

IoT based Vehicle Monitoring System using Bluetooth Technology

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ABSTRACT: The existing Wireless Sensor Networks technologies cuts across many areas of modern world. The combination of these sensor devices in a network creates the Internet of Things (IoT), where, sensors and actuators blend effortlessly with the environment, and the information is shared across different platforms. Different vehicles have different rate of emission of gases, but the problem arises, when the emission crosses the standardized values. The primary reason for this is the incomplete combustion of fuel supplied to the engine which is due to the improper maintenance of vehicles. It is not possible to neglect the emission of these gases, but it can be monitored. Therefore, this paper proposes a new vehicle monitoring system to help daily monitoring of engine health through the concept of Internet of Things. As there are numerous traffic lights in urban areas, they are employed to play an important role in the proposed system. The fact that every vehicle must stop in front of red lights, the real-time values obtained from the onboard vehicle unit is interrogated wirelessly through low energy Bluetooth technology.

KEYWORDS: Internet of Things, Bluetooth module, Microcontroller, Sensors, Vehicle Monitoring

I. INTRODUCTION

In this era of urbanization, there has been a relative increase in the number of land vehicles which have led to the decline of the air quality. To address this problem, the emission standards were made more stringent and different inspection and maintenance (I/M) programs have been introduced. These programs usually required the inspection of different vehicle parameters to maintain the standards of emission. Even though an attempt was made to improve the air quality by implementing the traditional I/M programs but it was ineffective in eradicating the problem of emission. While in research of these traditional I/M programs the studies have showed that the actual rate of emission of the land vehicles were higher than those measured during the inspection. Although remote sensing has been introduced for the inspection of on-road vehicles, it is still not able to cope up with the problem that the drivers may be able to avoid the inspection. Therefore, it is necessary to design a new vehicle monitoring system which helps in reflecting the vehicles emission condition and notify the vehicle owners, so that they are forced to repair the vehicle's engine which results in the reduction in emission of gases. One such system can be developed by using the concept called as "Internet of Things (IoT)". The basic idea of this concept is to tag all the "things" (might be living or non-living) around the world with a unique identification so that each and everything in this world can interact wirelessly. The aim of the paper is to monitor the raw sensor data which is obtained from the onboard vehicle diagnostic unit present in the vehicle.

II. LITERATURE SURVEY

[1] The creation of the Internet of Things depends on dynamic technical innovation in a number of important fields. First, to connect everyday objects and devices to large databases and networks – and indeed to the network of networks (the internet) – a simple, unobtrusive and cost-effective system of item identification is indispensable. Only then can data about things be collected and processed. Radio-frequency identification (RFID) offers just such a possibility. In

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this context, the present chapter examines four important technological enablers of the Internet of Things: radio-frequency identification (RFID), sensor technologies, smart technologies and nanotechnology.

[2] Mobile Cloud Computing (MCC) is an emerging paradigm where individual mobile devices can be both cloud users and service providers. Mobile phones are overtaking PCs as the most popular Web access method. By the end of this decade, a significant fraction of web access (from mobile as well as fixed devices) will be to mobile services and resources. Moreover, the data of interest may be scattered across many mobile observers, and will require in loco data aggregation and query resolution using software specialized for the local context. These mobile agents effectively form Mobile Clouds that offload the Internet Clouds from tasks that the latter cannot perform in a timely or efficient manner. For instance, a driver queries the Mobile Vehicular Cloud to find the cause of a sudden traffic jam (say, a minor accident in the next block). This type of information is created, maintained and propagated within the Mobile Cloud. It would be too costly to upload every traffic minutia to the Internet, and too time consuming to search the global Internet traffic cloud for such results. The increasing storage and processing capacity of the mobiles on one hand, and the scarcity of urban spectrum on the other make it more effective to communicate and keep the locally relevant content on the mobiles instead of uploading it to the Internet Cloud. The benefits of using the Mobile Cloud instead of the Internet Cloud are reduced communication delay, reduced spectrum costs and amply expanded range of applications.

[3] this paper, the proposed tracking system based on cloud computing infrastructure. The sensors are used to monitor the fuel level, driver conditions, and speed of the vehicle. All the data transferred to cloud server using GSM enabled device. All the vehicles equipped with GPS antenna to locate the place. To avoid the drunk and drive, the alcohol sensor installed to monitor the driver status. The proposed technology significantly avoids the accident in highways.

[4] Every vehicle has its own emission of gases, but the problem occurs when the emission is beyond the standardized values. The primary reason for this breach of emission level being the incomplete combustion of fuel supplied to the engine which is due to the improper maintenance of vehicles. This emission from vehicles cannot be completely avoided, but it can be controlled. To alleviate the air pollution problem caused by vehicle emissions, different vehicle inspection programs have been introduced, in which vehicles are examined by undergoing several emission tests. However, these emission tests are usually cost-ineffective and time-consuming. It is also difficult to enforce the vehicle owners on monitoring the health of their engines daily and taking immediate action to fix their vehicle emission problems.

[5] The concept of Cloud Computing (CC) has changed the notion of many applications that exist in various streams. This recent advancement in cloud computing befits the enhancement of the detection and prediction of air quality in indoor or outdoor environments. Internet of Technology (IoT)-driven applications play a key role to generate significant amounts of real-time data to analyse which could be used to predict the future values. The concept of smart cities is one of the emerging research areas of the 21st century. In the concept of smart cities one of the major areas that is getting promoted and focused is the "healthiest living environment or smart health".

[6] Most works concentrate on air pollutants such as Carbon Monoxide (CO), Sulphur Dioxide (SO₂), Ozone (O₃), Nitrogen Dioxide (NO₂) and other sulphur components which have adverse effects in nature and on the health of living beings. Concentration levels of the air pollutants are measured using Parts Per Billion (PPB) or Parts Per Million (PPM). PPB and PPM represents units of mass of a contaminant per one billion or one million units of total mass. To make an eco-system with less pollutants there should be a mechanism for measuring it in real time and to predict the pollution level in future irrespective of the size of the accumulated data. Hence distributed and localized monitoring of air pollution is really a major factor in determining the sources and the causes of pollution and to provide solutions to prevent pollution to an extent. In this proposed work, the technologies like WSN, IoT and CC are used for detection and analysis of air quality in real time with a notion of big data for predicting the air quality in the future. Many

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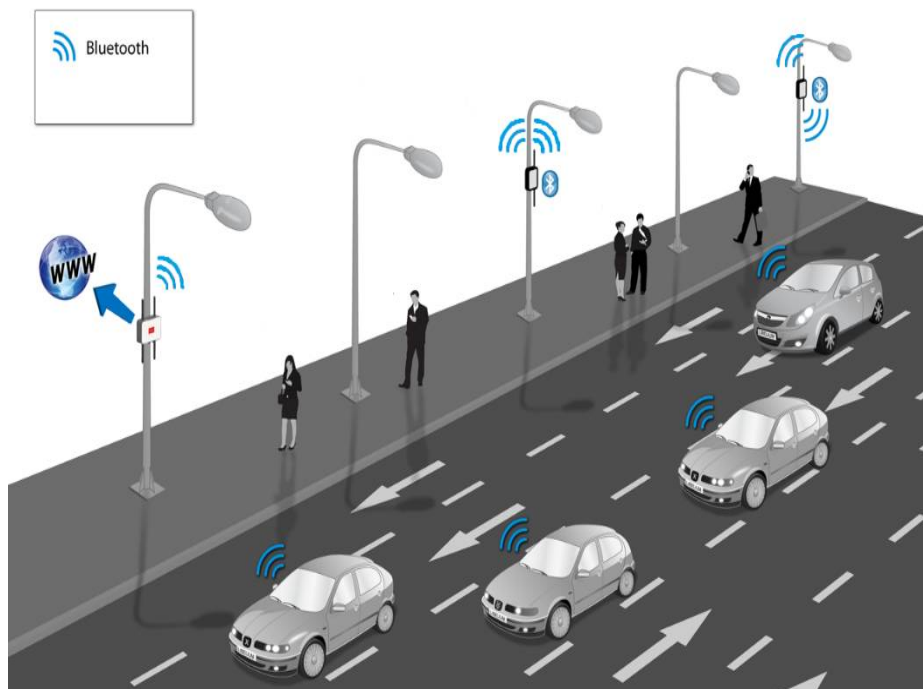
approaches are proposed to meet the requirements and a few works in this regard are discussed below. Abdullah Kadri et al. presents a simplified ambient realtime air quality monitoring system.

III. PROPOSED SYSTEM

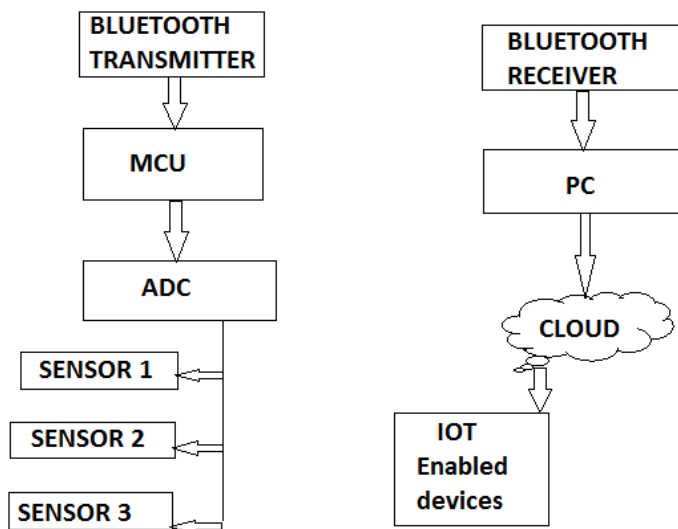
The system is intended for automatic recording of moving vehicle parameters and storing sensor readings into an embedded memory with a possibility of their further computer processing by means of specially developed software.

Monitoring system collects and records the following data:

- exhaust gas temperature at three points of vehicle exhaust system;
- ambient temperature;
- gas flow velocity in exhaust pipe;
- vehicle speed;
- wind velocity relative to driving direction;
- vehicle-tilt angle relative to horizontal axis;
- engine revolutions;
- vehicle coordinates with attachment to real terrain map;
- electric current, voltage and power of thermoelectric generator. In operation, current data from the sensors are reflected on a built-in display screen of recording device. Based on the processed data, the tabulated and graphical time dependences of moving vehicle parameters are obtained.



A. SYSTEM DESIGN



Microcontroller: It is the heart of the Vehicle monitoring system. Here, we are using 8051 series of microcontroller. It consists of the main firmware (ALP Program) that runs the hardware. The microcontroller runs at 11.0592MHz, it can also run on a crystal of up to 40MHz.

Analog to Digital converter: Here, we are using MCP3204/3208 devices. These are successive approximation 12-bit A/D. The resolution is expressed in volts. For instance, if we apply a varying voltage between 0V-5V analog input, an ADC with a resolution of 8 bits can give 256 unique levels reading.

Bluetooth Module: This module enables to wirelessly transmit & receive data. It is a drop-in replacement for wired serial connections allowing transparent two-way data communication. It acts as serial port replacement to establish a connection between MCU and the computer for data transfer.

Sensors: sensors are sophisticated devices that are frequently used to detect and respond to electrical or optical signals. A sensor converts the physical parameter into a signal which can be electrically measured. In this system, we use sensors such as traction sensor, alcohol sensor, electrochemical sensors such as CO, SO etc.

Cloud: Cloud computing is a type of internet-based computing that provides shared computer processing resources and data to computers and other devices on demand. It is a model for enabling ubiquitous, on demand access to a shared pool of configurable computing resources, which can be rapidly provisioned and released with minimal management effort. Cloud is a server of enabling data over internet of things.

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B. FIRMWARE DESIGN

1. Start
2. Initialize ADC and memory chip
3. Initialize the Bluetooth transmitter
4. Clear the HyperTerminal
5. Check the Log mode or Read Mode
6. Initialize the Log mode
7. Clear memory
8. Read the data from the channels of ADC
9. Write in the memory
10. Display the data
11. Stop

According to the algorithm, the ADC is initialized first so that it could take the raw data from the sensors and convert it to digital values. Once the digital values are obtained the microcontroller processes the data and transfers the values through the Bluetooth transmitter. Now the wireless transmission of these digital values takes place through the low energy Bluetooth. The data is fed to the central server and through the internet of things, the data is accessible to both the vehicle owner and government authorities.

IV. EXPERIMENTAL RESULTS

A. WINDOW FOR BLUETOOTH CONNECTION



Bluesoleil is a software/driver. It helps to connect with the nearby active Bluetooth devices. To make a connection the software should be in 'Display Classic View', then pairing needs to be done which requires a password to maintain the security. After pairing the service needs to be searched by selecting the 'Search services'. A COM port is made available from the computer which is used for the communication of the two devices.

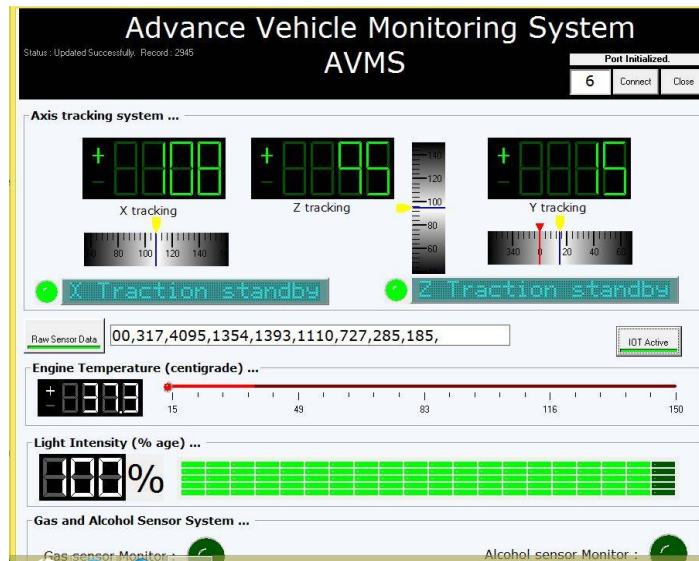
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B. SENSOR VALUES DISPLAY PAGE

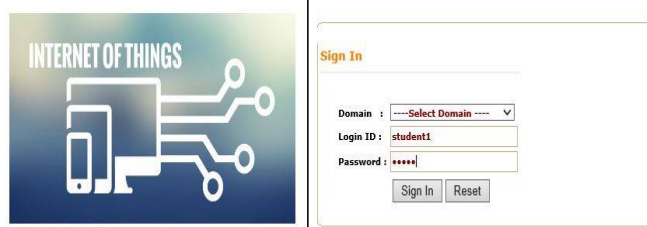


The sensor value display page is made on the visual basic software. This page displays the values of the various sensors interfaced with the microcontroller. The different tabs present on this page include: Axis tracking system (X, Y and Z axis), Engine temperature, Light intensity, Gas and alcohol sensor system, Raw sensor data, IOT active.

The tab IOT active helps in making the IOT system active and displaying the data on the web page. It also displays the latest data recoded by the web page.

C. LOGIN WINDOW

My IOT Project



Here the user can access the login page to view the data of the various sensors installed in the vehicle. Every user has a specific login id and a password. The domain tab gives two options: IOT sensor and IOT data, any one of the two can be selected.

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D. DATA TABLE

Sensor Data										
SrNo	UserKey	PersonalID	Temperature	Light	X Axis	Y Axis	Z Axis	Gas Sen	ALCOHL Sen	Data Dt / Time
3035	JE052	PID	303	4031	1354	1393	1110	626	219	3/29/2017 2:30:44 PM
3034	JE052	PID	302	4044	1355	1393	1109	626	219	3/29/2017 2:30:34 PM
3033	JE052	PID	304	4037	1355	1392	1110	626	220	3/29/2017 2:30:24 PM
3032	JE052	PID	307	4037	1354	1393	1109	626	220	3/29/2017 2:30:14 PM
3031	JE052	PID	303	4038	1355	1393	1109	626	220	3/29/2017 2:30:03 PM
3030	JE052	PID	329	4004	1355	1393	1110	627	220	3/29/2017 2:29:53 PM
3029	JE052	PID	308	4035	1355	1392	1109	628	220	3/29/2017 2:29:43 PM
3028	JE052	PID	302	4047	1354	1392	1109	629	221	3/29/2017 2:29:33 PM
3027	JE052	PID	316	4011	1354	1392	1108	630	221	3/29/2017 2:29:23 PM
3026	JE052	PID	304	3963	1353	1393	1109	632	222	3/29/2017 2:29:13 PM

The table displays the entries of the data serially with the proper date and time. The vehicle number along with its various sensor details is displayed.

E. HARDWARE UNIT



This figure displays the hardware unit of the system. It is installed in the vehicle. The system has a microcontroller, gas sensors, light sensor, accelerometer, temperature sensor, relay system and Bluetooth transmitter.

V. APPLICATIONS

- **Legal Profession:** Those who are qualified to practice law will benefit from the knowledge and understanding that MVEDR evidence is more secure and has greater authenticity if the data is introduced in civil and criminal cases.
- **Law Enforcement:** Officials at a crash site will benefit from following proper protocol that provides secure access to the vehicle diagnostic link connector and establishes a chain of custody for evidence.
- **Vehicle Telemetric:** Data protocol developed will enhance the ability of connected vehicles in the process of interchanging electronic data.
- **Consumer Protection and Privacy Advocates:** This project will help build a foundation for safeguarding consumer interests to help protect vehicle owners from misuse of data.
- **Automotive industry:** This project will help in designing database on many crashes of differing severities will be provided. Also, the standard is intended to provide early evaluation of system performance and vehicle design and allow for the global harmonization of automotive safety standards.

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- **Insurance industry:** The project will help protect data, and by doing so help in identifying fraudulent claims, which exceed \$20 billion annually, and odometer fraud cases, which is estimated at 452,000 instances per year by NHTSA. Also, this project is intended to improve risk management, expedite claims, decrease administrative costs, and give Insurers needed data to subrogate claims and recover expenses.
- **Government:** This project should help in promulgating and evaluating federal vehicle theft and odometer fraud standards, identifying problem injuries and mechanisms, stipulating injury criteria, and investigating defects. State and local officials should be able to obtain crash information on problem intersections and road lengths.

VI. CONCLUSION

In this paper keeping IoT concept as mandatory, vehicle monitoring is proposed. IoT is a fast-emerging technology, which allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. By monitoring the emissions data, engine health can easily be inspected and examined. Here we can also apply a core idea of “Green all over IoT” can be experienced which may also lead to advancement in the environment quality. The proposed circuit and algorithm of Vehicle Monitoring Systems gives satisfactory results. Data can be stored and retrieved as and when required. ‘IoT based Vehicle Monitoring System’, finds solution for vehicle safety and ease the work for automobile forensic studies by providing vital data.

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