Multiple Communicating Sensor Modules to achieve a Internet of Vehicles Network – A step towards Road Automation

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***Abstract*—** **Internet of Things is a bringing about a new revolution in today's world. This brings about a possibility to convert conventional Vehicle Ad-hoc Networks into the Internet of Vehicles (IoV). With the rapid development of computation and communication technologies, IoV promises huge commercial interest and research value, thereby attracting a large number of companies and researchers. Internet of Vehicles (IOV) comprises of Vehicle-to-Vehicle (V2V), Vehicle-to-Infrastructure(V2I) and some Intelligent Transport System (ITS) applications that require very low latency, much lower than is currently provided by existing communication networks. As time passes, all vehicles will be given the ability to connect to anything at anytime, from people to physical things, processes, contents, working knowledge, timely pertinent information and goods of all sorts in entirely flexible, reliable and secure ways This project proposes an abstract network model of the IoV, discusses the technologies required to create the IoV, the communications established in IoV, shows various applications of how IoT if extended to IoV and provides further research options.** [1]

Keywords*—*Road Automation; Internet of Vehicles(IoV); Arduino UNO R3; Internet Of Things (IoT)

I. INTRODUCTION

In the near future, the world is going to undergo drastic changes.

Homes are going to become smart homes. It knows what the occupant is doing and adjusts itself accordingly. It knows when we are on the way home from work and turns on the light, turns up the heat, turns on the oven and maybe even turns on music to lighten up the mood. It knows when the best times of day are to run the washer and clean the dishes; it knows to turn off the light when you leave a room and lock the doors when you leave the house.

Similarly, Cars are going to become smart cars. It knows who is driving and adjusts to the drivers heating/cooling preferences. It also knows when something is wrong or needs maintenance and schedules its own appointments with the repair shop.

Speaking of such an advance future, the underlying technology and methodology comes into question. It all depends on connecting things in an intelligent manner – which makes up for an abstract definition for The Internet of Things.

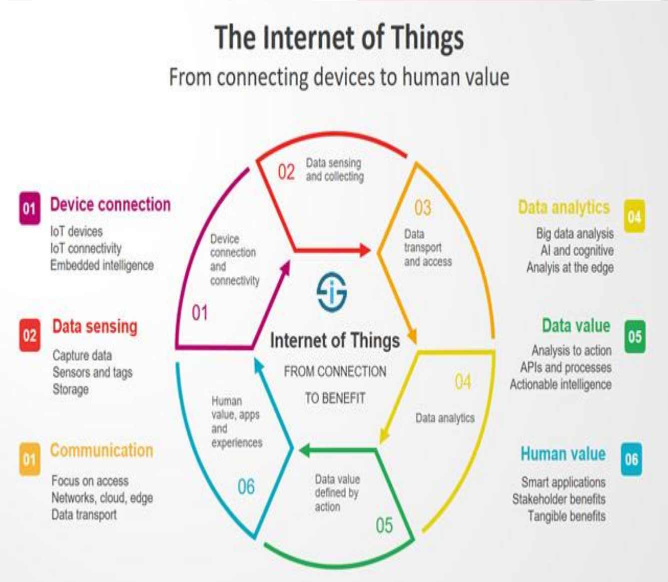

Fig 1. Internet of Things

The Internet has become a very common commodity in today's world. It's a global network that connects millions of computers, enabling electronic communication between those computers. More practically, when these computers are connected, the Internet connects together the users of these computers. Therefore, the Internet is a network of machines and also a network of people. All those machines connected together serve the diverse purpose of their human users. On the contrary, the Internet of Things, instead of connecting people, connects things forming large collective network of things. Once connected, everything can communicate with one another and serve a variety of useful purposes.

Most of the things connected to the IoT are actually simple devices that are often referred to as smart devices. The devices themselves are not necessarily smart in and of themselves, but become smart when joined together with other connected devices. In fact, upon first look, they don't appear to be much that's new a unique about the things connected to the Internet of Things. We have connected devices today. We have devices with embedded sensors today. We have devices that perform one or more discrete tasks today. So it’s not the devices or the sensors or the fact that they are linked together that makes the IoT so exciting.

Rather, it's the fact that once enough of these devices come together they create coherent system that can act with its own type of intelligence, without the need for human interpretation and interaction. It is all these relatively simple devices combined to create a single, giant machine that adds value to the idea of the Internet of Things.

In the IoT, every connected device becomes something greater than any given individual device by itself. The whole is greater than the sum of its parts, because everything is communicating with everything else in an intelligent, automated fashion. Any given device connects to the other surrounding and relevant devices to share collected data. This creates what experts call ambient intelligence, which results when multiple devices act in unison to carry out everyday activities and task using the information and intelligence embedded into the network. It all happens in the background, automatically, serving people's needs without requiring people's help on interaction.

II. INTERNET OF VEHICLES

Recalling the definition of Internet of Things (IoT), IoT is a concept which connects any number of smart things together over internet forming large collective network of things where huge amount of data is generated and can be shared between each other. Now when these things are confined particularly to Vehicles, it can be termed as Internet of Vehicles (IoV).

There is nothing the Internet cannot do, for it is a global phenomenon. With the advancement of internet, it is important that we use internet to its fullest ability, constructively. Considering IoV, internet can be put into great use which makes management of transportation a lot easier. Traffic management has become a primary issue in today's life and with the use of IoV, it is possible to monitor speed limits, pollution checks and immediate response to road accidents, thereby making it easier to manage and control traffic.

IoT has not only helped us evolve from conventional Vehicle Ad-hoc Networks (VANET) to Internet of Vehicles, but it also has brought in many advantages of IoV over Vanet. While in Vanet, only two types of communication can be achieved, namely V2V (Vehicle-to-Vehicle) and V2RSU (Vehicle-to-Roadside Unit), in IoV, it is possible to achieve more than the two that are mentioned above which will be briefly elaborated in the following sections to come. Simply put, IoV is a step towards Road Automation.

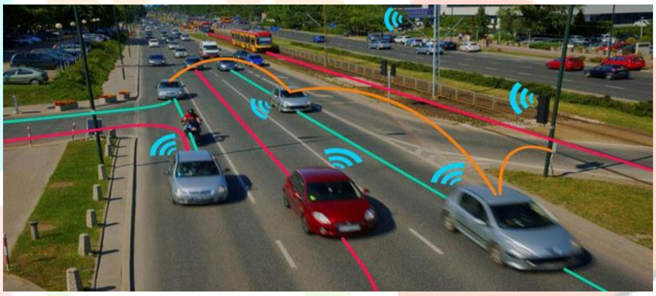

Fig 2. Internet of Vehicles

COMMUNICATIONS IN IoV

For the prospects of Internet of Vehicles (IoV) to be a reality, the vehicles need to be able to work and communicate seamlessly.

The following are the types of communication that can be achieved in Internet of Vehicles (IoV):

- Communication between the vehicles and the vehicle owners:
- Communication between vehicles
- Communication between vehicles and a centralized server
- Communication between server and third parties

Communications established in proposed system:

I. Communication between the vehicle and the vehicle owner

In our proposed system, we are trying to achieve two types of communication between the vehicle and the vehicle owner. First one is Alcohol detection and the second one is Smoke detection.

Driving under the influence of alcohol is one of the major reasons for road accidents, and this can be avoided using alcohol detection. Whenever the person who drives the vehicle is drunk, the vehicle’s engine would be locked automatically as soon as the alcohol content in the person’s body is detected and a message would be sent to the vehicle drive stating that he/she is drunk and cannot drive until he/she becomes sober. This is achieved by fitting an Alcohol detector in the vehicle’s steering wheel and as soon as the driver breathes, the alcohol detector would sense his breath and if it detects alcohol content in his breath, it would automatically lock the engine and will indicate the driver with a message.

The second type of communication between the vehicle and the vehicle owner is smoke detection. In this part of the system, whenever, the engine gets overheated and produces a smoke around the engine, the system would immediately sense the smoke using a smoke detector fitted near the engine and would indicate the owner of the vehicle with a message. The main purpose of this communication is to intimate the owner of the vehicle that the engine is about to wear out before it actually breaks down and stops running so that the owner will be able to take necessary measure immediately.

II. Communication between vehicles:

Most of the accidents occur due to lack of communication between the vehicles on the road and too many blind spots while driving. In order to avoid the road accidents that occur due to the above stated reasons, a type of communication between the vehicles can be achieved using a proximity detector. This proximity sensing detector will let the vehicle owner know whenever there is another vehicle approaching his/her vehicle beyond the allowed proximity range so that the owner could avoid any possible collision or accident.

III. Communication between vehicles and a centralized server:

The third type of communication in our proposed system is communication between vehicles and a centralized server. There may be hundreds and hundreds of cars that would skip the traffic signal every day and the traffic police will not be able to capture them all. In order to make it easier and to capture all of who have skipped the signal, a detection and capture of violation of traffic signal system is introduced. Here, in our system, whenever, a vehicle skips the traffic signal, the sensor would sense it and the number plate of the vehicle would be captured using a camera. All of the captured images will be sent to the police department so that they will be able to take necessary measures.

III. HARDWARE DESCRIPTION

Building the Internet of Things is a daunting process that presents both challenges and opportunities for those companies seeking to get into it. Experts envision three stages of development before the full potential of the IoT is realised; it's all about installing and connecting the devices , enabling two or more devices to work together for a joint purpose, and then creating application to analyse the connected data and initiate even more complex operations.

Stage 1: Device Proliferation and Connection

Because the foundation of the IoT is built on network of devices, it’s not surprising that the first stage in constructing the IoT is all about getting more devices out there. Networking devices such as sensors, processes, and smart hub. This can be free standing devices or smaller devices embedded into larger devices or systems.

The first stage is well underway. More and more consumer devices are connectable, from fitness trackers or televisions to thermostats. These devices connect wireless stick to the Internet, typically using Wi-Fi, and gain functionality from that connection. For that matter, smart phones and personal computers also function in this manner as devices, this adding to the size of the underlying network. There are various network technologies currently in place that can form the base of the necessary IoT connectivity. But there may be additional opportunities in the form of newer networking technologies - and, of course, somebody has to build, install, and connect all those billions of devices.

Stage 2: Making things work together

The second stage of development is where we get two or more of the so-called smart objects to work together for some greater purpose such as sharing data to automate some process. The data from one device is transmitted to a second device, which then makes some sort of decision and initiates a given operation.

This stage is about automating simple tasks and programming the necessary devices to do that. It’s not hyper intelligent; the device is perform operations entered into memory. It's Google type, algorithm driven decision making - If A then B, if C then D, and so forth.

Stage 3: Developing Intelligent Applications

Basic automation is like a decision tree: if the sensor says this, then do that ; if the sensor is that, then do this. If one wants to truly take advantage of the vast amounts of data collected from the IoT, there arises the need for applications that can act on larger, more complex, and often more obscure datasets. It's more than just tying together the behaviour of two simple objects; it's about creating sophisticated interrelationships that utilise and analyse additional data points.

In the third stage of IoT development, this simple sensor relationship will be augmented by other data. An application could then be developed that takes all this data (and more) and predicate exactly what operation should be performed and when. It’s not reactionary; it's predictive - and that's why the system gains intelligence.

As stated in the introduction, with this paper, we aim to establish multiple levels of communication on road to achieve the Internet of Things.

GROVE GAS SENSOR (MQ3 SENSOR) FOR ALCOHOL DETECTION

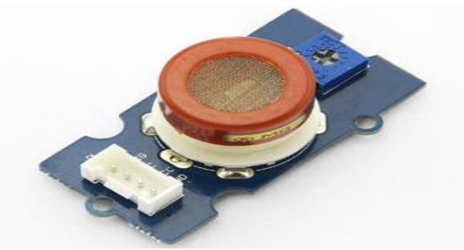

Fig 3. Grove Gas Sensor(MQ3 Sensor)

The Grove - Gas Sensor (MQ3) module is used for detection of gas leakage (in home and industry). It is suitable for detecting gasses like Alcohol, Benzine, CH4, Hexane, LPG, CO. Due to its good sensor sensitivity and response time, measurements can be made as they arrive. The sensitivity can be adjusted by using a potentiometer. [3]

GROVE GAS SENSOR (MQ2 SENSOR) FOR ENGINE OVERHEAT DETECTION

Fig 4. Grove Gas Sensor (MQ2 Sensor)

The MQ-2 Gas Sensor module detects gas leakage in home and industry. The MQ series of gas sensors use a small heater inside with an electrochemical sensor. They are sensitive to a range of gasses and are used indoors at room temperature. The output is an analog signal and can be read with an analog input of the Arduino.

Due to its fast response time and high sensitivity, measurements can be taken as soon as possible. The sensor sensitivity can be adjusted by using the potentiometer. [4]

The characteristics of the MQ2 sensor are as follows :

1. Wide detecting scope
2. High sensitivity and fast response
3. Long life and stable
4. Simple drive circuit

PASSIVE INFRARED SENSOR (PIR SENSOR) FOR TRAFFIC SIGNAL SKIPPING

Fig 5. Passive Infrared Sensor PIR Sensor)

A **passive infrared sensor** (**PIR sensor**) is an electronic sensor that measures infrared (IR) radiation being emitted from objects in its field of view. They are most often used in PIR-based motion detectors. All objects with a temperature above absolute zero emit heat energy in the form of radiation. Usually this radiation isn't visible to the human eye because it radiates at infrared wavelengths, but it can be detected by electronic devices designed for such a purpose. Hence, any motion that takes place around this sensor, will be sensed and detected. [5]

PROXIMITY SENSOR FOR DISTANCE CALCULATION AND COLLISION AVOIDANCE

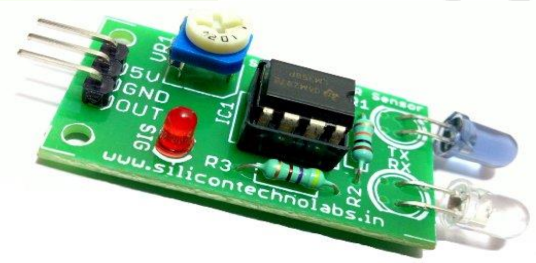

Fig 6. Proximity IR Sensor

A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal. The object being sensed is often referred to as the proximity sensor's target.[6]

IV. TECHNOLOGY USED

The base for the system is formed by the Arduino UNO R3 microcontroller. The **Arduino Uno R3** is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 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. [7]

The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. Revision 2 of the Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode.

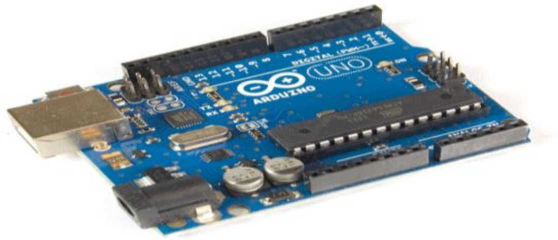

Fig 7. Arduino UNO R3

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 (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. 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 5V pin 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.

GROVE GAS SENSOR (MQ3 WORKING PRINCIPLE)

The core system is the cube. Basically, it is an Alumina tube cover by SnO_2, which is tin dioxide. And between them there is an Aurum electrode, the black one. And also you can see how the wires are connected. So, why do we need them? Basically, the alumina tube and the coils are the heating system, the yellow, brown parts and the coils in the picture.

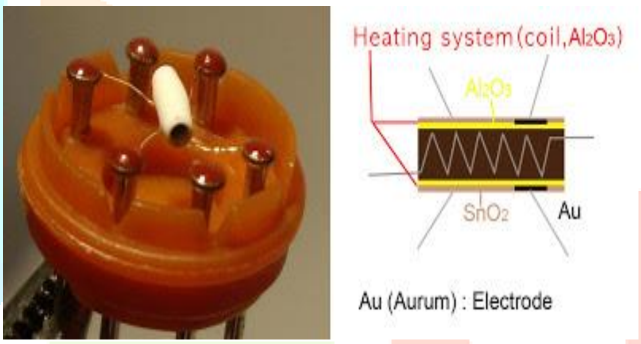

Fig 8. Grove Gas Sensor (MQ3 Internal Design)

If the coil is heated up, SnO_2 ceramics will become the semi - conductor, so there are more movable electrons, which means that it is ready to make more current flow. Then, when the alcohol molecules in the air meet the electrode that is between alumina and tin dioxide, ethanol burns into acetic acid then more current is produced. So the more alcohol molecules there are, the more current we will get. Because of this current change, we get the different values from the sensor. [9]

GROVE GAS SENSOR (MQ3 METHODOLOGY)

Drunken driving cases where drunk drivers crash their cars under the influence of alcohol causing damage to property and life have become alarmingly common. The proposed system would constantly monitor the driver breath by placing it on the driver wheel or somewhere the driver's breath can be constantly be monitored. So if a driver is drunk and tries to drive the system detects alcohol presence in his/her breath and locks the engine so that the vehicle fails to start. In another case if the driver is not drunk while he starts the vehicle and engine is started but he/she drinks while driving the sensor still detects alcohol in his breath and stops the engine so that the car would not accelerate any further and driver can steer it to roadside.

In this system we use an Arduino Uno R3 microcontroller interfaced with an alcohol sensor along with an LCD screen and a dc motor to demonstrate the concept. So here the alcohol sensor is used to monitor user's breath and constantly sends signals to the microcontroller. The microcontroller on encountering high alcohol signal from the alcohol sensor displays alcohol detection note on LCD screen and also stops the dc motor to demonstrate as engine locking. The system needs a push button to start the engine. If alcohol is detected at the time of starting the engine the engine does not start at all. If alcohol is detected after engine starting, the system locks the engine at that time.

Upon the detection of alcohol, an E-Mail is sent to the user's pre-set emergency contact requesting for help. This is achieved using a python program functionality that allows the system to directly connect to the internet.

GROVE GAS SENSOR (MQ2 WORKING PRINCIPLE)

The MQ2 has an electrochemical sensor, which changes its resistance for different concentrations of varied gasses. The sensor is connected in series with a variable resistor to form a voltage divider circuit, and the variable resistor is used to change sensitivity. When one of the above gaseous elements comes in contact with the sensor after heating, the sensor's resistance change. The change in the resistance changes the voltage across the sensor, and this voltage can be read by a microcontroller. The voltage value can be used to find the resistance of the sensor by knowing the reference voltage and the other resistor's resistance. [10]

The sensor has different sensitivity for different types of gasses. The sensitivity characteristic curve is shown below for the different type of gasses.

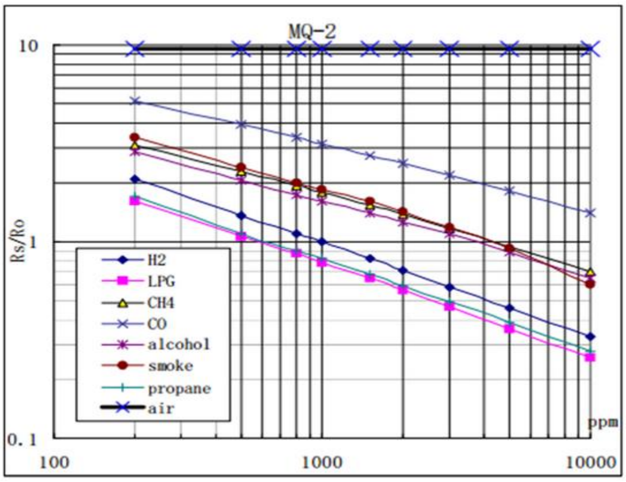

Fig 9. Sensor Sensitivity for Different Types of Gasses

Where,
1. Ro is the resistance of the sensor in clean air

2. Rs is the resistance of sensor when exposed to gasses

GROVE GAS SENSOR (MQ2 METHODOLOGY)

Break down of vehicles in the middle of the road contribute to traffic congestion and road accidents on a fair scale. Many such breakdowns are caused due to a prevailing engine problem that mostly results due to overheating. Such issues can be minimized if the engine is constantly monitored and the slightest malfunction is reported to the owner of the vehicle.

In this system we use an Arduino Uno R3 microcontroller interfaced with an smoke sensor along with an LCD screen and a dc motor to demonstrate the concept. So here the smoke sensor is used to monitor the engine health and constantly sends signals to the microcontroller. The microcontroller on encountering high smoke signals from the smoke sensor in case of an engine malfunction displays smoke detection note on LCD screen and also stops the dc motor to demonstrate engine locking. The system needs a push button to start the engine. If smoke is detected at the time of starting the engine the engine does not start at all. If smoke is detected after engine starting, the system locks the engine at that time.

Upon the detection of smoke, an E-Mail is sent to the vehicle service agency requesting for help. This is achieved using a python program functionality that allows the system to directly connect to the internet.

PIR SENSOR (WORKING PRINCIPLE)

An individual PIR sensor detects changes in the amount of infrared radiation impinging upon it, which varies depending on the temperature and surface characteristics of the objects in front of the sensor. When an object, such as a human, passes in front of the background, such as a wall, the temperature at that point in the sensor's field of view will rise from room temperature to body temperature, and then back again. The sensor converts the resulting change in the incoming infrared radiation into a change in the output voltage, and this triggers the detection. Objects of similar temperature but different surface characteristics may also have a different infrared emission pattern, and thus moving them with respect to the background may trigger the detector as well. [5]

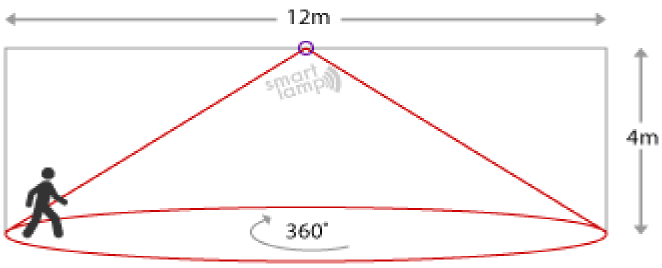

Fig 10. Approximate sensing range

PIR SENSOR (METHODOLOGY)

There may be hundreds and hundreds of cars that would skip the traffic signal every day and the traffic police will not be able to capture them all. In order to make it easier and to capture all of who have skipped the signal, a detection and capture of violation of traffic signal system is introduced, where the images of the number plate of the vehicles that skipped the signal will be sent to the police department where they can take necessary measures.

Here, in our system, we use a PIR sensor which will detect when a vehicle skips the red signal. The PIR sensor is interfaced with an Arduino UNO R3 microcontroller. Whenever there is a red signal, the PIR part of the system will be activated, and when a vehicle crosses the road, the PIR will sense the motion and it will immediately activate the camera part of the system and captures the vehicle. The camera is positioned in such a manner that it will focus and capture only the number plate of the vehicle. These captured images are then sent to a centralized server such a police department in our case.

PROXIMITY SENSOR (WORKING PRINCIPLE)

All objects which have a temperature greater than absolute zero (0 Kelvin) possess thermal energy and are sources of infrared radiation as a result. Sources of infrared radiation include blackbody radiators, tungsten lamps and silicon carbide. Infrared sensors typically use infrared lasers and LEDs with specific infrared wavelengths as sources

A transmission medium is required for infrared transmission, which can be comprised of either a vacuum, the atmosphere or an optical fibre. Optical components, such as optical lenses made from quartz, CaF_2, Ge and Si, polyethylene Fresnel lenses and Al or Au mirrors, are used to converge or focus the infrared radiation. In order to limit spectral response, band-pass filters can be used.

Next, infrared detectors are used in order to detect the radiation which has been focused. The output from the detector is usually very small and hence pre-amplifiers coupled with circuitry are required to further process the received signals. [11]

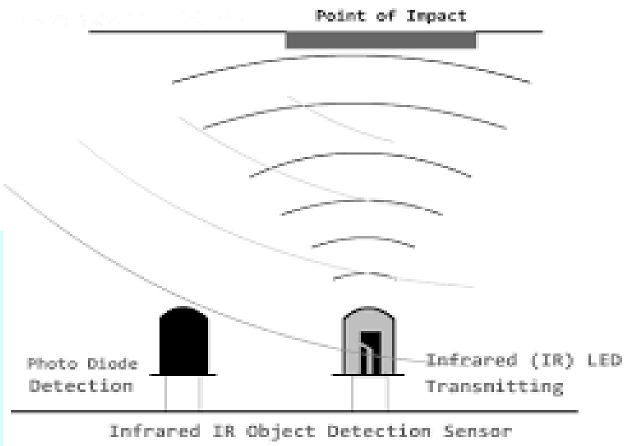

Fig 11. IR sensor sensing range

PROXIMITY SENSOR (METHODOLOGY)

Most of the accidents occur due to lack of communication between the vehicles on the road and too many blind spots while driving. In order to avoid the road accidents that occur due to the above stated reasons, a proximity sensor can be used to intimate the vehicle owner in order to avoid any possible collision or accident.

In this system, an Arduino UNO R3 microcontroller board is interfaced with the proximity sensor and a buzzer. Whenever another vehicle approaches your vehicle, the proximity sensor will sense it and if the approaching vehicle comes closer than the allowable range, the proximity sensor immediately triggers the buzzer, indicating the driver about the vehicle that is approaching so that he/she can be cautioned and made sure that any possible collision or accident can be avoided.

V. OUTPUT SAMPLES

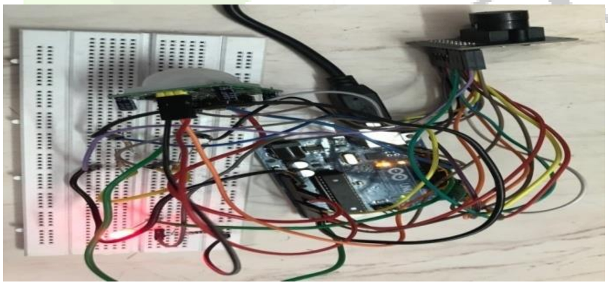

Fig 12. Detection and Capture of Traffic Signal Violation

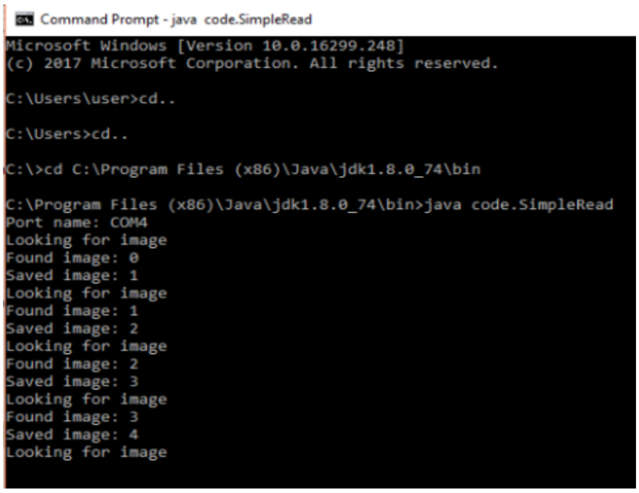

Fig 13. Detection and Capture of Traffic Signal Violation

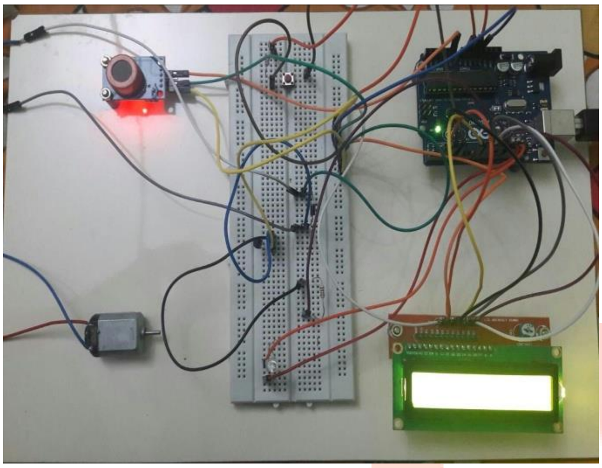

Fig 14. Alcohol Detection and Engine Control

Time	Timer	Alcohol Value
19:49:17	0.11	334
19:49:20	3.04	327
19:49:24	6.80	327
19:49:27	10.56	329
19:49:31	14.32	325
19:49:35	18.08	323
19:49:39	21.84	663
19:49:42	25.60	720
19:49:46	29.36	736
19:49:50	33.13	736
19:49:54	36.88	682
19:49:58	40.64	579
19:50:01	44.40	529
19:50:05	48.16	498
19:50:09	51.92	477
19:50:13	55.68	461
19:50:16	59.45	447
19:50:20	63.20	437
19:50:24	66.96	428
19:50:28	70.72	421
19:50:31	74.48	416
19:50:35	78.24	385
19:50:39	82.00	381
19:50:43	85.76	379
19:50:46	89.52	377

Fig 15. Simulation Sample Data for Alcohol Detection Sensor (Engine Locking System)

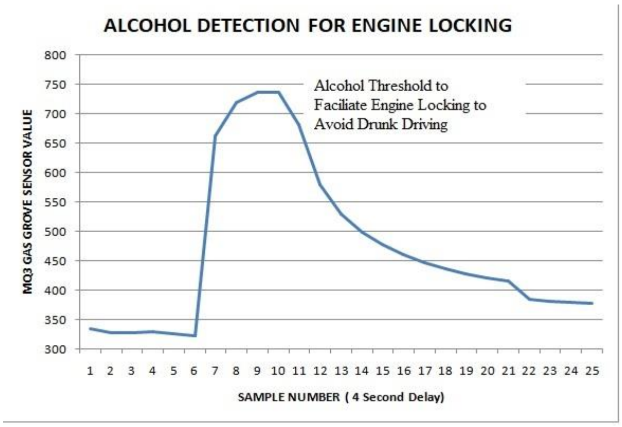

Fig 16. MQ3 Gas Grove Sensor Threshold

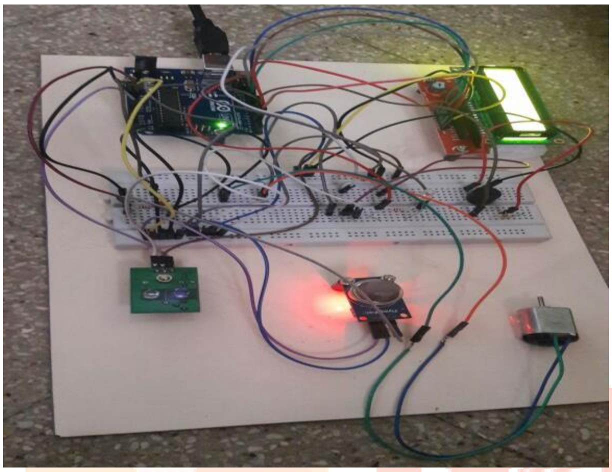

Fig 17. Proximity Sensing for Distance Calculation and Smoke Sensing for Engine Exhaust Check

Time	Timer	Smoke Value	Prox Value
19:49:17	0.11	117	32
19:49:20	3.04	141	69
19:49:24	6.80	139	69
19:49:27	10.56	139	68
19:49:31	14.32	139	68
19:49:35	18.08	138	69
19:49:39	21.84	138	69
19:49:42	25.60	213	69
19:49:46	29.36	211	69
19:49:50	33.13	234	68
19:49:54	36.88	180	617
19:49:58	40.64	140	68
19:50:01	44.40	138	69
19:50:05	48.16	138	69
19:50:09	51.92	138	69
19:50:13	55.68	138	618
19:50:16	59.45	140	69
19:50:20	63.20	138	69
19:50:24	66.96	138	69
19:50:28	70.72	138	69
19:50:31	74.48	137	69
19:50:35	78.24	137	69
19:50:39	82.00	137	69
19:50:43	85.76	137	69
19:50:46	89.52	137	69

Fig 18. Simulation Sample Data for Smoke Sensor (Engine Exhaust Check) and Proximity Sensor (Distance Calculation to Avoid Collision)

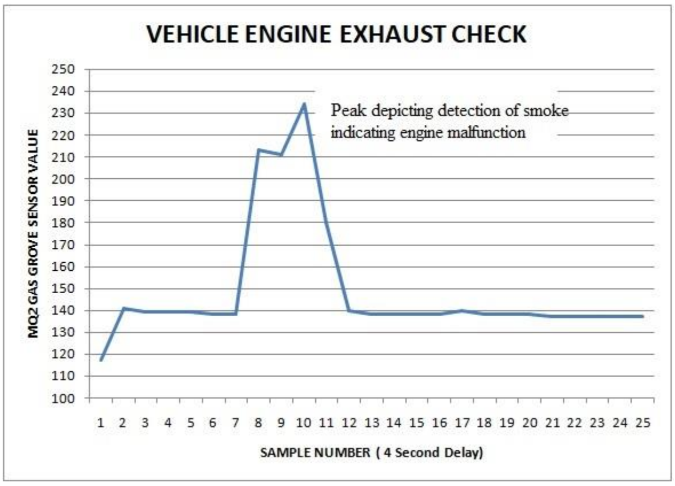

Fig 19. Vehicle Engine Exhaust Check Peak Threshold

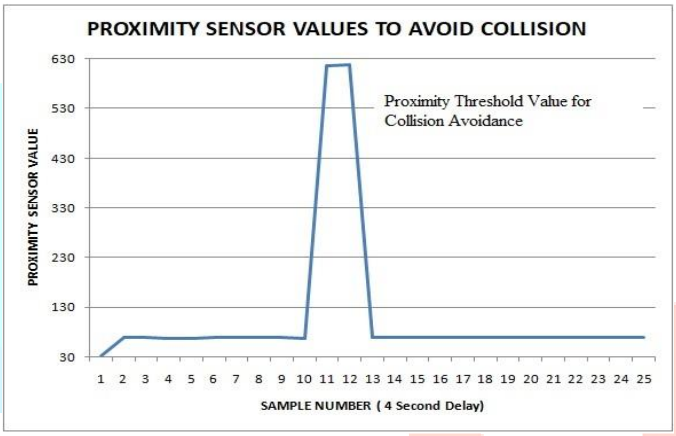

Fig 20. Proximity Sensor Threshold

VI. APPLICATION ALGORITHM

Proximity sensing applications requires the detection of small changes in capacitance (typically on the order of a few femtofarads) around the noise floor. There are many ways to process the data to determine whether a target was detected or not. This application procedure describes an algorithm that can be used for proximity sensing or capacitive touch button applications that does not require significant processing overhead.

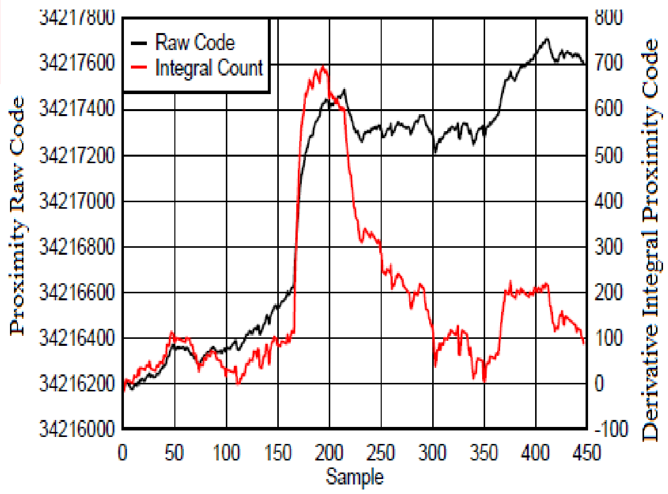

Fig 21. Graph comparing Proximity Sensing between Raw Proximity Code and Integral Code

DERIVATIVE INTEGRATION ALGORITHM

This algorithm tracks the rate of change or derivative (D[i]) between the current measurement (X[i]) and previous measurement (X[i-1]). Proximity sensing applications require the detection of small capacitance changes (on the order of fF). This requires the derivative threshold (DT) to be very low. As the derivative value passes the threshold, a variable that tracks the integral or sum of the derivative differences accumulate until it passes an integral threshold (IT). Once IT is reached, an object has been officially detected. Changes in capacitance due to noise can be a severe problem, especially if the DT is very low. The integral of the derivative (I[i]) can start to accumulate and falsely trigger as aa detection. Random noise should stabilize the integral value so that the mean is zero (no capacitance drift occurs), but a high integration threshold (IT) can allow enough noise margin for non-random noise. [12]

```
X[i-1] = X[0]
I[i-1] = 0

Loop1:
D[i] = X[i] - X[i-1]
Is (ABS(D[i]) greater than DT)?
        true:
                I[i] = I[i-1] + D[i]
        else:
                I[i] = I[i-1]
Is (I[i] ≥ IT)
        true:
                Object detected
                I[i-1] = I[i]
        else:
                Object not detected
                I[i-1] = I[i]*L
```

```
Parameters
IT = Integration threshold
DT = Derivative threshold
L = Leakage factor
X[i] = Current sample point
X[i-1] = Previous sample point
D[i] = Derivative
I[i] = Integral of derivative
I[i-1] = Previous integral of derivative
```

Fig 22. Pseudo Code for Derivative Integration Algorithm

VII. CONCLUSION

This paper identifies the potential advantages posed by the concept of Internet of Vehicles (loV) over the tradition Internet of Things (loT) in traffic and vehicle management. By facilitating communication between user and vehicle, the proposed system prevents various accidents, ensuring a safer atmosphere on road. This research is intended to suggest a much efficient way of traffic management and in making road travel better for everybody. This study can also be used in bringing up better architectures and strategies for road traffic management and to make an impact on the effectiveness of monitoring and emergency response to traffic incidents. Enabling internet in each and every vehicle on the road can pave way for complete automation of vehicles and traffic. The concept of Internet of Vehicles (loV) can be extended to all modes of transport making a significant difference in the way that communication occurs between different media of transport. The proposed system works in a cost and power efficient manner where the intended output is achieved at an optimal cost.

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