SIGNS WITH SMART CONNECTIVITY FOR BETTER ROAD SAFETY

1. INTRODUCTION

Traffic Signs or Road Signs are signs erected at the side of roads to provide information to road users. Pictorial signs are used as symbols in place of words. As control devices for traffic, signs need full attention, respect and adequate driver's response. There are three basic types of traffic signs. They are mandatory signs, cautionary signs, informative sign. Mandatory signs are signs that gives order. These are represented by red circle. Cautionary signs give warnings. Informative signs that give information signs. Road safety rules and traffic signals are the life saviour methods which should be adopted by each and every person while walking on the roads. These safety methods are designed to avoid accidents on the road and to reduce the risk of injury. Traffic signs give information about the road conditions ahead, provide instructions to be followed at major crossroads or junctions, warn or guide drivers, and ensure the proper functioning of road traffic. Being unaware of road signs is akin to throwing caution to the wind. It can lead to loss of life and property. A person is supposed to be familiar (get through a written or oral test) with the traffic signs and symbols before acquiring a driving license in India.

Road safety awareness is not just about preventing accidents, and it is also about avoiding the vehicle from becoming a weapon. When cars are designed with speed in mind, they are more likely to be involved in a crash, so careful driving is very essential. Ensuring everyone is safe on the road is important in keeping people’s lives safe from accidents. Driving is the standard way of transportation in today’s world. If someone injures themselves in a road accident, it can be the result

of not following the road safety measures. Hence, it is important to follow road safety rules and drive safe. One of the leading causes of car accidents is speeding. In 2018, society lost about $62 billion to speeding accidents. Speeding was the leading cause of his one-third of fatal car crashes in the last two decades. Speeding was responsible for 27% of all fatal crashes in 2017. To detect accidents involving cars, traffic authorities have started using speed radars installed on roads. A lot of money has been invested in speed cameras, but the problem is that they don't really control the speed of the car they detect. Despite the fact that all drivers are aware of the dangers of speeding, many continue to exceed the prescribed speed limit. Increased speed doubles the chance of accidents and the severity of injuries. Faster vehicles collide more often than slower ones, and the severity of collisions is greater for faster vehicles. As the speed increases, the danger increases. A vehicle moving at high speed requires a longer braking distance. Due to the laws of perception, a slow car will stop quickly, while a fast car will stop more slowly and have to slip more. High-speed vehicles cause more injuries due to their greater impact during collisions. Driving faster reduces your ability to anticipate future events, leading to poor judgment and ultimately accidents.

Fig 1.1 Road safety signs

Our project is made to meet the need to improve traffic efficiency and road safety. The goal of the project is to develop and build an autonomous road network, Signs improve traffic efficiency and safety. The most common highway crashes may be manage to avoid using smart road signs to control traffic. These collisions are caused by drivers who do not adapt their speeds to the weather and physical conditions of the road, as well as such as cornering in case emergency braking is absolutely necessary. Here we have used IOT to reduce the complications based on road platforms. Our idea is to get the signs of weather condition and to react according to it. The crashes are caused by the drivers because they are unable to change their limits according to the weather. We therefore have a strategy to deal with this issue. The weather signs are auto generated in the app. The weather can be viewed through the web application created using Node-Red service. The Iot devices are connected with IBM cloud to send and receive the data.

Traffic signs in India are like a guide on the road and thus, having good knowledge about them is a must for everyone especially the person driving the vehicle. Traffic signs in India are there to provide the necessary information to the driver about the road ahead and ensure there is no unnecessary disruption in traffic. All major junctions and roads need instructions and also information is needed about the road conditions, thus, making the traffic signs in India very important.

Traffic signs and road safety in India are a must know for everyone to make sure they are safe on roads and so are the people around them. Good knowledge and understanding of the road signs in India reduce the number of accidents that happen on the road. India has one of the highest numbers of road accidents in the world. For those who are not fluent with English, they can see the traffic signs and symbols in Hindi and understand for their safety.

2.LITERATURE SURVEY

Present breakers are design in semi circular or semi oval shape in upward direction but for power generation we are designing a breaker in downward direction with long cylinder shape steel bars with specific diameter. A breaker contain five steel bars (shaft) whose both side is joint with bears for providing relative motion to steel bar when vehicles passes over the circular shaft (steel bars) its tends to rotated on their axis of rotation due to friction between tires and circular shaft. Each shat (steel bars) is interconnected with connecting belt for maintaining rpm (rotation per minute) throughout the breakers. The depth depend on minimum base clearance of most used vehicles and the length is carried out by the size of tires of most used vehicles of that area with considering factor of safety, and the arrangement of shafts (steel bars) in a such way that design length and depth will appear automatically.

We identified areas with a large number of accidents of the same type in a small area within Districts 3 and 5. To do this, we used ArcGIS to map each crash resulting in a fatality between 2010 and 2015. With this information, we went over state maintained roads, or roads that the NMDOT has jurisdiction over, looking at the causes of each crash. The first step of our process was to limit the roads to those which had over 8000 average annual daily traffic (AADT). This was a basic way of filtering out low traffic, non-state maintained roads which tend to be smaller than roads that are within the state's jurisdiction. On the remaining roads we noticed irregular clusters of crashes. We then investigated each one of these clusters to see if they were potential hotspots by inspecting if there was a common theme regarding the causes of crashes. We would then determine how far apart these accidents were spaced. We chose 2.5 miles per crash to be the threshold for

determining hotspots because most of the locations with high concentrations of similar accidents fit within this range.

This means that each location had to have at least one crash every 2.5 miles to be considered a high crash frequency location. However, we also determined a stretch of I-40 to be a hotspot even though it did not fit this definition. I-40 Mile Marker 221-258 is influenced by large patterns of similar crashes and were pointed out to us by our liaison. One additional location, the intersection of Rio Grande and I-40, was selected to be a hotspot based on interviews with Nancy Perea. During the last few weeks of our project, we implemented a different method of hotspot identification which used the number of crashes divided by the amount of traffic recorded over the course of a day. This method displays smaller spots and tends to prioritize low traffic non state maintained roads. We did not use this method to identify the hotspots as we discovered it near the end of our project.

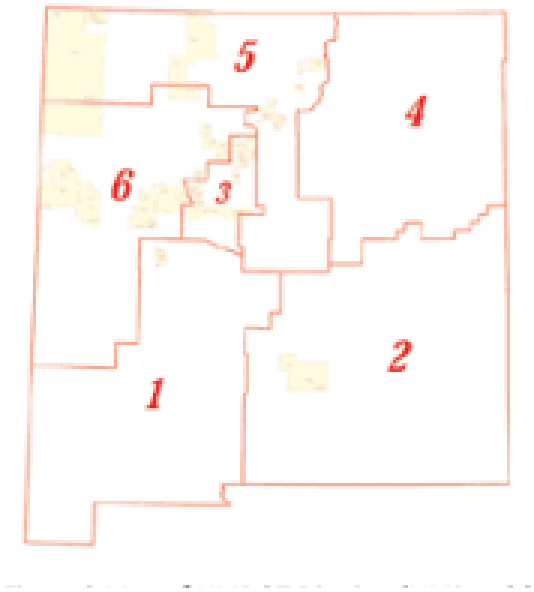

Fig 2.1 Hotspot identification

This system mainly consists of two parts: Hardware and software. Hardware design consists of sensors like infrared sensor, Arduino UNO and LED. infrared sensor uses +5V DC supply. Arduino UNO need a power supply of 6-12V Arduino

UNO Software design is done for sensing the vehicle or obstacle and to operate the LED by using Arduino 1.0.5 IDE tool which is open source software. Ha rdware design consists of IR sensor, Voltage Regulator, Supply, Arduino, LED Buzzer.

It uses two IR sensors, which are placed on either side of the turn. One sensor ir1 is installed by the side of the uphill section of the road, similarly one sensor ir2 is installed by the side of the downhill section of the road. The sensors are connected to ATmega328P microcontroller through wires. Based on the output of sensors, position of vehicles on either side of the bend is detected which is provided as an input to the microcontroller.IR sensor has pins +5V VCC, GND, IR emitter led and IR receiver led. IR sensor sends the signal in the form of pulses from emitter led. When this signal hit the object it will get reflected back and is received by the echo receiver led. From echo the signal is sent to microcontroller Arduino UNO. Microcontroller Arduino UNO processes this data and operates the LED which is connected to output pin of the microcontroller ArduinoUNO. LED is operated according to the command i.e. LED will glow if the signal is reflected back. In the absence of the object the signal will not reflect back. Hence the LED will not glow.

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. Control strategy includes the interference of Hardware and Software. The different colours of Led are being used on the both side of road as shown in fig. When the Vehicle is coming from A to B and No vehicle in coming from B to A then the same rule is used for vice versa. Considering the case when cars are coming from both the sides and Car coming

from side A has already entered/ crossed the line then the signal for the car coming from other side will become Red. In this fashion this project provides a better way to reduce the chances of accident. In addition, we can also include a buzzer in synchronism with the Led for improving the quality of output. Schematic diagram of Accident prevention system Condition SA SB Output 1# Red Red Stop 2# Red Green Vehicle on side A will stop 3# Green Red Vehicle onside B will stop 4# Green Green Empty Road IV. RESULTS It involves the physical setup of the model. There are two infrared sensors kept at a particular distance. The two sensors are used because the intention to show that vehicle is at safe distance means far from the curve but which ensures the vehicle is coming. This can be done by glowing the green LED light and when the vehicle approaches very near the curve then it will glow red LED light, by this one can alert at the other side ,which helps to avoid the accident.

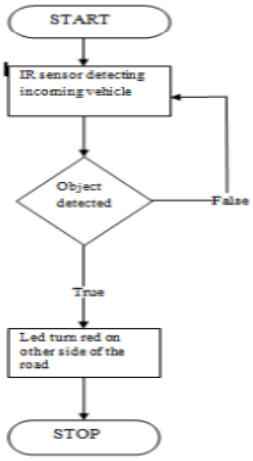

Fig 2.2 Flow diagram

With the rapid growth of modernization, there is a havoc rise of traffic, which increases congestion and leads to severe crashes and accidents, putting many lives

in danger. Approximately 1.35 million people lose their lives every year due to accidents, and around 50 million suffer from severe injuries. With India focussing on building smart cities, this is a major concern for India to find an effective solution. The best way to implement IoT and Machine Learning techniques and make a smart Road safety system that will analyze the physical parameters of vehicles and study the drivers' behavior that will efficiently reduce congestion, reduce the time of travel, and help prevent crashes. IoT and Machine Learning are both the most booming technologies of today. IoT describes communication between various physical objects, embedded with sensors,
software for analyzing and transmitting information between systems with the help of the internet. IoT makes it possible for users to collect and analyze data with minimum human intervention making the process cost-effective due to easily available sensors and efficiency. Devices and sensors are connected to an IoT Platform that integrates data and applies analytics to give the most valuable information. These IoT platforms make it easy to transmit useful pieces of information that can be used for detection and make recommendations for a particular problem. Another growing technology is Machine Learning, a branch of artificial and computer science that focuses on using data and algorithms the way humans learn with accuracy. Machine Learning uses data, various algorithms, and statistical methods to understand, recommend, classify and detect different situations with high accuracy. Thus, we can use these booming technologies to make a highly efficient and user-friendly road safety system. For example, as discussed in, to tackle the problem of traffic congestion leading to crashes and accidents due to the increase in population during the 2022 World Cup in Qatar, the naturalistic driver behavior is utilized to collect and analyze the data for traffic planning to maintain safety. An IoT-based solution is implemented, which collects vehicle data like - time of the trip, GPS location, maximum, minimum, and average speed to study the data and predict accidents and road infrastructure development to prevent crashes. The driver's behavior is also considered, including the driver's

drowsiness level. The describes the alarming situation in Road Safety due to Driver drowsiness. A framework and a deep learning-based application are implemented to check the drowsiness level of the driver to an accuracy of 82%.

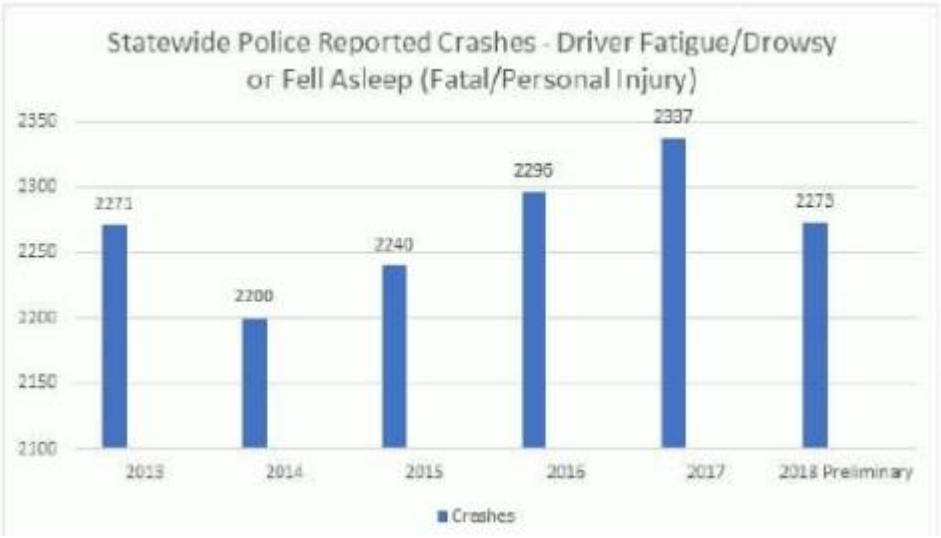

Fig 2.3 Accidents due to drowsiness

A cost-effective, novel IoT architecture is made with robust computational methods in assessing road safety. This safety system approach to road safety is now adopted worldwide. However, the considerations are made for the medium-to-long term. This work implements the approach for a short-to-medium-term dynamic assessment of road safety. In addition, the use of machine learning in the design of the computational core is show-cased by using an application of Hidden Markov Models. The proposed architecture is demonstrated through an application to safety-based route planning. Machine Learning also plays a vital role in predicting accidents. Prediction of the automotive accident severity is important for an intelligent traffic system. In some classification models like Logistic Regression, Artificial Neural network, Decision Tree, K-Nearest Neighbors, and Random Forest have been implemented to predict accident severity. A secure communication architecture model has been explained to exchange information among the devices, and a web-based alarm system is introduced that can alert the

user for any accident. However, these techniques require a wide range of land data as input, reducing to a low resolution and losing detail. So, to solve this problem, a solution as stated in has been proposed to use a high-resolution data framework and the application of IoT is the deep learning architecture of Convolution Neural Network (CNN). It is found that high resolution of data provides a result with more accuracy. Several solutions have been presented to solve the problemof tackling traffic congestion. One of these methods is to solve this problem through Artificial Neural Networks (ANN). odeling smart Road Traffic Congestion Control using Artificial Back Propagation Neural Networks (MSR2C-ABPNN) is proposed with the help of ANN for road traffic regulation and control. The proposed MSR2C-ABPNN based model predicts the point of congestion using neural network and backpropagation algorithm. It is further divided into two sub-layers The first layer, i.e., prediction layer, backpropagation, is used to detect the occupancy. In contrast, the second layer, i.e., the performance layer, evaluates the prediction layer performance in terms of RMSE, Accuracy, and Miss Rate. Tab-1 from shows the statistics of law-breakers in two-wheelers and four-wheelers which is a major reason behind accidents. In, smart accident prevention and detection is proposed using V2V communication technologies, Raspberry Pi, various sensors, MEC architecture, etc. for the prevention of two-wheeler accidents. This system detects accidents by vibration sensors, accelerometers. For detection, the GPS and GSM modules locate the accident site and correspondingly inform the person's nearest ones and nearby hospitals through a text message. The system also requires the person that will be riding the bike to have a valid driving license using the already embedded RFID on the driving license. The RFID reader on the bike will have at most ten registered users, hence handling theft-related issues. The system is efficient in terms of both the parameters and performance.

Law breakers	Two-wheelers	Four-wheelers
Signal jump	2,20,859	1,46,945
Drunken drive	36,727	17,237

Table 2.1 Statics table

Furthermore, to prevent accidents, an alerting system has been set up as proposed. The prototype is designed using Raspberry Pi, Pi Camera, sensors for monitoring driver's eye movements, detecting yawning, detecting toxic gases, and alcohol consumption to prevent accidents and to provide safety assistance to the drivers. Thereafter the Internet of Things (IoT) and Machine Learning (ML) enabled system is implemented in vehicles for transmitting the behavior of the driver and his driving pattern to the cloud to take quick response under emergencies. Cloud services and machine learning are employed in identifying the fatigue of the drivers through the collected dataset. Various Machine Learning and IoT based algorithms work simultaneously to smoothly execute all the different prevention methods. The general architecture model is also shown below in the image. The device is experimentally tested, and the results show its efficiency and effectiveness. A model was proposed to incorporate ITS context incorporating speed and pollution adaptive traffic control systems with weather advisories. The Scalable Enhanced Road Side Unit (SERSU) was developed for use as part of a comprehensive Intelligent Transportation System based on the Internet of Things (IoT) concept. It collects information using a variety of sensors and an onboard camera. The collected data can then be uploaded to a central server for speed limit adjustment, metering routes to reduce vehicle congestion and emissions, and issuing weather advisory warnings. Wireless cellular networks and RF modules are used for communication with all the devices. To prevent accidents on the road, Smart IoT cars are proposed in which we can control distinctive things or keep track of a vehicle for security, solace, and proficiency. Technologies such as ease liquor sensor, safety belt consisting of an inbuilt heartbeat sensor, and edge restrict are designed to prevent mishaps from occurring. All controls are accessible in auto

proprietors' dashboard accessible both in auto and in a versatile application. Another prominent factor that contributes to fatal accidents is the behavior of drivers. Often due to driver drowsiness or drunken driving, major accidents are caused, which contributes to a large number of deaths. So it is of grave importance to solve this problem. With the help of the Q-135 sensor , alcohol can be detected from the air, so whether the driver is drunk or not can be checked. The sensor sends the signal to ARM-7. If the driver is drunk, then vehicle ignition will not start until the driver is not changed. In case the car is already in driving condition, then the system alerts the driver using a buzzer. Another human behavior that contributes to road accidents is microsleep. This is due to the current trend of life like heavy workloads, long working hours, excess consumption of caffeine, and many others causing massive fatal accidents. The creation of SMART Vehicles in the IoT increases the technology capabilities in reducing the number of crashes on the roads. An integration with Artificial Intelligent (AI) can be used to detect microsleep. While the image processing can see the face changes from normal to microsleep symptoms by tracking the eye degree, the head motion, and the mouth yawning. Another critical aspect leading to road accidents is low visibility. It can also be caused by other accidents, work-in-progress on roads, excessive motorized vehicles, especially at peak times, and so on. Fixed traffic sensors are installed on roads that interact with drivers' mobile apps through the 4G network to solve this problem. This, however is not feasible on all roads. To make it work for non-highway roads, mobile traffic sensors can be installed in private and public transportation and volunteer vehicles. An IoT Cloud system based on OpenGTS and MongoDB is proposed to solve this problem and assist critical rescue vehicles such as ambulances, etc. It is also shown below in run on this application show-case that this system shows the acceptable response time to be sent to drivers to mitigate this problem by avoiding accidents.

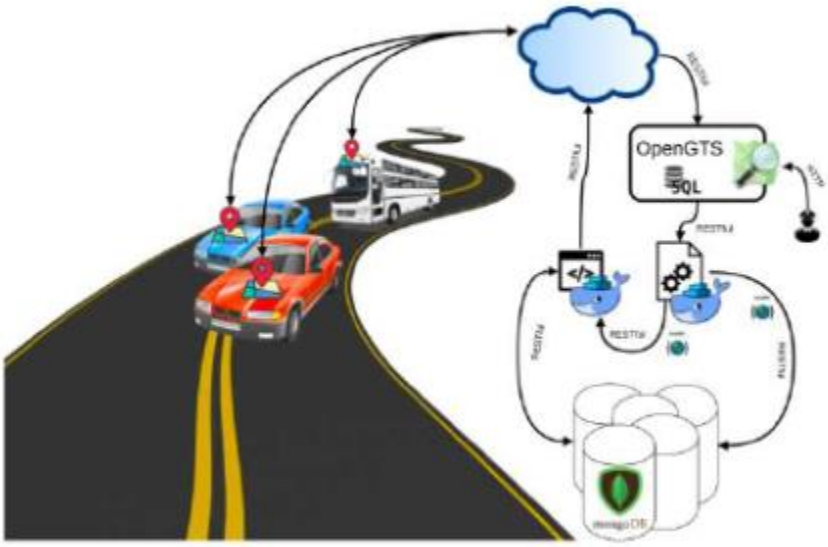

Fig 2.4 Iot cloud system

3.PROJECT DESCRIPTION

3.1 IOT DEVICES:

Fig 3.1 Iot device

The introduction of IoT (Internet of Things) establishes the platform for the world to showcase hi-tech machine-to-machine interaction ranging from connected cars to smart cities to weather monitoring systems and smart homes. The IoT revolution is transforming the way humans interact with machines. This system uses **NodeMCU ESP8266** which is connected with Open weather map and fetches data from it. NodeMCU is an open-source Lua based firmware and development board specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espress +if Systems, and hardware which is based on the ESP-12 module.

NodeMCU ESP8266 Specifications & Features

- Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106
- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1

- UARTs: 1
- SPIs: 1
- I2Cs: 1
- Flash Memory: 4 MB
- SRAM: 64 KB
- Clock Speed: 80 MHz
- USB-TTL based on CP2102 is included onboard, Enabling Plug n Play
- PCB Antenna
- Small Sized module to fit smartly inside your IoT projects

3.2 PIN DIAGRAM:

The pin diagram of the NODEMCU ESP8266 is shown below. It consists of 30 pins.

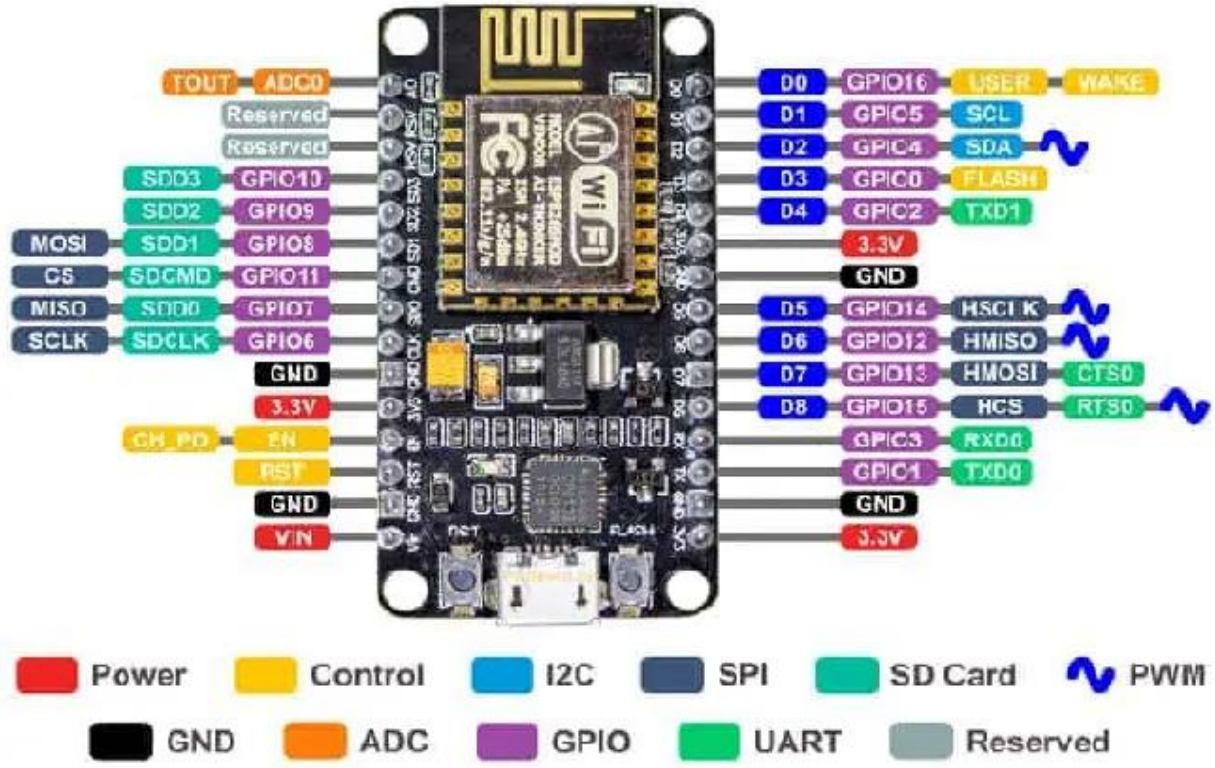

Fig 3.2 Pin Diagram

There are four power pins. **VIN** pin and three **3.3V** pins.

- **VIN** can be used to directly supply the NodeMCU/ESP8266 and its peripherals. Power delivered on **VIN** is regulated through the onboard regulator on the NodeMCU module – you can also supply 5V regulated to the **VIN** pin
- **3.3V** pins are the output of the onboard voltage regulator and can be used to supply power to external components.

1. GND → are the ground pins of NodeMCU/ESP8266.
2. I2C PINS → are used to connect I2C sensors and peripherals. Both I2C Master and I2C Slave are supported. I2C interface functionality can be realized programmatically, and the clock frequency is 100 kHz at a maximum. It should be noted that I2C clock frequency should be higher than the slowest clock frequency of the slave device.
3. GPIO PINS → NodeMCU/ESP8266 has 17 GPIO pins which can be assigned to functions such as I2C, I2S, UART, PWM, IR Remote Control, LED Light and Button programmatically. Each digital enabled GPIO can be configured to internal pull-up or pull-down, or set to high impedance. When configured as an input, it can also be set to edge-trigger or level-trigger to generate CPU interrupts
4. ADC Channel→ The NodeMCU is embedded with a 10-bit precision SAR ADC. The two functions can be implemented using ADC. Testing power supply voltage of VDD3P3 pin and testing input voltage of TOUT pin. However, they cannot be implemented at the same time.
5. UART Pins→ NodeMCU/ESP8266 has 2 UART interfaces (UART0 and UART1) which provide asynchronous communication (RS232 and RS485), and can communicate at up to 4.5 Mbps. UART0 (TXD0, RXD0, RST0 &

CTS0 pins) can be used for communication. However, UART1 (TXD1 pin) features only data transmit signal so, it is usually used for printing log.

6. SPI Pins→NodeMCU/ESP8266 features two SPIs (SPI and HSPI) in slave and master modes. These SPIs also support the following general-purpose SPI features:
    a. 4 timing modes of the SPI format transfer
    b. Up to 80 MHz and the divided clocks of 80 MHz
    c. Up to 64-Byte FIFO
7. SDIO Pins→ NodeMCU/ESP8266 features Secure Digital Input/Output Interface (SDIO) which is used to directly interface SD cards. 4-bit 25 MHz SDIO v1.1 and 4-bit 50 MHz SDIO v2.0 are supported.
8. PWM Pins→ The board has 4 channels of Pulse Width Modulation (PWM). The PWM output can be implemented programmatically and used for driving digital motors and LEDs. PWM frequency range is adjustable from 1000 μs to 10000 μs (100 Hz and 1 kHz). Control Pins are used to control the NodeMCU/ESP8266. These pins include Chip Enable pin (EN), Reset pin (RST) and WAKE pin.
    a. **EN:** The ESP8266 chip is enabled when EN pin is pulled HIGH. When pulled LOW the chip works at minimum power.
    b. **RST:** RST pin is used to reset the ESP8266 chip.
    c. **WAKE:** Wake pin is used to wake the chip from deep-sleep

POWER SUPPLY :

NodeMCU ESP8266 operates at **5V & 3.3V**. It has an onboard **LDO voltage regulator** to keep the voltage steady at 3.3V. We can power NodeMCU using a Micro USB jack as well as a VIN pin (**External Power Supply Pin**). The NodeMCU requires **600mA** power, as ESP8266 pulls around **80mA** during RF

transmission. For boot and Wi-Fi operation, it draws up to **200mA** peak current. Thus supply power from Micro-USB Cable is not enough for NodeMCU Board when we are adding multiple sensors or modules to the Board. Basically, a Computer USB port can provide around **500mA** of current.

OPEN WEATHER MAP:

OpenWeatherMap is an online service, owned by OpenWeather Ltd, that provides global weather data via API, including current weather data, forecasts, nowcasts and historical weather data for any geographical location. The company provides a minute-by-minute hyperlocal precipitation forecast for any location. The convolutional machine learning model is used to utilise meteorological broadcast services and data from airport weather stations, on-ground radar stations, weather satellites, remote sensing satellites, METAR and automated weather stations.

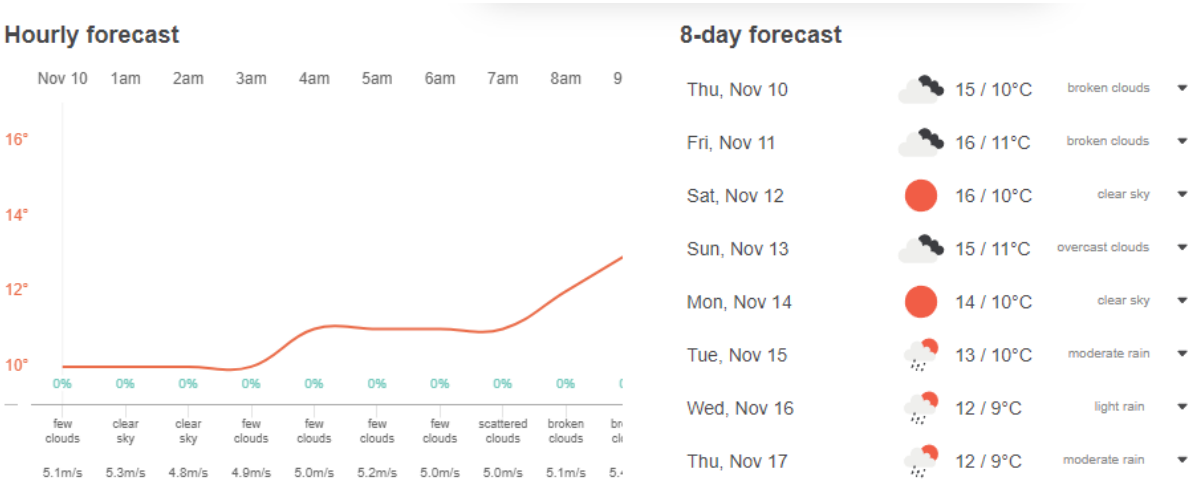

Fig 3.3 Forecast graph

IBM WATSON IOT PLATFORM :

Watson was created as a question answering (QA) computing system that IBM built to apply advanced natural language processing, information retrieval, knowledge representation, automated reasoning, and machine learning technologies to the field of open domain question answering. In recent years, Watson's capabilities have been extended and the way in which Watson works has been changed to take advantage of new deployment models (Watson on IBM Cloud), evolved machine learning capabilities, and optimized hardware available to developers and researchers. It is no longer purely a question answering (QA) computing system designed from Q&A pairs but can now 'see', 'hear', 'read', 'talk', 'taste', 'interpret', 'learn' and 'recommend'.

Software:

Watson uses IBM's software and the Apache UIMA (Unstructured Information Management Architecture) framework implementation. The system was written in various languages, including Java, C++, and Prolog, and runs on the SUSE Linux Enterprise Server 11 operating system using the Apache Hadoop framework to provide distributed computing.

Hardware:

The system is workload-optimized, integrating massively parallel processors and built on IBM's technology, which it uses to generate hypotheses, gather massive evidence, and analyze data. Watson employs a cluster of ninety IBM Power 750 servers, each of which uses a 3.5 GHz eight-core processor, with four threads per core. In total, the system has 2,880 processor threads and 16 terabytes of RAM.

According to John Rennie, Watson can process 500 gigabytes (the equivalent of a million books) per second. IBM master inventor and senior

consultant Tony Pearson estimated Watson's hardware cost at about three million dollars. Its Linpack performance stands at 80 TeraFLOPs, which is about half as fast as the cut-off line for the Top 500 Supercomputers list. According to Rennie, all content was stored in Watson's RAM for the Jeopardy game because data stored on hard drives would be too slow to compete with human Jeopardy champions.

Data:

The sources of information for Watson include encyclopedias, dictionaries, thesauri, newswire articles and literary works.Taxonomies and ontologies including DBPedia, WordNet and Yago The IBM team provided Watson with millions of documents, including dictionaries, encyclopedias and other reference material, that it could use to build its knowledge.

OPERATION:

Watson parses questions into different keywords and sentence fragments in order to find statistically related phrases. Watson's main innovation was not in the creation of a new algorithm for this operation but rather its ability to quickly execute hundreds of proven language analysis algorithms simultaneously. The more algorithms that find the same answer independently, the more likely Watson is to be correct. Once Watson has a small number of potential solutions, it is able to check against its database to ascertain whether the solution makes sense or not

NODE RED :

Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways. It provides a browser-based editor that makes it easy to wire together flows using the wide range of nodes in the palette that can be deployed to its runtime in a single-click.

Node-RED provides a browser-based flow editor that makes it easy to wire together flows using the wide range of nodes in the palette. Flows can be then deployed to the runtime in a single-click. JavaScript functions can be created within the editor using a rich text editor. A built-in library allows you to save useful functions, templates or flows for re-use. The light-weight runtime is built on Node.js, taking full advantage of its event-driven, non-blocking model. This makes it ideal to run at the edge of the network on low-cost hardware such as the Raspberry Pi as well as in the cloud.

With over 225,000 modules in Node's package repository, it is easy to extend the range of palette nodes to add new capabilities. The flows created in Node-RED are stored using JSON which can be easily imported and exported for sharing with others.

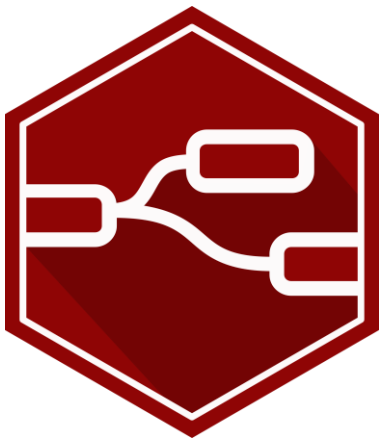

Fig 3.4 Node red

NODE RED IN IBM CLOUD :

Node-RED is available on the IBM Cloud platform as one of the Starter Kits applications in the catalog. We also provide a 'Deploy To IBM Cloud' enabled repository

Starter Kit application :

1. Log in or sign-up for an account at cloud.ibm.com
2. Navigate to the catalog and search for 'Node-RED'. This will present you with the **Node-RED Starter**. This gives you a Node-RED instance running as a Cloud Foundry application. It also provides a Cloudant database instance and a collection of nodes that make it easy to access various IBM Cloud services.
3. Click the starter application you want to use, give it a name and click create. A couple of minutes later, you'll be able to access your instance of Node-RED.

Through programming, we make machines imitate complex behavior by following sequences of simple instructions. Using textual programming languages such as Assembly, C, Python, and JavaScript is one of the primary way of doing this. Designers of these programming languages have spent countless hours trying to make the experience of writing programs as easy as possible through expressive syntax, robust programming constructs, and powerful toolchains. However, all of these programming languages share a common trait: textual source code. Writing programs in text works, and in most cases it works well. However, the ability to express programs visually is often desirable. Being able to design the flow of information through various components of a larger system is often all that is needed.

3.3 IOT CLOUD PLATFORMS:

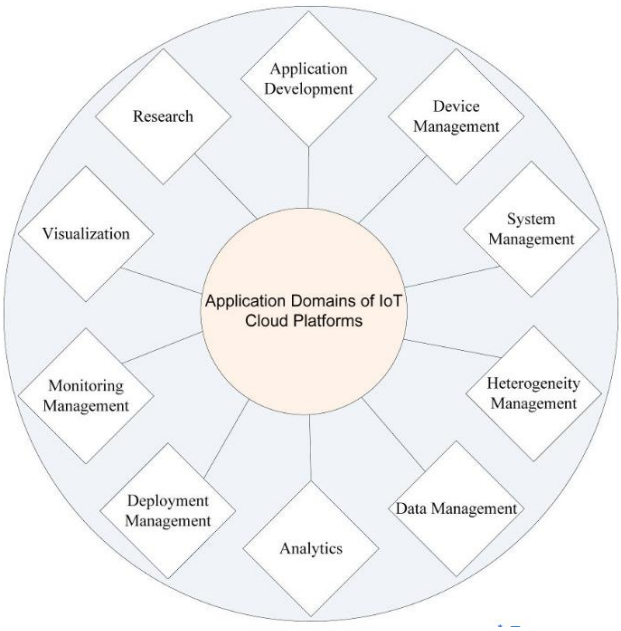

Fig 3.5 Cloud application

An IoT cloud platform may be built on top of generic clouds such as those from Microsoft, Amazon, Google or IBM. Network operators such as AT&T, Vodafone and Verizon may offer their own IoT platforms with stronger focus on network connectivity. Platforms could be vertically integrated for specific industries such as oil and gas, logistics and transportation, etc. Device manufacturers such as Samsung (ARTIK Cloud) are also offering their own IoT cloud platforms.

In most cases, typical features include connectivity and network management, device management, data acquisition, processing analysis and visualization, application enablement, integration and storage.

Cloud for IoT can be employed in three ways: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) or Software-as-a-Service (SaaS). Examples of PaaS include GE's Predix, Honeywell's Sentience, Siemens's MindSphere, Cumulocity, Bosch IoT, and Carriots. Developers can deploy, configure and control their apps on PaaS. Prefix is built on top of Microsoft Azure (PaaS). Likewise, MindSphere is built on top of SAP Cloud (PaaS). Siemens's Industrial Machinery Catalyst on the Cloud is an example of SaaS which is a ready-to-use app within minimal maintenance.

- **Cloud-centric**: Data from IoT devices such as sensors are streamed to a data centre where all the applications that do the analytics and decision making are executed, using real-time and past data from one or more sources. Servers in the cloud control the edge devices too.
- **Device-centric**: All the data is processed in the device (sensor nodes, mobile devices, edge gateways), with only some minimal interactions with the cloud for firmware updates or provisioning. Terms such Edge Computing and Fog Computing are used in this case.

Today, for IoT Cloud Platforms, the goal is to stretch the analytics and data processing across Cloud and Device, leveraging the resources at each end seamlessly. In general, we are beginning to see a shift towards leveraging the compute and service capabilities of the cloud to manage IoT devices better. This is also quite evident from a snapshot of the Google Trends showing increasing interest in Cloud compute compared to just IoT

4.PROPOSED SOLUTION

4.1 BLOCK DIAGRAM:

Receiving road sign values to the IBM IOT platform from Node-RED Web. Weather conditions can be viewed in the Web Application. To accomplish this, we have to complete all the activities and tasks listed below:

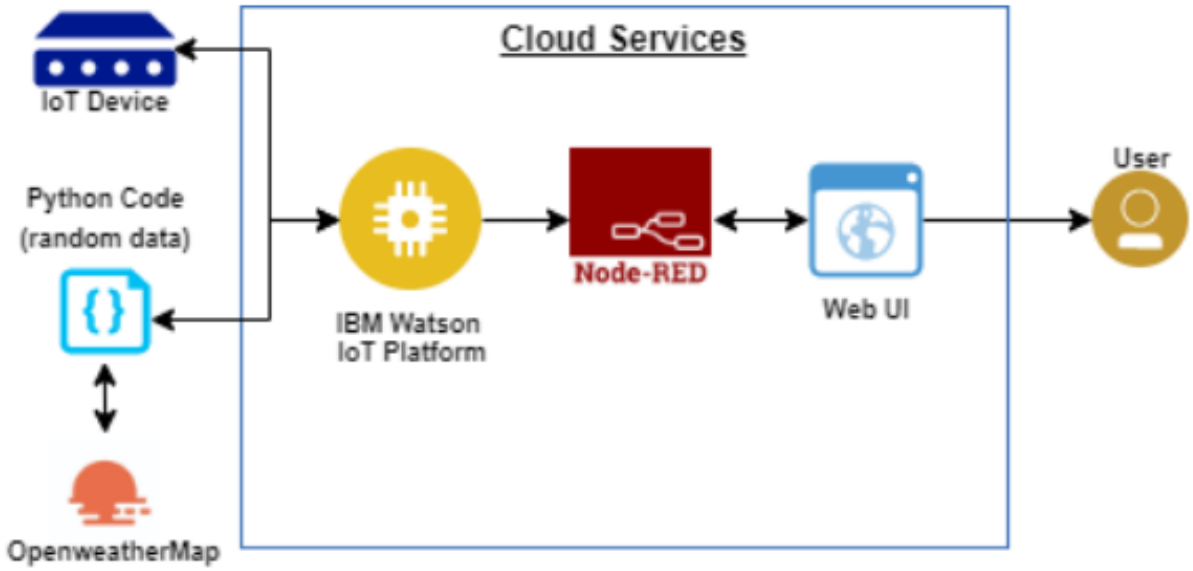

Fig 4.1 Block digram

- Create and configure IBM Cloud Services
- Create IBM Watson IOT Platform
- Create a device & configure the IBM platform
- Create the Node-RED service for application
- Create a database in cloudant DB to store location data
- Utilizing the Node-RED Service, create a web application.
- Develop a python script to publish the location details to the IBM IoT platform

Create IBM Watson platform and Device:

This platform acts as the mediator to connect the web application to IoT device, so create the IBM platform. In order to connect the IoT device to the IBM cloud, create a device in the platform and get the device credentials. Configure the connection security and create API keys that are used in the Node-RED service for accessing the IOT Platform. The device is connected via MQTT. The device requires a MQTT software for connection and for publishing the event. The requirement for the connection are URL, port, device Id, username, password, event topic format and message format.

Fig 4.2 Bluemix

First and foremost, will need a Bluemix Account . Bluemix is IBM’s cloud platform and allows you to host the applications as well as make use of over 150 micro services as well as infrastructure offerings.

Once if have an account then will be able to access the services that require to get started building the chatbots. The main service will need is ‘Watson Conversation’, which is the core service that allows to build chatbot solution.
Then will need to create a service instance of conversation – simply click on the service in the ‘Catalogue’. Then need to name the service instance and decide its location. You will also need to pick the plan.

You will now need to create a new Workspace, a workspace is where you create and train the chatbot. Usually you will start with 1 workspace per chatbot, but there are scenarios where you would want multiple workspaces per chatbot. For example, you could have a chatbot operating in multiple languages, then you would want a workspace for each language. You could also have a larger chatbot covering a number of knowledge areas; in this instance you could put our Watson Natural Language Classifier in front and then have multiple workspaces that specialise in different knowledge areas.

There are a number of IBM cloud services that are a part of the IBM cloud. These services are grouped into 16 categories:

- AI/machine learning: A collection of Watson-based AI resources and tools for building your own AI models.
- Automation: Automation resources enable business workflows to be automated using IBM Cloud Pak. Turbonomic is also available as an automation resource and can be used for application resource management and cost optimization.
- Containers: IBM offers its own cloud Kubernetes service, as well as access to the container registry, Red Hat OpenShift and Istio.

- IBM Cloud : IBM Cloud are applications that are certified for use on Red Hat Open Shift. Cloud exist for business automation, data, integration, network automation, security and Watson.
- Quantum: Provides the ability to run workloads on quantum systems through IBM Quantum composer, the IBM Quantum Lab and the Qiskit SDK.
- Compute: Offers various compute resources, including bare-metal servers, VMs and serverless computing on which enterprises can host their workloads.
- Networking: Provides cloud networking services, such as a load balancer, a content delivery network, VPN tunnels and firewalls.
- Storage: IBM's cloud storage offerings include object, block and file storage for cloud data.
- Logging and monitoring: Provides tools to log, manage and monitor cloud deployments, including Cloud Activity Tracker, Cloud Log Analysis and Cloud Monitoring.
- Security: Includes services for activity tracking, identity and access management and authentication.
- Databases: Provides a variety of SQL and NoSQL databases, as well as data querying, warehousing and migration tools.
- Analytics: Offers data science tools such as Apache Spark, Apache Hadoop and IBM Watson Machine Learning, as well as analytics services for streaming data.
- Internet of things (IoT): Includes the IBM IoT Platform, which provides services that connect and manage IoT devices, and analyzes the data they produce.

- Developer tools: Includes a CLI, as well as a set of tools for continuous delivery, continuous release and application pipelines.
- Blockchain: Provides IBM's Blockchain Platform, a SaaS offering to develop apps, enforce governance and monitor a blockchain network.
- Integration: Offers services to integrate cloud and on-premises systems or various applications, such as API Connect, App Connect and IBM Secure Gateway.

Develop A Python Script:

The data for weather is obtained from weather API. So in order to obtain those data from the API form open weather map, we are writing a code in python. The purpose of this code is to get the data from API and send it to the cloud. From the cloud those data are fetched and then displayed in the python compiler.

- **Extract weather data from OpenWeatherMap using APIs**: OpenWeatherMap provides a range of weather-related products in a variable combination of depth and steps of measurement to millions of clients globally. The product range includes current, historical and forecasted weather data with the granularity as high as 1 minute. The length of the nowcast reaches 2 hours, short-term forecast reaches 16 days and long-term forecast can reach up to 1 year length. Historical weather data goes over 40 years deep. OpenWeather also provides a range of weather maps and weather alert services.

  It is a library in python used to extract data from HTML and XML files i.e. for web scraping purposes. It generates a parse tree from the page source code, which can be used to extract data in a more readable and hierarchical manner. For installing a beautiful soup library in the system use the code below in the terminal. Here we will use

Python’s requests module to make HTTP requests. For installing use the code below in the terminal. Here we are using **headers** because the headers contain protocol-specific information that is placed before the raw message i.e retrieved from the website. After that, we will use the **get()** function and pass the google search in it along with the name of the city to retrieve the data from google. Then we will use BeautifulSoup and parse the HTML data that is required from the website.

Then we will use the **select ()** function to retrieve the particular information like time, info, location, store them in some variable, and, store them further.

- **Send the extracted data to the cloud:** Cloud data transfer is a process of moving data to and from a cloud computing environment. There are various needs that cloud transfers fulfill: one type of cloud data transfer takes data from a local, on-premises data center and brings it to the cloud. Another type of transfer moves data from one cloud platform to another. A third takes data from a cloud platform and brings it to a local, on-premises data center. The main benefit of cloud storage solutions is to host data in the most effective way possible. Organizations typically choose to use cloud services, whether to transfer data or store and access it, based on cost, performance, and security. Overall, cloud storage provides greater elasticity, self-service provisioning, and redundancy which makes it a great choice for organizations.

  The cloud is one of the most cost-effective methods that an organization can use. As network bandwidth rises, the speed by which data is transferred into the cloud also rises. This element is especially

critical with remote workforces, giving any organization the ability to perform data transfers effectively and efficiently from anywhere in the world without creating data transfer bottlenecks. Cloud storage offers an increase in agility, lower costs, and stronger security.

- **Receive data from the cloud and view it in the python compiler:** With the cloud, the physical server is eliminated and the data gets stored on the servers within data centers. The server which stores a particular user's data is leased/rented on a monthly basis to the user. This usage can be increased or decreased and the customer is billed according to the usage only.

To publish data to the catalog:

- To publish data that you are virtualizing, click Submit to catalog before you click Virtualize.

  A Cloud Pak for Data data steward with the Data Virtualization Admin or Steward roles must approve the request before the asset is added to the catalog. Additionally, the approving user must have the required permissions to edit the default catalog in Watson Knowledge Catalog.

- To publish data that you already virtualized:

  1. Go to the My virtualized data.
  2. In the Preview tab of the My virtualized data page, you can preview the renaming of virtual tables and columns with business terms.
  3. Select the virtual object that you want to publish and click Submit to catalog.

4. A Cloud for Data steward with the Data Virtualization Admin or Steward roles must approve the request before the asset is added to the catalog.

- To govern your virtual data with data protection rules:

1. Virtualize your data.
2. Publish your data to the catalog.
3. After the data steward approves the publishing request, your virtual data is published in the catalog. This data is automatically profiled in the catalog. The profile of a catalog data asset includes generated metadata and statistics about the textual content of the data.
4. To govern your virtual data in the catalog:

- Assign business terms and tags that are authored in Watson Knowledge Catalog to your virtual tables and columns. See Managing business terms for details on how to manage and author business terms in Watson Knowledge Catalog. Use data protection rules to deny access to a virtual table. Data Virtualization users can see the virtual table but cannot preview the contents of the table or perform any actions on the table or its columns. See Managing data protection rules for details on how to create data protection rules in Watson Knowledge Catalog.

- A lock icon to the table name on the My virtualized data page indicates that access to the data in the table is denied by a data protection rule.
- Use a data protection rule to mask data in columns of a virtual table. Masked columns disguise the original data to all catalog members. Depending on the method of data masking, data is redacted, substituted. Data masking has certain limitations in Data Virtualization.

Masking virtual data (Data Virtualization):

Data masking applies to the result sets of the queries only. The original data in tables and columns remains untouched. Masking does not apply to query predicates. You can use data masking to avoid exposing sensitive data. However, data masking does not stop a Data Virtualization users from connecting to the service and running queries against that data. Users can join and group data, generate the reports, perform analytics and collect insights by using the raw data, while masking the result set only.

Data masking policies apply to the most *basic virtual tables* in Data Virtualization. Typically, basic virtual tables meet all of the following criteria:

- Tables that were not virtualized in the strict virtualization mode.
- Tables that have one-to-one mapping with the original (non-virtualized) table. Therefore, data masking is not supported for grouped tables or tables that can be grouped before or during the virtualization process.

Depending on the method of data masking, data is redacted, substituted, or obfuscated.

The Cloud for Data data fabric:

A data fabric is an architectural pattern for managing highly distributed and disparate data. Because it is designed for hybrid and multi-cloud data environments, a data fabric supports the decoupling of data storage, data processing, and data use.

With the intelligent knowledge catalog capabilities, you can elevate data into enterprise assets that are governed globally regardless of where the data is stored, processed, or used.

Catalog assets are automatically assigned metadata that describes logical connections between data sources and enriches them with semantics so that you can provide business-ready data for your applications, services, and users.

The data fabric architecture that is provided by Cloud Pak for Data enables your organization to accelerate data analysis for better, faster insights. With the capabilities of the Cloud Pak for Data data fabric architecture, you can:

- Simplify and automate access to data, across multi-cloud and on-premises data sources, without moving data.
- Universally safeguard the use of all data, regardless of source.
- Provide business users with a self-service experience for finding and using data.
- Use AI-powered capabilities to automate and orchestrate the data lifecycle.

Web Application:

Node-RED is a programming tool for wiring together hardware devices, APIs and online services in new and interesting ways. It provides a browser-based editor that makes it easy to wire together flows using the wide range of nodes in the palette that can be deployed to its runtime in a single-click

Node-RED allows you to create functionality by wiring together flows of data between nodes using a browser. And it has gained tremendous popularity in the IoT space, by modeling bits of application functionality between IoT devices like sensors, cameras, and wireless routers

As you can see that the data’s are being pushed to the cloud. In order to see that data we need a UI. UI is nothing but a designer page or the screen that the user can view the data from the database or cloud and they can perform any operation on those data’s. This UI is called the web page which shows the data in the user

required and readable format. Here the tech stack that is used to build the web page is Node red. This node red that we are using is programming tool where the hardware devices are connected together. It is based on the flow for visual programming.

Now let's discuss the simple flow of our project. We have our data from random values through python code and we get the data from an API that is fetched by the python code that we have written. Then all these data will be pushed to the cloud. From the cloud they will retrieved and viewed in the web application which was developed using node red. This method helps the drivers be cautious on speed based on the weather condition and important zones which can avoid accidents and ensures the safety of the drivers as well as the common people.

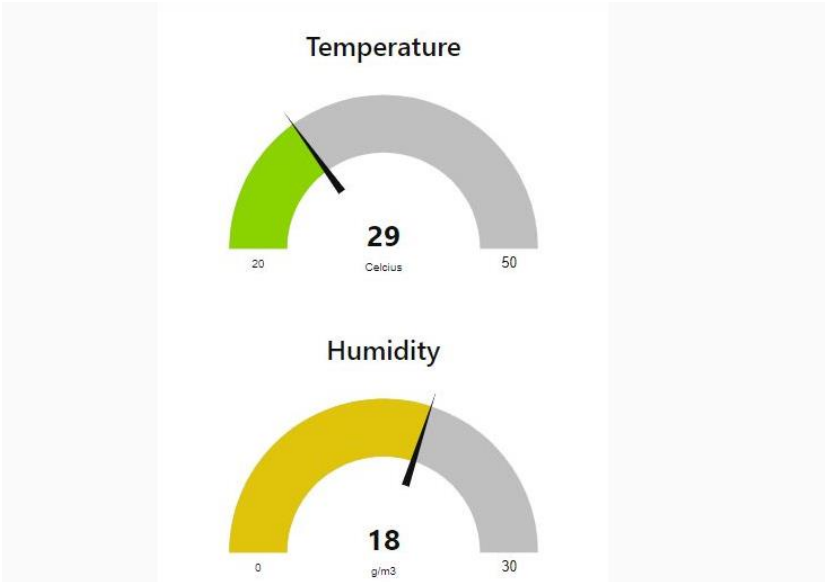

Fig 4.3 Temperature graph

5.CONCLUSION

Road, travel and transport plays main role in a country. India takes special concern in the road safety measures that too in an efficient and effective manner. Using new technology in road safety will prevent from many road accidents and improve road safety measures. Iot is the leading technology used worldwide. Iot Is a technology which is used to handle things in a easy and time efficient way. Anything may be controlled using it from any location. Here we have used IOT to reduce the complications based on road platforms. Our idea is to get the signs of weather condition and to react according to it. The crashes are caused by the drivers because they are unable to change their limits according to the weather. We therefore have a strategy to deal with this issue. The weather signs are auto generated in the app. The weather can be viewed through the web application created using Node-Red service. The Iot devices are connected with IBM cloud to send and receive the data. The data that is sent is the signs and level of the weather conditions associated with that.

The data which is sent as input is processed and the data is given as the result. The received data output data gives the weather conditions. These output result will be in the form of data which is displayed as the speed limit.

The speed is automatically generated by the system for different cases. The user can take this received output data as the information and limit the speed accordingly. This method helps to know the weather conditions of the places that you want to visit. By comparing the paper we have come to know that this method have a significant role in reducing the road accident issue and ensures the safety of the users. The proposed method is mainly designed in a way to establish link to

know the weather conditions and to improve safety measures. The user who uses this method can save time and can improve the safety.
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The result of this project is to achieve smart sign boards by connecting them to internet via IOT. The weather condition values and the landmarks that are obtained through API. And by this the auto generated values are uploaded to the IBM cloud. The value which are uploaded will be then used to change the signs. Based on the values of weather that are obtained from the weather API the speed limits will be changed. When the weather is poor, the speed limits are automatically reduced. When the speed limit is set to low then the user can see this and control the speed. Once the weather clears and the condition is set to normal then the speed limit is set to high accordingly. This method helps to know the weather conditions and act according to it. This will help to avoid accidents. This ensures the road safety for passengers as well as pedestrians. Based on the landmarks and accident prone zone the landmark signs will be displayed. The landmark signs such as school zone, accident prone zone, junction, hospitals will be alerted to the drivers. This technique contributes to a decrease in traffic accidents and increases safety.

6. FUTURE SCOPE

Solar powered roadways Photovoltaic cells are embedded within hexagonal panels made of tempered glass, which are used to pave roads. These panels contain LEDs, microprocessors, snow-melting heating devices and inductive charging capability for electric vehicles when driving. Glass is renewable and can be engineered to be stronger than steel, and to allow cars to stop safely even when traveling at high speeds. While this idea has gained widespread support, scalability is a challenge as it remains expensive. Smart Roads Specially engineered roadways fitted with smart features, including sensors that monitor and report changing road conditions, and WiFi transmitters that provide broadband services to vehicles, homes and businesses. The smart road can also charge electric cars as they drive.

Glowing markers painted onto existing roadway surfaces use a photo-luminescent powder that absorbs and stores daylight. The 500m long strips glow for 8 hours after dark. This technology is still in the testing phase, and the glow is not yet consistent, but it could be more cost-effective than traditional road lighting technologies. Road lights activated by motion sensors to illuminate a particular section of the road as cars approach. The lights dim once the car passes. Suited for roads with less traffic, interactive lights provide night visibility as needed and reduce energy wastage when there are no cars. One design, developed in Holland, uses the wind generated by passing vehicles to power lights. Embedded cables generate magnetic fields that charge electric vehicles while driving. A receiver coil in the vehicle picks up electromagnetic oscillations from a transmitter coil embedded in the road and converts them to AC, which can then power the car. Inductive charging technology already exists for static cars, but future wireless

technology could charge batteries while in motion, providing distance range solutions for electric vehicles which travel longer journeys.

Networks of AI-integrated sensors detect weather conditions that impact road safety. Road Weather Information Systems (RWIS) in use today are limited because they only collect data from a small set of weather stations. A larger future network could use automated weather stations to collect atmospheric and weather data and instantly upload it to the cloud. Dynamic temperature-sensitive paint could be used to highlight invisible roadway conditions like black ice. Data that helps travellers plan their routes. Sensors lining highways monitor traffic flow and weight load, warn drivers of traffic jams, and automatically alert the authorities about accidents. Fiber-optic cables embedded in the road detect wear and tear, and communication between vehicles and roads can improve traffic management. For example, rapid flow technologies use artificial intelligence (AI) to manage traffic lights, which respond to each other and to cars. Traditional systems were pre-programmed to optimize flow around peak journey times, new technologies are able to process and optimize flows in real time.

The concept holds tremendous potential for India considering its road network is the second largest in the world and continues to be the most important means of transport carrying almost 80 per cent of the country's passenger traffic and around 65 per cent of its freight. This large road asset can be leveraged for a lot more than it currently is, implementing technology innovations that yield significant improvements in the driving experience. We have identified several such innovations that can be applied to create smart highways to help improve and redefine the driving experience across three thematic areas: communication, convenience and safety.

REFERENCE

[1]. Cui, M., Han, D., & Wang, J. (2019). An efficient and safe road condition monitoring authentication scheme based on fog computing. IEEE Internet of Things Journal, 6(5), 90769084.

[2]. Gozdecki, J., Łoziak, K., Dziech, A., Chmiel, W., Kwiecień, J., Derkacz, J., &Kadłuczka, P. (2019, June). Communication system for Intelligent Road Signs network. In 2019 6th International Conference on Models and Technologies for Intelligent Transportation Systems (MT-ITS) (pp. 1-6). IEEE.

[3]. Gandhi, U. D., Singh, A., Mukherjee, A., &Chandak, A. (2014, February). Smart vehicle connectivity for safety applications. In 2014 International Conference on Reliability Optimization and Information Technology (ICROIT) (pp. 262-266). IEEE.

[4]. Divyaprabha, M., Thangavel, M., & Varalakshmi, P. (2018, December). A comparative study on road safety problems. In 2018 IEEE International Conference on Computational Intelligence and Computing Research (ICCIC) (pp. 1-7). IEEE.

[5]. Sharma, A., Awasthi, Y., & Kumar, S. (2020, October). The role of blockchain, ai and iot for smart road traffic management system. In 2020 IEEE India Council International Subsections Conference (INDISCON) (pp. 289-296). IEEE.

[6]. Lai, C. H., & Yu, C. C. (2010, November). An efficient real-time traffic sign recognition system for intelligent vehicles with smart phones. In 2010 International Conference on Technologies and Applications of Artificial Intelligence (pp. 195-202). IEEE.

[7]. Abdelsalam, M., & Bonny, T. (2019, March). Iov road safety: Vehicle speed limiting system. In 2019 International Conference on Communications, Signal Processing, and their Applications (ICCSPA) (pp. 1-6). IEEE.

[8] Vishal, D., Afaque, H. S., Bhardawaj, H., & Ramesh, T. K. (2017, December). IoT-driven road safety system. In 2017 International Conference on Electrical, Electronics, Communication, Computer, and Optimization Techniques (ICEECCOT) (pp. 1-5). IEEE.

APPENDIX

```
# import required modules
import requests, json

# Enter your API key here
api_key = "Your_API_Key"

# base_url variable to store url
base_url = "http://api.openweathermap.org/data/2.5/weather?"

# Give city name
city_name = input("Enter city name : ")

# complete_url variable to store
# complete url address
complete_url = base_url + "appid=" + api_key + "&q=" + city_name

# get method of requests module
# return response object
response = requests.get(complete_url)

# json method of response object
# convert json format data into
# python format data
x = response.json()

# Now x contains list of nested dictionaries
```

```
# Check the value of "cod" key is equal to
# "404", means city is found otherwise,
# city is not found
if x["cod"] != "404":

# store the value of "main"
# key in variable y
y = x["main"]

# store the value corresponding
# to the "temp" key of y
current_temperature = y["temp"]

# store the value corresponding
# to the "pressure" key of y
current_pressure = y["pressure"]

# store the value corresponding
# to the "humidity" key of y
current_humidity = y["humidity"]

# store the value of "weather"
# key in variable z
z = x["weather"]

# store the value corresponding
# to the "description" key at
# the 0th index of z
weather_description = z[0]["description"]
```

```
# print following values
print(" Temperature (in kelvin unit) = " +
str(current_temperature) +
"\n atmospheric pressure (in hPa unit) = " +
str(current_pressure) +
"\n humidity (in percentage) = " +
str(current_humidity) +
"\n description = " +
str(weather_description))

else:
print(" City Not Found ")
```