IOT BASED INTELLIGENT TRAFFIC SYSTEM USING MQTT PROTOCOL

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Abstract : As a fastest growing economy, India is becoming a major superpower. Economy of India is majorly depending upon its work force. But this work force faces various problem in accomplish their task one among them is Traffic. To proceed with their work, first they must reach the place and that is not happening in India properly due to increase in population and unorthodox traffic system. Indian traffic has to be improved by incorporating technology advancement. This technology that we are going to deploy must be high range in communication and should be easily accessible. All this can be achieved using IoT based Traffic system. With this Intensity of the traffic can be monitored using IR sensor networked with IoT cloud and communicated with help of MQTT protocol.

IndexTerms - **IoT, MQTT protocol, IR sensor, Networked, Traffic.**

I. INTRODUCTION

India is the one of the fast growing economy in the word, this is mainly because of booming IT sector. India is the major contributor of the work force of the IT sector, with this more than 35% of the World's IT work force is supplied from India. With revolutionary off shore working Indians are to provide IT service for almost every part of world from India itself. This larger work force is reaching to office every day, to provide a continuous support different part of the world. This enormous workforce always faces a huge problem in reaching the office in time, due to underdeveloped traffic system followed in India. And because of emergency vehicle like Ambulances, Fire Truck, etc., also facing trouble because of unorthodox traffic system. So, Indian traffic is high need of intelligent traffic system which enables people to provide smart solutions which is efficient and easy accessible for emergency vehicle.
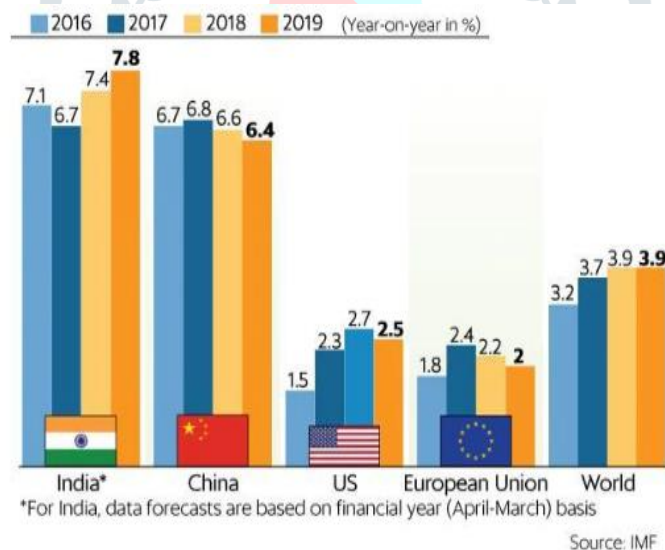

Fig 1. World Economy Growth

Internet of things (IoT) is an emerging edge technology which finds its application almost every field. With its vast availability and great infrastructure, IoT is very adaptable and accessible by everyone with their handset. Internet of Things is very suitable in machine to machine communication and provide a node to server communication. With all this advantage, IoT is perfect technology for employing in the traffic system. And this makes our traffic system in to a smart independent system. IoT can be employed using various protocol system, but for our proposed system Message Queuing Telemetry Transport (MQTT) protocol is best suitable. This is MQTT is light weight messaging protocol which is based on subscription/publish, provides a confidential message transfer between Machine either by open-text username and password or by SSL/TL certification authorization, which is based on the device capability. MQTT can be used in resource restricted device, which makes any device to connect with Internet for data transfer.

II. WORKING

Wherever This proposed system will have implemented in MQTT as framework and this will be deployed in the NodeMCU microcontroller platform. This system has LED for traffic lights, IR sensor, DC motor and NodeMCU as a prime controller. Here IR sensor is used to find the intensity of the vehicle in the street. Based on the intensity level on the IR sensor, the various LED in the traffic light system is switched on and off. IR sensor is also used to find the traffic signal violator and it will have communicated to NodeMCU, and which in turn control the Android based camera to take picture of the traffic signal violator.

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│   IR SENSOR     │      │  DC MOTOR &     │
│                 │      │  LED LIGHTS     │
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         │                        ▲
         └──────────┬─────────────┘
                    ▼
           ┌─────────────────┐
           │    NodeMCU      │
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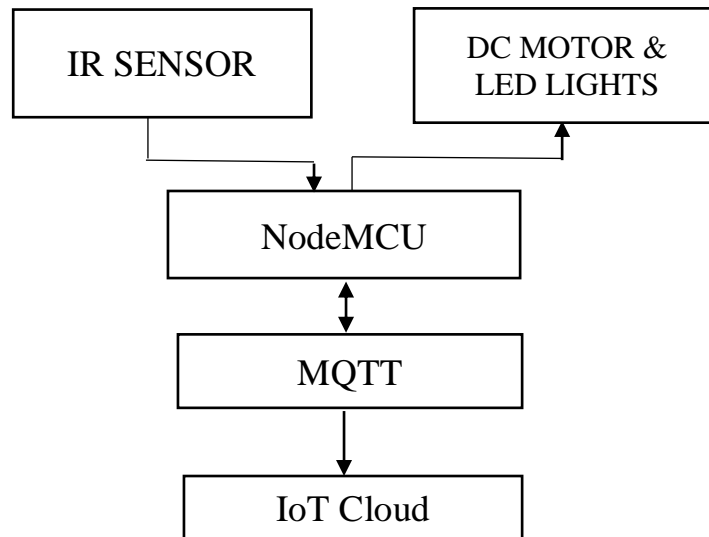
Fig 2. Block Diagram of the process

a. NodeMCU

NodeMCU is a microcontroller platform which has inbuilt Wi-Fi in it. Because of the inbuilt Wi-Fi NodeMCU is preferred in Internet of Things (IoT) based application. NodeMCU is most integral hardware structure, which has 11 digital Pins, 1 analog pin, 1 data port and other pins for communication protocol like SPI, I2C, etc.,.
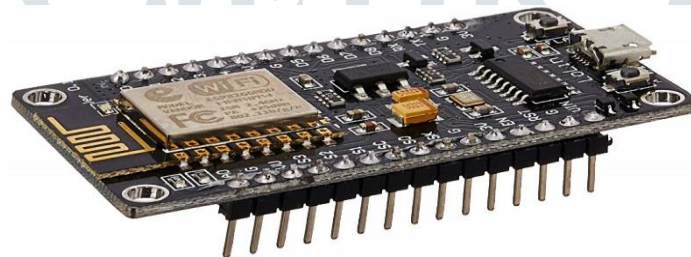

Fig 3. NodeMCU

NodeMCU is cost effective microcontroller which have made into hotspot and Wi-Fi based on the requirement. It can be almost every time peripherals like analog sensor, digital sensor, RFID reader, GSM, GPS, ZigBee, Bluetooth module, RF transmitter/receiver, LCD, Touch screen, OLED and other device.
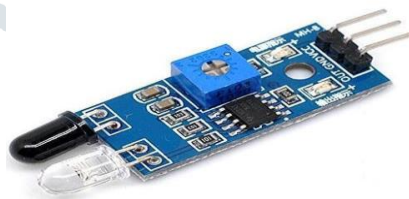
b. IR Sensor

Fig 3. Infra-Red Sensor

IR sensor is Infra-Red intensity sensing sensor, by sending rays of infra-red light and it will sense bounce back infra-red sensor. With that it will used to identify the presence of any other object in front of it. Here its deployed to identify the intensity of the vehicle in the road by sending stream of infra-red light. And also its used to find the traffic violator by the same principle.

c. DC Motor & LED light

DC motor & LED light are digital output device, which are controlled by NodeMCU. This DC motor are used to control the gate of sidewalks; on the red signal it will allow people to use sidewalks. LED light system are used as Traffic lights are controlled systematically with internal NodeMCU timer and also by IR sensor reading which used to sense intensity of vehicle in the road.

d. Android Application

It is important non-hardware component of the process, a custom made android app are used. These apps will let the user to control the signal, those apps will be given to driver of emergency vehicles in order to control the traffic light and other function of this app is used to take the picture of the traffic signal violator which is sensed by IR sensor used for monitoring.

e. Message Queuing Telemetry Transport (MQTT) protocol

MQTT is a lightweight telemetry protocol used for communication. It is widely used in the machine-to- machine (M2M) communication. Basic operation in the MQTT protocol is Publish and Subscribe to a particular to given topic. This information of topic sent to a server by a broker. The broker pushes data to a client which is subscribed to particular client topic. It is widely used in the resource-constrained IoT devices. A resource constrained device is a small device with limited CPU memory and power resource. So to enable MQTT in the small device is possible that makes its compatible.
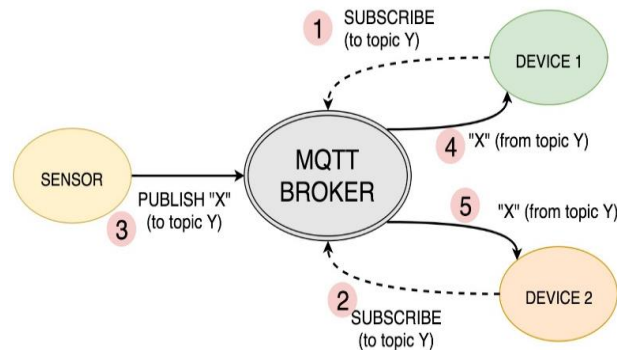

Fig 4. MQTT Communication

MQTT sessions divide into four stages:

- Connection
- Authentication
- Communication
- Termination

MQTT connection starts by client creating a TCP/IP connection to a broker. It is either by using standard port (or) custom port. When creating connection its important to recognize that server might continue an old session if its provided with a reused client identity. The standard port are using SSL/TLS, which is 1883 for non-encrypted communication and 8883 using for encrypted communication.

MQTT authentication is presented as clear-text username and password that is sent to client. And also by using SSL/TS server certificate.

MQTT communication is send as message packet which consists of Fixed header, Optional Variable header, a message payload (256 MB) and Quality of Service (QoS) level. There are 3 different quality of service. Although higher level of QoS are more reliable but they have more latency and bandwidth requirements.

MQTT termination is disconnecting the MQTT connection properly, it gives ability to easily reconnect and resuming where it let off.

III. CONCLUSION

With this systematic & intelligent approach, a greater traffic system can be provided to our country people which make their life ease and it will help the country's workforce in greater extent. By using IoT in the system we can extend and upgrade the system with any device or adapt the existing system with future trend.

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