



Intelligent Transportation System,

Node MCU – MQTT Implementation

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Abstract: Transport framework is perceived as one of the significant elements for a nation's advancement and monetary development. Further, open transportation lessens the traffic which has been the significant concern and cost effective. Two primary issues being looked by the present open transportation framework remember potential dangers to individual security and abnormalities for planning. Existing transportation frameworks gives insights concerning the current area of the transport, its normal appearance time and expected holding up time chiefly dependent on GPS and GSM frameworks. The essential focal point of this venture is to give a diagram of such frameworks, and propose a framework with which, a client can arrive at his/her ideal goal securely, effectively and proficiently. These targets can be accomplished by gathering, handling and giving all the important insights about the appearance/flight time of the transport, its genuine area time of appearance, accessibility of seats, mishap/breakdown recognition and cautioning frameworks. When this information is gathered, it very well may be imparted alongside other custom information to the clients by means of a remote correspondence framework utilizing GSM model. Subsequently, the astute transportation frameworks fulfill the clients and improve utilization of open transportation.

Index Terms – MQTT, Node MCU, ITS.

I. INTRODUCTION

The term ITS was authored in 1994, and means "Intelligent Transport Systems" or "Intelligent Transportation Systems." In an expansive sense, an ITS is a framework identifying with versatility that has expanded in sophistication through data innovation (IT). In any case, the particular terms and ideas contrast as indicated by the nation and circumstance. Transport assumes a significant job in a nation's economy. Open vehicle is the most fundamental method of transportation all through the world, and in creating nation like India, open vehicle is the significant source. The quantity of vehicles is expanding step by step which prompts overabundance traffic. Since the cost of fuel is expanding regular yet the administration needs to satisfy the need of each resident so it has presented an enormous number of open vehicle however certain residents want to utilize their own vehicles as they can't locate the right timings of the appearance and takeoff of the transport from a bus station.

II. LITERATURE SURVEY

- *Manini Kumbhar et al.* [1] proposed a system which provides information about the number of buses going from source and destination along with the route details and real time location. This system consists of a GPS which is attached to each bus and receives the signals from three satellites in order to determine the location of the bus. The location of the bus is then transmitted using GSM/GPRS.
- *Abid khan et al.* [2] proposed system which contains GPS and GSM with a high speed ARM processor. The location of the bus is tracked by a system that provides effective on time vehicle location which is used to inform the necessary information about the where the vehicle is and where it has been and for how long is it there. Microcontroller unit is used as unit for tracking, which processes vehicle position provided by GPS.
- *Saylee Gharge et al.* [3] proposed a device to guide the passengers the mode of transport. The proposed system uses an RF device to transmit as well as receive data. GPS module contained in every bus finds GMT and vehicle location through GPS and monitors the speed and transmits the readings through RF transmitter module. In this system, LCDs are to monitor the best routes which display the bus numbers along with their routes to the upcoming bus stop. It also has an advantage of providing a backup power during night.
- *Swati Chandurkar et al.* [4] proposed a system whose application includes bus simulator and central data processing server. In this the GPS receiver is used for determining the location with the help of satellites whose information is stored on the simulator. The GPRS serves continuously holds and monitors the location based on latitude and longitude of the bus. The simulator on the bus continuously downloads the upcoming ordinates of stops.

- *Pankaj Verma et al.* [5] proposed a system consisting of two units placed at monitoring as well as at transmitting end. At transmitting side GPS is employed to determine the vehicle location. The bus position vector is determined by the signals received by the GPS. GSM modem is employed for trans receiving data about the location of the bus. At monitoring side GSM mobile furnished with a suitable application is employed.
- *Maruthiet et al.* [6] presented an SMS based application which furnishes the trip requirements of the passengers by helping them through the facilities such as route notification, bus availability notification through the help of SMS. The GPS receiver placed in the bus receives the information related to its ordinates from the GPS satellites,. This information is preferably transmitted using a GSM module to the server . The users can get notified about the information by registering themselves by providing their route number and bus stop.
- *Manikandan et al.* [7] proposed a system where in users sends the request to the server for information of the buses. The server is interactive with the buses such a way that passengers are notified about all the bus information. The information consists of the present route of the bus and its expected time of arrival. The data received by the server is sent to the person using GSM modules. It also notifies the real time updates of the bus.
- *Raja et al.* [8] proposed a system containing GSM, GPS, micro-controller, multichannel Voice module, LCD display, and RF trans-receiver. Every bus is incorporated with a GSM and GPS module interfacing with the microcontroller to determine the coordinates of the bus. Every bus is furnished with a LCD display board along with the speaker to notify the passengers about the upcoming bus stop/station.
- *Dhruv Patel et al.* [9] proposed a system where the GPS module which is fixed in each and every bus starts sending data in the form of latitude and longitude which is stored in the computer system. At the same time, a user can enter the source and destination of the bus which he wishes to go. At the very same time, the computer system will update the longitude and latitude of the required bus and then looks up for the range of bus from the user to its current location.

III. PROPOSED METHODOLOGY

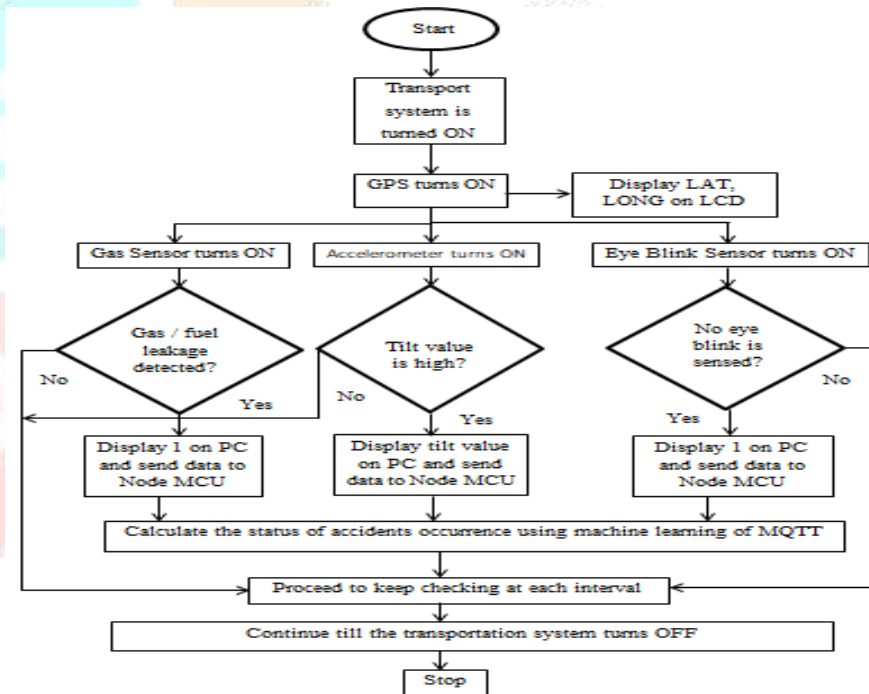


Figure 1.1: Flow chart ITS operation

In light of the previous investigations carried on different techniques for vehicle following and ready framework that utilizes GPS (Global Positioning System), which can follow the vehicle, yet additionally can deal with crises, for example, mishaps, transport breakdown, which are not unsurprising. Further, the travelers are absolutely given the following data of the vehicle for their handling so they can adequately design their excursions with no disarray and can arrive at their goal in a sensible time. This vehicle framework can adequately deal with the unanticipated cases utilizing a compelling information procurement, handling and cautioning framework. The core of this framework is GPS and distributed computing. This framework is constrained by a processor which is utilized for handling different signs from an assortment of sensors, for example, air pack sensor, pressure sensor, liquor sensor, eye squint sensor, gear sensor and temperature sensor. The controller is likewise taken care of with the areas of the transport that is given by the GPS. The prepared information is pipelined to distribute computing.

1. ARM (Advance Risk Machine) Microcontroller

The ARM processors have low number of transistors since they have Reduced Instruction Set, which permits a littler size for the IC. Along these lines being space effective too. The majority of the electronic gadgets, for example, tablets, mobiles, advanced mobile phones and other cell phones comprise of these processors. By consolidating the ARM microchip with RAM, ROM and different peripherals in a single chip, we get an ARM microcontroller, for instance, LPC2148.

A 32 piece RISC Load Store Architecture is available in ARM machines. The control of memory is beyond the realm of imagination straightforwardly; the registers are utilized for this reason. Various assortments of tasks are offered by the guidance set yet the fundamental center is to decrease the quantity of cycle required for every guidance. The directions present in the ARM ISA are on the whole contingent. The condition AL is joined by typical execution guidelines. Barring the condition AL, 14 different conditions are likewise accessible. The quantity of transistors has expanded from 30000 in ARM2 to 26 million in the cortex-A9 ARM. A Thumb engineering was additionally evolved which upheld 16 piece guidelines. Expanding the code thickness caused a drop in execution of these machines. Be that as it may, it was repaid by Thumb 2. ARM, Advanced RISC Machine, RISC Machine, is a family of Reduced Instruction Set Computing models for computer processors. Processors that have a RISC engineering normally require fewer transistors than those with a Complex Instruction Set Computing (CISC) design, (for example, the x86 processors found in most personal PCs, which improves cost, power utilization, and warmth dispersal).

2. Node MCU

Node-MCU is an open source software for which open source prototyping board plans are accessible. The name "NodeMCU" joins "Node" as well as "MCU" (Micro-Controller unit). The expression "NodeMCU" carefully alludes to the firmware as opposed to the related improvement packs. Both the firmware and prototyping board structures are open source. The firmware utilizes the Lua scripting language. The firmware depends on the eLua venture, and based on the Espressif Non-OS SDK for ESP8266. It utilizes many open source ventures, for example, luacjson and SPIFFS. Because of asset requirements, clients need to choose the modules significant for their undertaking and manufacture a firmware custom fitted to their necessities. Backing for the 32-piece ESP32 has likewise been actualized.

The prototyping equipment normally utilized is a circuit board working as a double in-line bundle (DIP) which incorporates a USB controller with a littler surface-mounted board containing the MCU and radio wire. The decision of the DIP group takes into account simple prototyping on breadboards. The structure was at first depended on the ESP-12 module of the ESP8266, which is a Wi-Fi SoC coordinated with a Tensilica Xtensa LX106 center, generally utilized in IoT applications

2.1. MQTT (Message Queuing Telemetry Transport)

MQTT (Message Queuing Telemetry Transport) is an open OASIS and ISO standard (ISO/IEC 20922), lightweight, distribute subscribe network convention that transports messages between gadgets. The convention ordinarily runs over TCP/IP in any case, any system convention that gives requested, lossless, bi-directional associations can bolster MQTT. It is intended for associations with remote areas where a "little code impression" is required or the system data transfer capacity is constrained.

The MQTT convention characterizes two sorts of system substances a message broker and various cilents. A MQTT agent is a server that gets all messages from the customers and afterward courses the messages to the suitable goal customers. A MQTT customer is any that runs a MQTT library and associates with a MQTT representative over a system. Every customer can both deliver and get information by both distributing and buying in, for example the gadgets can distribute sensor information and still have the option to get the design data or control orders (MQTT is a bi-directional correspondence convention). This aside in both sharing information, overseeing and controlling gadgets.

Message Types

- **Connect:** Trusts that an association will be built up with the server and makes a connection between Nodes.
- **Disconnect:** Trusts that the MQTT customer will complete all work it must do, and for the TCP/IP session to detach.
- **Publish:** Returns quickly to the application string in the wake of passing the solicitation to the MQTT customer.

3. ACCELEROMETER (ADXL345)

An accelerometer is a device that estimates appropriate increasing speed. Legitimate increasing speed is the quickening (the pace of progress of speed) of a body in its own prompt rest outline; this is not quite the same as facilitate increasing speed, which is increasing speed in a fixed arrange framework. For instance, an accelerometer very still on the outside of the Earth will quantify an increasing speed because of Earth's gravity, straight upwards (by meaning) of $g \approx 9.81 \text{ m/s}^2$. Paradoxically, accelerometers in free fall (falling toward the focal point of the Earth at a pace of about 9.81 m/s^2) will gauge zero.

Accelerometers have numerous utilizations in industry and science. Profoundly touchy accelerometers are utilized in inertial route frameworks for airplane and rockets. Vibration in turning machines is observed by accelerometers. They are utilized in tablet PCs and advanced cameras with the goal that pictures on screens are constantly shown upstanding. In unmanned airborne vehicles, accelerometers help to balance out flight. At the point when at least two accelerometers are composed with each other, they can quantify contrasts in appropriate quickening, especially gravity, over their detachment in space that is, the angle of the gravitational field. Gravity gradiometer is valuable since supreme gravity is a feeble impact and relies upon the nearby thickness of the Earth, which is very factor.

4. GPS (Global Positioning System) SKG13

The Global Positioning System (GPS), initially NAVSTAR GPS, is a satellite-based radio route framework claimed by the United States government and worked by the United States Space Force. It is one of the worldwide route satellite frameworks (GNSS) that gives geolocation and time data to a GPS collector anyplace on or close to the Earth where there is an unhampered view to at least four GPS satellites. Snags, for example, mountains and structures obstruct the generally feeble GPS signals. The GPS doesn't require the client to transmit any information, and it works freely of any telephonic or web gathering, however these advancements can upgrade the handiness of the GPS situating data. The GPS gives basic situating abilities to military, common, and business clients around the globe. The United States government made the framework, looks after it, and makes it uninhibitedly available to anybody with a GPS recipient. At the point when particular accessibility was lifted in 2000, GPS had around a five-meter (16 ft) precision. The most recent phase of exactness improvement utilizes the L5 band and is presently completely sent. GPS collectors discharged in 2018 that utilization the L5 band can have a lot higher precision, pinpointing to inside 30 centimeters or 11.8 inches.

5. PRESSURE SENSOR

Limit switch otherwise called small scale switch. In CNC, 3D Printing and RepRap Printers these switches are utilized as End Stops and to distinguish max and min cutoff points of pivot. Mechanical switches are easy to utilize and less expensive than optical end stops since they don't require a circuit board and just utilize 2 wires for interfacing the switch. Pull here and there resistors can be put near the principle board. A breaking point switch identifies the physical development of an article by direct contact with that object.

6. GAS SENSOR (MQ-3)

This module is made utilizing Alcohol Gas Sensor MQ3. It is a minimal effort semiconductor sensor which can distinguish the nearness of liquor gases at fixations from 0.05 mg/L to 10 mg/L. The delicate material utilized for this sensor is SnO₂, whose conductivity is lower in clean air. It's conductivity increments as the centralization of liquor gases increments. It has high affectability to liquor and has a decent protection from unsettling influences because of smoke, fume and gas. This module gives both computerized and simple yields. MQ3 liquor sensor module can be effectively interfaced with Microcontrollers, Arduino Boards, Raspberry Pi and so forth.

7. EYE BLINK SENSOR / IR SENSOR

This Eye Blink sensor is IR based. The Variation Across the eye will differ according to eye squint. In the event that the eye is shut methods the yield is high in any case yield is low. This to realize the eye is shutting or opening position. This yield is given to rationale circuit to show the caution. This can be utilized for venture includes controlling mishap because of oblivious through Eye squint. The eye-blink sensor works by enlightening the eye and eyelid territory with infrared light, at that point checking the adjustments in the reflected light utilizing a phototransistor and differentiator circuit.

8. LCD DISPLAY

LCD (Liquid Crystal Display) is a kind of level board show which utilizes fluid gems in its essential type of activity. LEDs have an enormous and differing set of utilization cases for buyers and organizations, as they can be normally found in cell phones, TVs, PC screens and instrument boards. LCDs were a major jump as far as the innovation they supplanted, which incorporate light-emitting diode (LED) and gas-plasma shows. LCDs permitted showcases to be a lot more slender than cathode beam tube (CRT) innovation.

9. Block Diagram

- Two microcontrollers, ARM and NODE MCU are used.
- The sensors are connected to the ARM microcontroller along with NODE MCU.
- The gas sensor, IR sensor and the pressure sensor which are connected to the ARM detects and the sensor values, and displays on PC.
- The LCD, which is also connected to the ARM and it displays the location using GPS system.
- These collected data are sent to the PC using MQTT.

In the MQTT the prediction is done using Cloud machine learning.

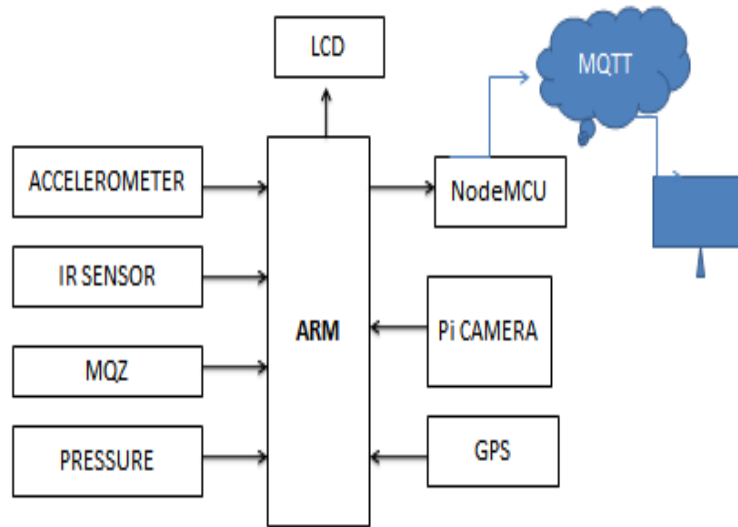


Figure 9.1: Block Diagram

10 SOFTWARE TOOLS

10.1 Keil Micro Vision

The μ Vision IDE joins venture the executives, run-time condition; assemble offices, source code altering, and program investigating in a solitary incredible condition. μ Vision is anything but difficult to-utilize and quickens your implanted programming advancement. μ Vision underpins different screens and permits you to make singular window designs anyplace on the visual surface. The μ Vision Debugger gives a solitary domain where you may test, check, and advance your application code. The debugger incorporates customary highlights like basic and complex breakpoints, watch windows, and execution control and gives full deceivability to gadget peripherals. With the μ Vision Project Manager and Run-Time Environment you make programming application utilizing pre-assemble programming segments and gadget support from Software Packs. The product segments contain libraries, source modules, arrangement records, source code layouts, and documentation. Programming segments can be nonexclusive to help a wide scope of gadgets and applications.

10.2 IDLE Python

IDLE (Integrated Development and Learning Environment) is an incorporated improvement condition (IDE) for Python. The Python installer for Windows contains the IDLE module as a matter of course. Inert isn't accessible as a matter of course in Python dispersions for Linux. It should be introduced utilizing the individual bundle chiefs. IDLE can be utilized to execute a solitary proclamation simply like Python Shell and furthermore to make, alter and execute Python contents. Inactive gives a completely included content manager to make Python contents that incorporates highlights like linguistic structure featuring, auto completion and shrewd indent. It additionally has a debugger with venturing and breakpoints highlights.

IV. RESULTS

1. Results

In my paper of ITS, initially, GPS tracks the exact Latitude and Longitude of location and displays on the LCD as well as prints on the monitor screen. Meanwhile, ARM processor collects all sensor values such as Accelerometer sensor's tilt value, Gas sensor, Pressure sensor, Eye-blink sensor, values and displays on to the PC. By using these all data, we can predict the probability of occurrence of accidents. Hence, these all data are sent to the MQTT broker using Node-MCU. In Machine Learning, these data are analyzed and sensed for status of transportation. Here, the entire data can be stored, analyzed, processed, in an open source cloud storage. And can be accessed anytime from anywhere, hence it is easy and economical to use.

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Python 3.8.1 Shell
File Edit Shell Debug Options Window Help
Python 3.8.1 (tags/v3.8.1:1b293b6, Dec 18 2019, 22:39:24) [MSC v.1916 32 bit
tel]] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
----- RESTART: E:\N.Tech\4th Semester\Project\Node MCU MQTT\ml.py -----
Features:-
1
TILT 309
2
Pressure 0
3
GAS 1
4
EYE 0
Accident status: 64
  
```

Figure : Output values and status of Accidents prediction

V. CONCLUSION AND FUTURE SCOPE

1. Conclusion

India is driving in transport division with its a lot of difficulties which can be comprehended by improving the current innovations and client centered methodologies. An essential worry of each individual is whether they can arrive at their ideal goal on time securely. Individuals think that its hard to depend on open transportation without being acclimated with the appearance/flight timings, courses and accessibility of seats and so on. The continuous execution of the proposed keen transportation gives an answer for give total data of the transports and their inhabitation around the city. The GPS tracks the specific and ongoing area of the transports and ascertains their moving toward time at various stops in their courses. Information gets refreshed each time the transport sends the data. Showing this data at the bus stations and conveying to the clients by means of web or portable based application spares client's time. The voice declarations about the appearance of each transport at the stops helps visually impaired and cautions the rest, in this manner serving the necessities of the client, vehicle drivers and directors of the transportation framework. Along these lines a total arrangement of the transport framework is built up to improve the best usage of the open vehicle lessening traffic.

2. Future Scope

It is imperative to design key activities and exercises which progress and improve the turn of events and utilization of ITS in India. These incorporate exercises tending to the Global Navigation Satellite System (GNSS), consolation of worldwide norms advancement through contact with the International Organization for Standards, work power improvement/preparing, and improved gracefully chain the board forms in a practical manner. India's ITS can't be completely displayed on the current effective ITS of different countries because of fundamental social, geographic and down to earth contrasts among the nations. The current ideas must be altogether comprehended so as to alter them to fit the Indian traffic situation.

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