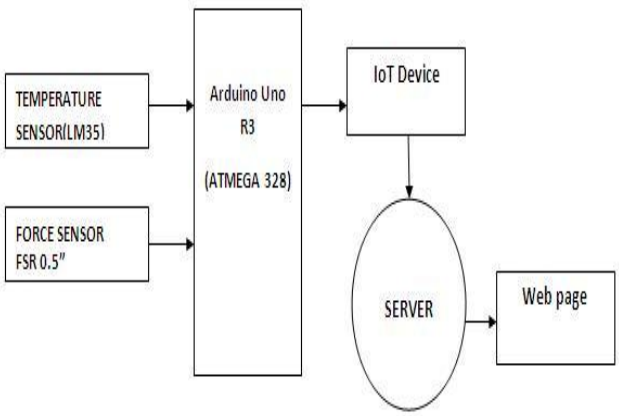

Figure 1: System block diagram of IoT Based connected vehicle.

Block diagram Description:

In this proposed work, the parameters of vehicle are measured i.e. temperature and force. the sensors are interfaced with arduino to measure these parameters of vehicle. The arduino is further interfaced with the IoT device such as mobile or laptop. The IoT device show the status of measured parameters and this info is transferred on the internet. On a hub side one can easily monitor these parameters.

Arduino uno board:

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins, 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

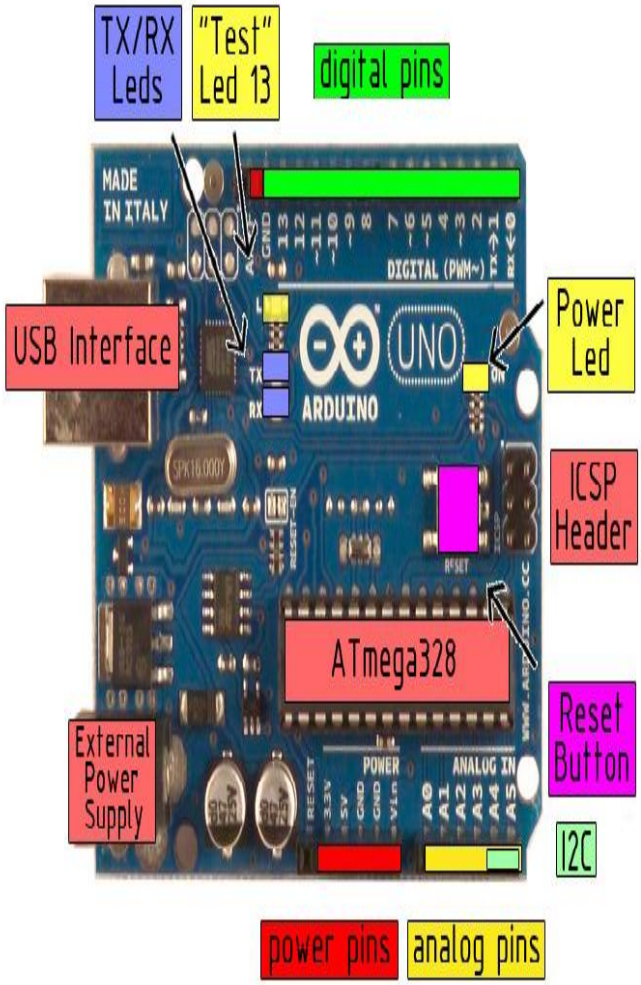

Figure 2: Arduino Uno Board

Table1: Specifications of arduino uno board.

Microcontroller	ATmega328
Operating Voltage	5V
Input voltage	7-12V
Input voltage limit	6-20V
Digital i/o pins	14
Analog input pins	40Ma
Dc current per i/o pin	50 mA
Flash memory	32 KB of which o.5 KB used by bootloader
SRAM	2 KB
EEPROM	1KB
Clock Speed	16MHZ

Power:

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter or battery. Leads from a battery can be inserted in the gnd and Vin pin headers of the power connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5Vpin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

- **VIN-**The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- **5V-** The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.
- **3V3-** A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA
- **GND.-**Ground pins.

TEMPARATURE SENSOR:

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The LM35 device does not require any external calibration or trimming to provide typical accuracies of ±¼°C at room temperature and ±¾°C over a full −55°C to 150°C temperature range. Lower cost is assured by trimming and calibration at the wafer level. The low-output impedance, linear output and precise inherent calibration of the LM35 device makes interfacing to readout or control circuitry especially easy. The device is used with single power supplies, or with plus and minus supplies. As the LM35 device draws only 60 µA from the supply, it has very low self-heating of less than 0.1°C in still air.

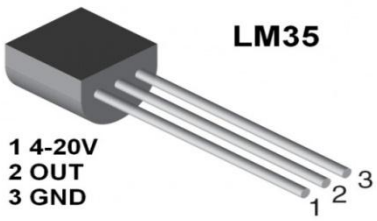

Figure 3: Temperature sensor- LM35

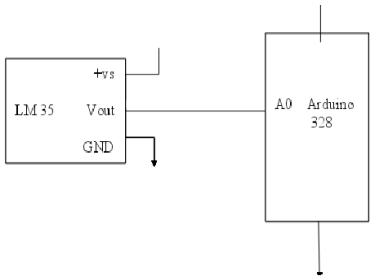

Figure4: Interfacing of LM35 with arduino

FORCE SENSOR

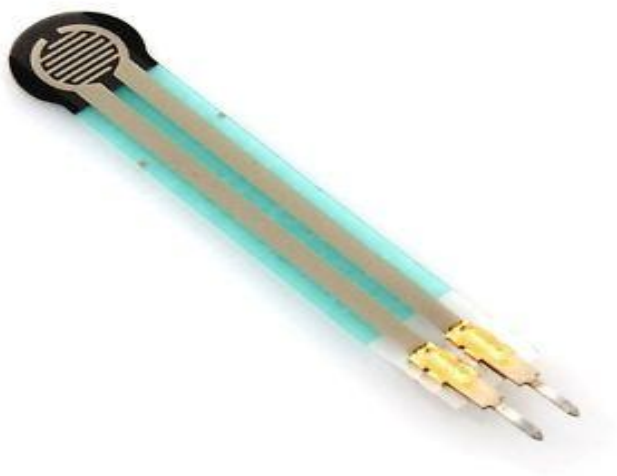

Figure5: FSR-Force sensitive resistor

SPECIFICATIONS:

- Force Sensitivity Range : < 100 g ~ > 10 kg
- Pressure Sensitivity Range : < 1.5 psi ~ >150 psi (< 0.1 kg/cm^2 ~ > 10 kg/cm^2)
- Stand-Off Resistance : > 1MΩ
- Device Rise Time : 1 – 2 msec
- Life Time : > 10 million actuations
- Temperature Range : -30ºC ~ +70°C
- Connector Pitch : 2.54mm

Server:

Server is used to store the initial data it is linked with IoT device which reads all the data from sensor. The data stored on a server further fetched from the web terminal.

Standards and protocols:

HTML:

- Hyper Text Markup Language.
- Extension: .html
- Used for creating web pages and web applications.

- HTML elements are the building blocks of HTML pages, it includes heading, paragraphs, lists and links.
- These elements are shown by angle bracket <input/>
- Markup language that web browser use to interpret and compose text, images and other data into visual web pages.

HTTP:

- Hypertext Transfer Protocol.
- The world wide web is composed primarily of HTML documents transmitted from web server to web browser using the HTTP.
- HTTP is used to serve images, sound, text and other contents.
- The other information also transmitted along with the document, this data usually includes the text/html or application and the character encoding.

Hyper Terminal:

- Hyper terminal can be used to set up a connection to another computer through the modem.
- The serial port data can be seen on this terminal.
- It is used to set up a connection between two computers or external instrument or device.
- We can connect any controller to hyper terminal by interfacing it to serial port of the computer.

Result and Discussion

IoT Based connected vehicle system can be used for monitoring of vehicle parameters and it is useful for the vehicle testing industry. it can be also used for future development of vehicles like smart cars or smart vehicles.

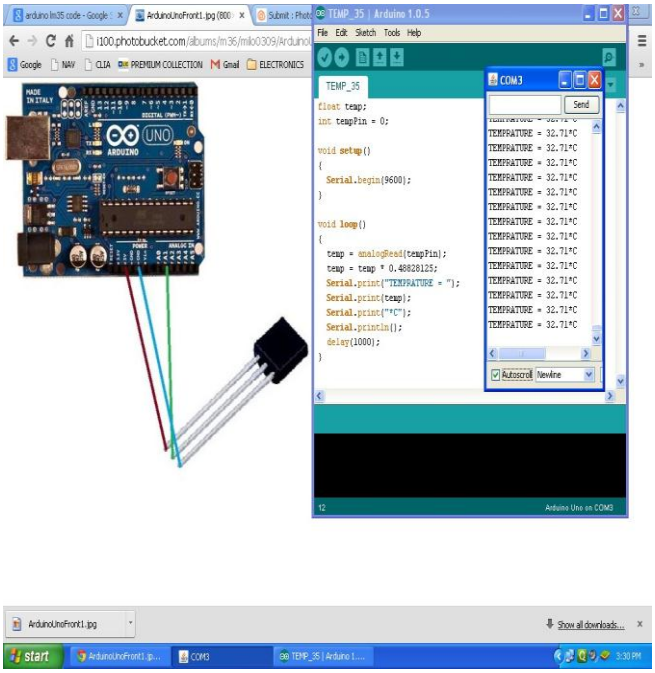

Figure6: Temperature readings using LM35

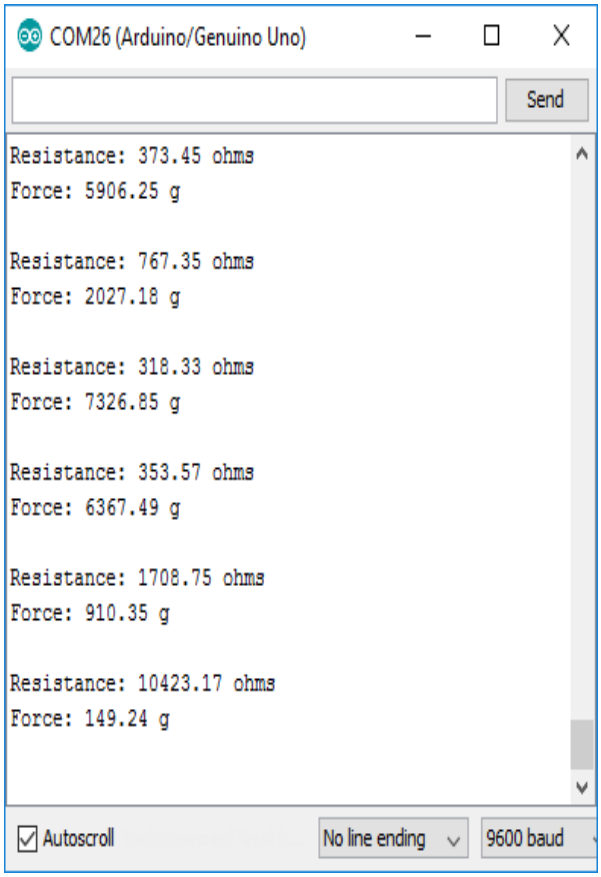

Figure7: Force readings using FSR.

Conclusion

IoT is the smart way to connect vehicles and make them more efficient and smart. It supports all electronics and sensor system. Sensor system mobilization is possible with this system. System can measure and analyze all the vehicle parameters and data is available for 24×7 monitoring. IoT Based connected vehicle is also a building block for emerging an internet of vehicle (IoV) systems. Vehicle solutions expected to be the next frontier for automotive revolution and the key to the evolution to next generation intelligent transportation systems.

We hope this paper gives an overall understanding of the topic in concise and quick way to the reader and researcher in the IoT based connected vehicle system. Extensive research activities and numerous industrial initiatives have paved the way for the coming era of connected vehicles.

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[1] Ning Lu, Nan Cheng, Ning Zhang ,Xuemin (Sherman) Shen and Jon W. Mark,"Connected Vehicles: Solutions and Challenges" IEEE University of Waterloo, 200 University Avenue West, Waterloo, Ontario, Canada Page no. 1 to 10.

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