Implementation of Real Time Vehicle Data Acquisition and Sending it as SMS and E-Mail Alerts During Emergency

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Abstract— **To improve the Vehicle features by collecting the Vehicle various parts information using CAN bus protocol and transmitting the collected data to the Cloud through IOT Gateway, so the vehicle data can be accessed from the server by the authorized people and the critical vehicle data can be sent as SMS Alert to the owner of the Vehicle during Emergency time only. Entire architecture of CAN Protocol, IOT and STM8 microcontroller is studied, Using the STM8 microcontroller the vehicle part data can be collected periodically or by the request from end user. The Analog pins of STM8 is connected with Sensors and configured with the message ID for the particular vehicle part data collection and the collected data will be in the form of CAN messages with message ID. The CAN messages would be converted to Human understandable format and these messages would be transmitted to IOT through with the data is uploaded to the Cloud. For the Implementation purpose, we have used the NS2 simulator where we create the different vehicle as nodes and collect the practical data as a file and is extracted from the vehicle node. The extracted file is being uploaded to cloud using Pycharm software and the critical data is sent as SMS and also as an email alert to the owner of the vehicle using Ubidots simulator.**

Keywords—CAN bus;Sensors;STM8; Internet of Thing; Cloud; Network Simulator2; NetBeans; Cloud Sim.

I. INTRODUCTION

A Controller Area Network (CAN) is generally suited to the many high-level industrial protocols emerging CAN and ISO-11898:2003 as their physical layer. Its cost, performance, and upgradeability provide for tremendous flexibility in system design. This report application presents an introduction to the fundamentals of CAN, operating principles, and the implementation of a basic CAN bus with TI's CAN transceivers and DSPs. The electrical layer requirements of a CAN bus are discussed along with the importance of the different features of a TI CAN transceiver[7]-[11].

A. CAN

The CAN bus was developed by BOSCH as a multi-master, message broadcast system that specifies a maximum signaling rate of 1 megabit per second (bps). Unlike a traditional network such as USB or Ethernet, CAN does not send large blocks of data point-to-point from node A to node B under the supervision of a central bus master. In a CAN network, many short messages like temperature or RPM are broadcast to the entire network, which provides for data consistency in every node of the system. Once CAN basics such as message format, message identifiers, and bit-wise arbitration -- a major benefit of the CAN signaling scheme are explained, a CAN bus implementation is examined, typical waveforms presented, and transceiver features examined [1].The Basic CAN architecture is shown in the

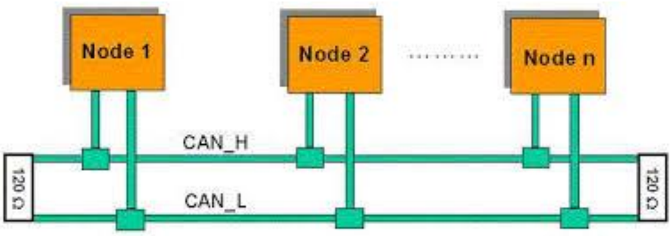

figure 1.

Fig. 1. CAN Bus with CAN Node.

B. IOT

The Internet of Things (IoT) is an important topic in technology industry, policy, and engineering circles and has become headline news in both the specialty press and the popular media. This technology is visible in a wide spectrum of network products, systems, and sensors, which take advantage of advancements in computing power, electronics devices, and network interconnections to offer new capabilities which was not previously possible. A Large number of conferences, reports, and news articles discuss and debate the prospective impact of the "IoT revolution"— to concerns about security, privacy, and technical interoperability from new market opportunities and business models[3].

The large-scale implementation of IoT devices promises to transform many aspects of the way we live. For consumers, new IoT products like Internet-enabled appliances, home automation components, and energy management devices are moving us toward a vision of the "smart home'', offering more security and energy efficiency. Other personal IoT devices like wearable fitness and health monitoring devices and network enabled medical devices are transforming the way healthcare services are delivered. This technology promises to be beneficial for people with disabilities and the elderly, enabling improved levels of independence and quality of life at a reasonable cost.[5].

C. Sensors

The detection in the changes of physical or electrical or other quantities for which the corresponding output is produced as an acknowledgement forming the definition of sensors. Output of sensor will be in form of optical and electrical signal. The different types of sensors are shown in figure 2.

There are different types of sensors which are most frequently used based on the classification of variety of quantities such as Thermal or Heat or Temperature sensors, Proximity sensors, Optical sensors, Position sensors, Chemical sensor, Environment sensor, Magnetic switch sensor , Electric current or Potential or Magnetic or Radio sensors, Humidity sensor, Fluid velocity or Flow sensors, Pressure sensors etc.[10]

Fig. 2. Different types of sensors.

D. STM8

STMicroelectronics (STM) are the manufacturers of STM8 microcontrollers which are 8-bit general purpose microcontrollers. STM is mainly famous for its 32-bit ARM microcontrollers Cortex – the STM32s. STM8 microcontrollers are discussed in that context very rarely. However, The robust feature of STM8 MCUs comes with lot of hardware feature packed into a microcontrollers. STM8s has many peripheral similarities with STM32s except for the ARM core, 32-bit architecture, performance and some minor differences. In my opinion, STM8s are sometimes equally matched more than the popular PICs and AVRs in different areas. In hole packages only a handful of STM8 chips are available in Plastic Dual-Inline Package (PDIP). I believe this is the main reason for which many small industries and hobbyists don't play with STM8s as much as with other 8-bit families. People setup their test projects in breadboards, PCB trials or strip-boards first, prototype and then for production will be developed. The basic STM8 code dumping diagram is shown in the figure3.

Fig. 3. STM8 Microcontroller

E. NS2

The network simulator 2 is discrete event packet level simulator. A very large number of application are covered in NS2 of different kind of protocols of different types of networks consisting of different network elements and models of traffic . The Networks behavior can be simulated using the network simulator package tools by creating network topologies, log events that happen under any load, analyze the events and network understanding. Well the main aim of our first experiment is to create and play the different vehicle nodes in simulator and to get acquainted with the simulated objects and understand the operations of network simulation and we also need to analyze the behavior of the simulation object using network simulation.[15]

II. BLOCK DIAGRAM

The various vehicle part are considered as CAN nodes and are connected each other with CAN bus, Different CAN nodes are connected with different sensors to collect the information and the collected information is transmitted over CAN bus to STM8 microcontroller. The information collected will be in the form of messages with the CAN message ID and those can be analyzed by the CAN Bus Analyzer. The coding would be done and dumped to STM8 microcontroller in such a way that every vehicle part(CAN node) information is coded with message ID, so we can analyze which vehicle's parts data that we are collecting. The collected messages would be converted to human understandable format and uploaded to the cloud server through IOT[12]-[13] gateway which is shown in Fig.4. The block diagram. Fig. 5. Shows the different vehicles are created as nodes in NS2 simulator and the real time parameters are given, Once we play the simulator the file can be extracted which contains the real time information of the vehicles, which is further uploaded to the cloud server by executing the Python code in the Pycharm simulator .

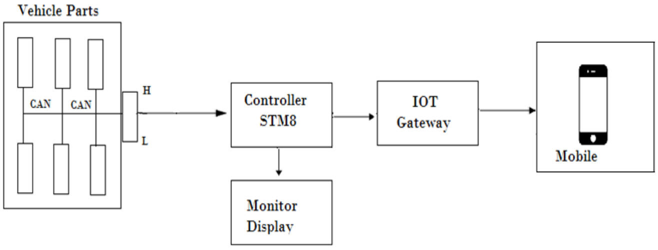

Fig. 4. Proposed Block Diagram.

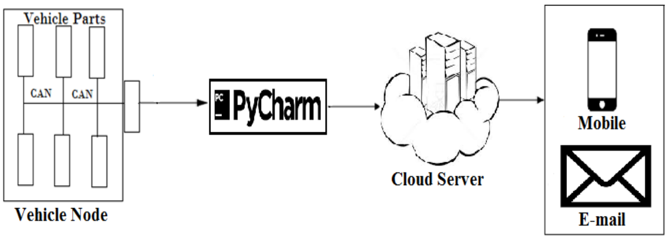

Fig. 5. Implementation Block Diagram.

III. RESULTS AND OUTCOMES

The Fig. 6 show the SMS Alert received message to the mobile phone for the vehicle ID9 and ID20 showing the critical petrol level. The critical information is received also as an email alert as shown in the Fig. 7 and Fig.8. The Uploaded data to the cloud can be monitored and analyzed through Ubidots tool as shown in the Fig.9 where the configuration where made for SMS and E-mail Alerts.

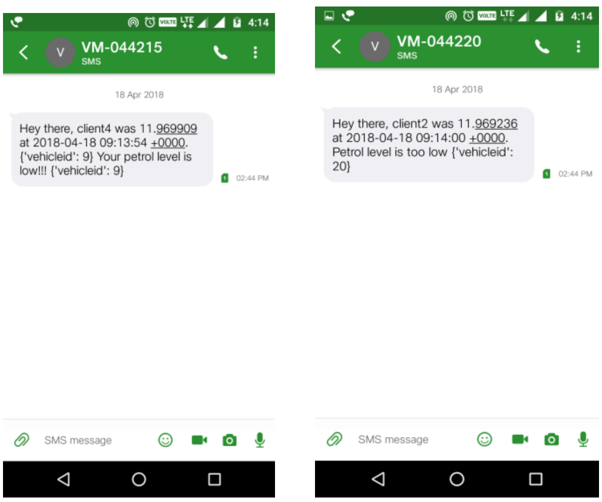

Fig. 6. SMS Alert for the Vehicle ID9 and ID20.

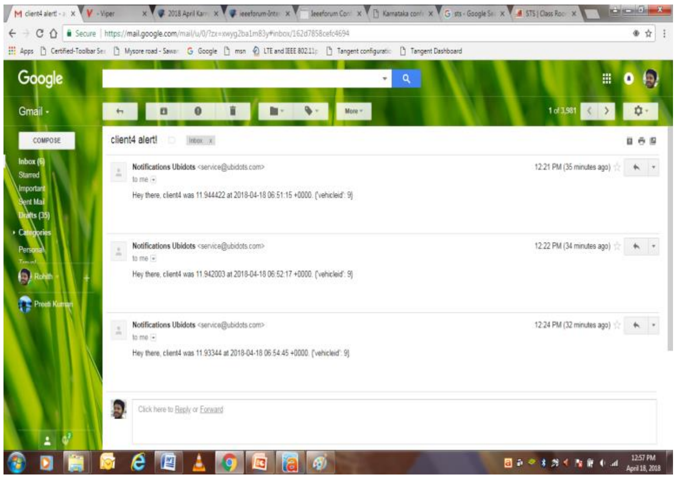

Fig. 7. E-mail Alert for the Vehicle ID9

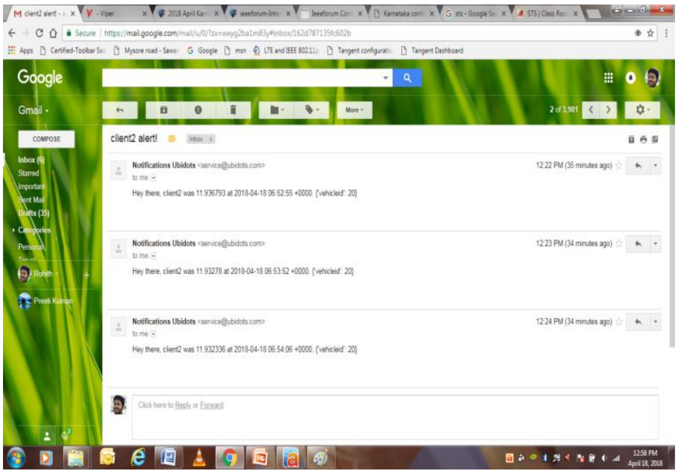

Fig. 8. E-mail Alert for the Vehicle ID20

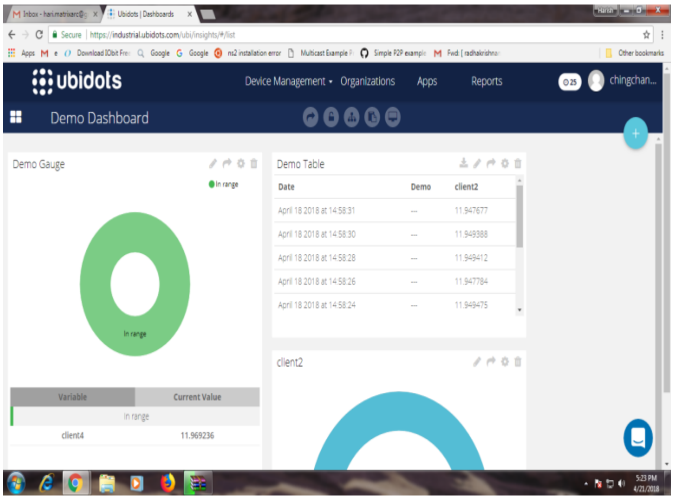

Fig. 9. Ubidots Dashboard demo tool.

The vehicle's data is analyzed with different vehicle IDs at different time which is as shown in the Table1. These values varies according to the conditions of different vehicles as per their critical condition. In the similar ways the different vehicle part data like room temperature, wiper data, Air level in the tyre, exhaust pollutants, mileage, engine condition, Oil level etc.. can be collected and analyzed using Ubidots Dashboard and sent an SMS and E–mail Alert to the owner of the vehicle.

TABLE I. PRACTICAL VALUES OF DIFFERENT VEHICLES

Vehicle ID	Petrol Remaining	Critical Message
ID9	11.969909	Your Petrol Level is Low!!
ID20	11.969236	Petrol Level is Low!!

IV. APPLICATIONS

The Main Application is to know your Vehicle condition better and take action accordingly to keep your vehicle safe and healthy condition. This can be used for different commercial application and it can be beneficial for Travels companies where they can track and monitor the condition of their different vehicles.

V. CONCLUSION AND FUTURE SCOPE

To improve the Vehicle features by collecting the Vehicle various parts information using CAN bus and transmitting the collected data to the Server through IOT Gateway, so the vehicle data can be accessed from the server by the authorized people. By using the CAN message protocol, we can reduce the wiring in the vehicle. CAN protocols and IOT are Lesser cost protocols. Using the STM8 microcontroller the vehicle part data can be collected periodically or by the request from end user. Using of Different sensors makes easy to collect various vehicle data. The CAN messages would be converted to Human understandable format and these messages would be transmitted to IOT through with the data is uploaded to the server. Making Some of the vehicle part to work automatically and know the current status of the different vehicle parts based on the data collected by CAN, these are some of the additional feature which can be incorporated in future.

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REFRENECES

[1] Zhufeng Li, Guangquan Yang, Xusheng Du and Xin Liu “Data Acquisition and Management of Remote Crane Monitoring System Based on CAN Bus” China Academy of Railway Sciences,China.

[2] A. A. Salunkhe, Pravin P Kamble, Rohit Jadhav “Design And Implementation of CAN bus Protocol for Monitoring Vehicle Parameters.” India.

[3] A. T. van Zanten, R. Erhardt, K. Landesfeind, and G. Pfaff "Uderstanding the Internet of Things (IoT) “, July 2014.

[4] Stankovic, John. "Research directions for the internet of things." Internet of Things Journal, IEEE, 2014, pp. 3-9.

[5] Karimi, Kaivan, and Gary Atkinson. "What the Internet of Things (IoT) needs to become a reality." White Paper, FreeScale and ARM 2013.

[6] Gubbi, Jayavardhana, et al. "Internet of Things (IoT): A vision, architectural elements, and future directions." Future Generation Computer SystemsVol. 29, No. 7, 2013, pp 1645-1660.

[7] Dogo, E. M. et al. "Development of Feedback Mechanism for Microcontroller Based SMS Electronic Strolling Message Display Board." 2014.

[8] Mayada Abdelgadir , Rashid Saeed and Abuagla Babiker “Vehicular Ad-hoc Networks (VANETs) Dynamic Performance Estimation Routing Model for City Scenarios” , 2015.

[9] Michael Reininger_, Seth Miller_, Yanyan Zhuang_y, Justin Cappos_ “A First Look at Vehicle Data Collection via Smartphone Sensors” University of British Columbia, 2013.

[10] Evjola Spaho, Leonard Barolli, Gjergji Mino, Fatos Xhafa and Vladi Kolici. “VANET Simulators: A Survey on Mobility and Routing Protocols”, 2013.

[11] Hamed Noori and Mikko Valkama “ Impact of VANET-Based V2X Communication using IEEE 802.11p on Reducing Vehicles Traveling Time in Realistic Large Scale Urban Area”, 2014.

[12] Nasser Torabi, Behrouz Shahgholi Ghahfarokhi “Implementation of the IEEE 802.11p/1609.4 DSRC/WAVE in NS-2”, 2012.

[13] Ibtihal Mouhib and Moulay Driss El Ouadghiri and Hassan Naanani “Network as a service for smart Vehicles”, 2012.