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Internet of Robotic Things Based Robotic Platform for Smoke and Gas Detector in Automobile

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Abstract: ***The prime source of the air pollution to arrive at an alarming condition is Automobiles.Automobiles generate enough emissions which is polltuing the atmosphere to a great level and the need of identifying the pollutant emissions has become a tedious task.In order to monitor the pollution emissions, Internet of Things (IoT) has been pioneered through this paper to keep a check on these harmful emanations which are directly effecting the environment.Through this paper a smart vehicle emission monitoring system using IoT is introduced which can literally track down the vehicles which are causing a real threat to the environment. A gas sensor comes in the limelight which can be used as a real-time air polluting monitoring system at any time and at any place.The monitoring data caputred is then shared with the vehicle owner through a text message and a copy of the same data is send to the national environmental agencies to have a better picture of the emission standards.The smart emission system effciently diagnose vehicle exhaust in real time and also perks up the level of diagnosing and the accurateness of the exhaust monitoring system.This system is considered to deliver its best in terms of monitoring air pollution in urban areas and provides a good upshot.***

Key words: Emission monitoring, gas sensor, Internet of things, Pollutants

I. INTRODUCTION

In the last few years, it has been seen increasing in the number of automobiles and as it has increased; the risk of traffic, pollution and most importantly accidents is also increasing. Pollution is a major probelm that we are facing today. It has been seen that many vehicles actually not in good condition are running on the streets causing safety hazard to both environment and health. IoT(Internet of things) is now playing a key role in avoiding these type of problems. Wireless computing and sensors using IoT are widely used for monitoring the automobile monitoring and pollution detection for obtaining the various pollution emitted by vehicles. By using this technology we can also monitor the engine temperature. We can use Arduino and can connect the sensors and furhur connect them with any android device to get the data saved in cloud automatically. This technology would prove as boom in future automobile.[1]

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Using an air pollution sensor, we can receive the date from a network using communication system based on IoTand can have the level of air pollutants coming from the source of air pollution of a stationary vehicle.[2] For detecting fire and smoke along with a parking lot sensor can also be added in the vehicle.

[3] For obtaining some results for the smoke testing, a new type of system that can control the emission from the exhaust of the vehicle is introduced. Using this type of system one can locate the evaporation leak and the size of evaporation system leak without any costly device, [4]

Because of this increase in air pollution, it has seen that some people has lost the normal ability of smell. This is olfactory impairment. This paper proposes an idea for detecting the detrimental gases like Methane, carbon dioxide, LPG and some other toxic air contaminants. The device can have an audio output which indicates and compare the threshold level. [5] This type of problems has lead to rhe development of Internet of Things (IoT) and Wireless Sensor Network (WSN) .Using very tiny sensor and the processing techniques and with the help of these systems, we can collect data and monitor the physical condition of any system. Location based service (LBS) are mostly used in localization. There are various localization scheme using IoT could be proposed in future.[6] This paper has proposed an idea for real time air pollution monitoring system and it can be used anywhere anytime. A real time operating system can sense the pollution from exhaust in real time. To prevent this type of issues, IoT is playing a key role in and is removing environmental barrier. It can be proved as a green thumb in tracking the vehicle which is becoming the main cause of this serious damage to environment and health. Excessive amount of air pollution has mostly been seen in urban areas.[7] The adverse effect of air pollution can clearly be seen on the environment and further leads to some serious damage on the environment i.e. depletion of ozone layer and causing acid rain. This has becomes a international issues that should be solved out as sson as possible and many scientists and engineers are working to develop the technologies wich can really help in preventing environment from these damages. This paper has proposed a method to calculate the level of air pollutants in environment using UV-1 sensor and along with a PH sensor simultaneously we can obtain the pH level of water that is how clean the water is. This data can be stored in the different working or administrator station.[8] Now a days, in emission testing sensor due to lack of quality of machines and sensors one can easily alter the values of emission to avoid the vehicle servicing which is going beyond the emission threshold. In today's emission testing station,

all the data has collected manually an is uses paper works which doesn't ensure the true condition of vehicle and to avoid that IoT based system can be used to avoid this variation of data and information. The certificate provided by this system can be considered as the authenticated one.[9] IoT can also be used for monitoring the level of CO2 emitted by the vehicles and it has been seen that CO2 is causing the major problems like global warming which is caused by green house gases too.

To prevent this environment from these problems these issues should be solved and to avoid this more effective control technologies has to be developed. A smart system can be implemented for monitoring the level of such harmful gases in environment. A Simple Notification Service (SNS) connected to mobile phone, which will give the information about pollutants having more level in particular areas [10].

II. HARDWARE AND SYSTEM DEVELOPMENT

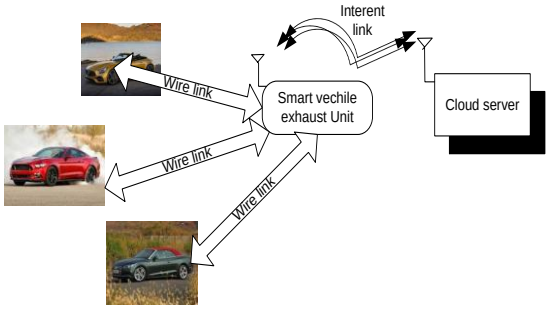

Fig1 Generalized Block Diagram

The above diagram in fig1 shows the smart vehicle exhaust system, which will be connected in the vehicle with, wired arrangement. Smart vehicle exhaust system can be able to monitor the pollutants level present in the exhaust gases emitted by the vehicles using some smoke detecting sensors. In this smart system we will be using controller Arduino Uno which will be further connected to some smoke detecting sensors like CO, CO2, temperature sensors and with the help of a display unit it will be able to display the data on to the car dashboard unit.

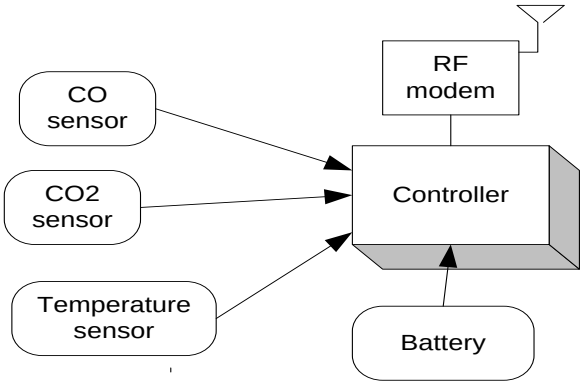

Fig2 Smart exhaust control unit [SECU]

Fig2 shows the smart exhaust Unit [SECU] attached with vehicle.The location of CO_2 rear (downstream) sensors are behind the catalytic converter.The rear oxygen sensors are held responsible to monitor the oxygen content of the exhaust gases which are making a way out from the catalytic converter. Carbo dioxide sensors works on the principles of NDIR. This is an industrial term called Nondispersive Infrared.An infrared (IR) lamp guides the waves of light using a tube filled with air towards an IR light detector, which is responsible to quantify the amount of IR light that strikes it.The harmful carbon monoxide (CO) gas emission is monitored through a carbon monoxide detector (CO detector). In most of the vehicles it has been observed that because of fault in the cooling systems, the vehicle get heated and it can seize the engine and can make you loose your pockets.Coolant temperature sensor (CTS) is normally located somewhere near the engine thermostat in most of the vehicles, thus agreeing to help function the CTS optimally.The sensor carries out it work by measuring the temperature recorded by the thermostat or the coolant itself. The temperature is then sent to the on-board electric control unit system also called the brain of the automobiles.

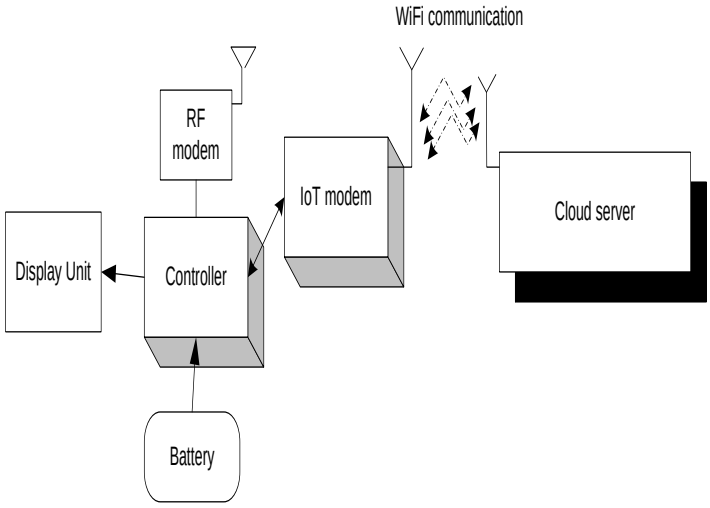

Fig3. Car Dashboard display unit with cloud server [CDDU&CS]

Fig3 shows the Car dashboard unit with cloud server [CDDU & CS]. Now comes the RF modem, it is able to send the data up to ten kilometers, along with IoT modem we can make it send the data to some specific administrator and can save that data on the cloud itself. The whole system will communicate through Wi-Fi communication system.

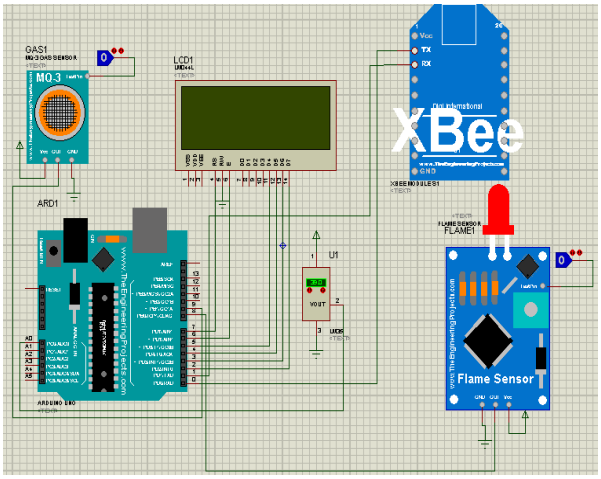

Fig4 Schematics of Smart exhaust control unit [SECU]

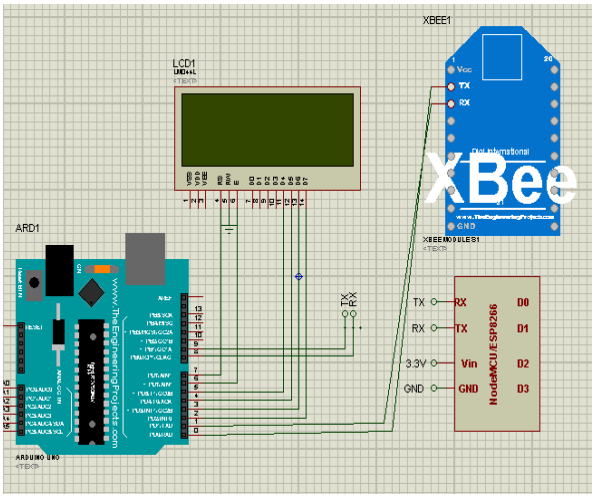

Fig5. Schematics of Car Dashboard display unit [CDDU]

The above circuit is describing how the Arduino Uno, LCD display and sensors will be connected and will make a whole smart gas detecting system which can be use in any vehicle depending on the emission and the pollutants present in the exhaust gases. Fig 4 and 5 shows the schematics of Smart exhaust control unit [SECU] and schematics of Car Dashboard display unit [CDDU]

III. SOFTWARE DEVELOPMENT

Fig6, Fig7 and Fig 8 depict the flow chart of information in SECU, CDDU and NodeMCU. The Wi-Fi Module (ESP8266) is self-reliant SOC which uses protocol like TCP/IP microcontroller provide, stack to access to Wi-Fi network. The wifi module is competent enough of hosting an application and offloading of Wi-Fi networking from another application processor.This wifi modyle is capable of interfacing and support external storage and interfacing of sensors. It consists of smd IC circuit which reduces the size of the circuit.

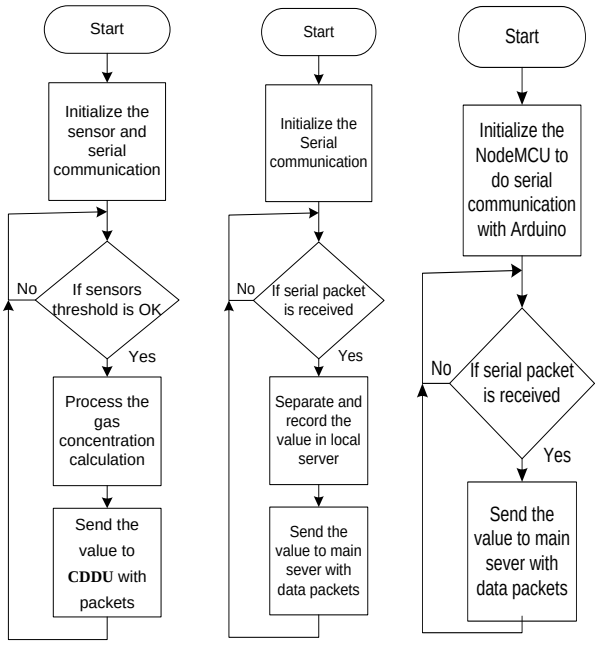

Fig6 Flow chart of SECU Fig7 Flow chart of CDDU
Fig8 Flow chart for NodeMCU

IV. IOT IMPLEMENTATION

Execution of various processes like sensing and /or actution, storing data, carrying out the analysis and hosting the application is done by a level 1 IoT system bearing a single node/device very efficiently.The system finds a great fit for modelling low cost intricate solutionswhere the data involved is small and the anlaysis requirements are not computationally exhaustive.Example is smoke detector where single node that allows records the smoke from remotely. Fig9 shows the IoT level implantation for smoke and gas detector.

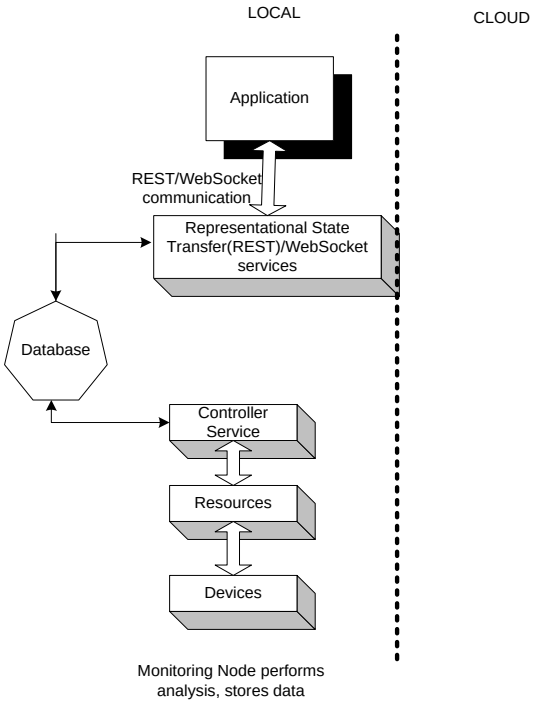

Fig9 IoT level implantation for smoke and gas detector

V. RESULT

NodeMCU embedded into a Cloud Server becomes the focal point in scrutinizing and controlling the harmful emissons like carbon dioxide from vehicles, industries and forest fire. CO_2 level is well diagnosed by the CO_2 sensor between the given interval of time.The data so sensed and collected is forwarded to the raspberry pi which is in loop with the sensors. Using Arduino IDE, the NodeMCU is able-bodied to send the monitored data to a secure server with connection protocol IPV6.The sequential table present in the predefined database stores all necessary information send and duly collected by the remote server.Thus maintaing the data in the database enables the user to verify and validate the history and also guides the user to look for the current atmospheric status. Devices such as smart phones, tablet, PCs and PDAs are found very handy in monitoring the carbon dioxide concentration data in real time thus providing the users an upper hand on having a close watch on the air quality.It is also heavily benficial as the check on CO2 emissions is closely monitored and controlled .

Fig10 Snapshot of Application developed in BLYNK APP

Fig 10 shows the application on Blynk APP, which shows the CO level, CO2 level and temperature value. The APP also shows the Button to control the robotic platform, which carries the smart exhaust control unit [SECU].

VI. CONCLUSION AND FUTURE SCOPE

The objective of paper to develop smart smoke monitoring system which is capable to reduce and detect the presence of harmful gas level and give the reading, it takes less time to monitor and analise data these data is further uploaded to cloud using iot,.this is smart technique to link any vechile this device is connected to exhaust of the vechile .By the use of this device we can analyse our vechile performance and we don't hoe to go for polluction checkup every time,we can see the detail of any vechile using internet of things.

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Dr. Rajesh Singh is currently associated with Lovely Professional University as Professor with more than fifteen years of experience in academics. He has been awarded as gold medalist in M.Tech and honors in his B.E. His area of expertise includes embedded systems, robotics, wireless sensor networks and Internet of Things. He has organized and conducted a number of workshops, summer internships and expert lectures for students as well as faculty. He has twenty three patents in his account. He has published around hundred research papers in referred journals/conferences.

Under his mentorship students have participated in national/international competitions including Texas competition in Delhi and Laureate award of excellence in robotics engineering in Spain. Twice in last four years he has been awarded with "certificate of appreciation" and "Best Researcher award- 2017" from University of Petroleum and Energy Studies for exemplary work. He got "certificate of appreciation" for mentoring the projects submitted to Texas Instruments Innovation challenge India design contest, from Texas Instruments, in 2015.He has been honored with young investigator award at the International Conference on Science and Information in 2012. He has published ten books in the area of Embedded Systems and Internet of Things with reputed publishers like CRC/Taylor & Francis, Narosa, GBS, IRP, NIPA and RI publication. He is editor to a special issue published by AISC book series, Springer with title "Intelligent Communication, Control and Devices"-2017 & 2018.

Dr. Anita Gehlot is associated with Lovely Professional University as Associate Professor with more than ten years of experience in academics. She has twenty patents in her account. She has published more than fifty research papers in referred journals and conference. She has organized a number of workshops, summer internships and expert lectures for students. She has been awarded with "certificate of appreciation" from University of Petroleum and Energy Studies for exemplary work. She has published ten books in the area of Embedded Systems and Internet of Things with reputed publishers like CRC/Taylor & Francis, Narosa, GBS, IRP, NIPA and RI publication. She is editor to a special issue published by AISC book series, Springer with title "Intelligent Communication, Control and Devices-2018".

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