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TRAFFIC INFORMATION SYSTEM USING INTERNET OF THINGS

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Abstract: - *Over the years, there has been a sudden increase in the number of vehicles on the road. Traffic congestion is a growing problem everyone faces in their daily life. Manual control of traffic by traffic police has not proved to be efficient and also the predefined set time for the all circumstances like low and high traffic density has not solved this problem. A model to effectively solve the above mentioned problems by using internet of things (IoT) is proposed. We use cloud for internet based computing, where different services are used to share the current status of traffic information for better traffic management, This model uses arduino based circuit system to monitor traffic signal densities and transmits the data online through internet.*

A network of sensors is used to track the number of vehicles and the traffic congestion at the intersection on a road and rerouting will be done on the basis of traffic density on the lanes of a road.

Key words: *Internet of Things, Traffic Management System.*

1. INTRODUCTION

Traffic congestion has been one of the major issues that most metropolises are facing in spite of measures being taken to mitigate and reduce it. In the recent past, traffic congestion has emerged as one of the main challenge for engineers, planners and policy makers in urban areas which cause crowdedness, time waste, and sometimes harmful accidents. Since the space of the new roads is very limited, it is necessary to improve the exploitation of the existing network.

In this Traffic Information System we use ESP8266, Microcontroller and sensors like HC-SR04 Ultrasonic sensor, DS18B20 Temperature sensor are used to gather information. Cloud computing is an information technology (IT) paradigm, a model for enabling ubiquitous access to shared pools of configurable resources (such as computer networks, servers, storage, applications and services), which can be rapidly provisioned with minimal management effort, often over the Internet. Cloud computing allows users and enterprises with various computing capabilities to store and process data either in a privately-owned cloud, or on a third-party server located in a data centre, thus making data-accessing mechanisms more efficient and reliable. Cloud computing relies on sharing of resources to achieve coherence and economy of scale, similar to a utility.

Internet of Things refers to the communication of devices through internet. The Internet of Things extends internet connectivity beyond traditional devices like Desktop, laptops, computer and Mobiles to a diverse range of devices and everyday things that utilize embedded technology to communicate and interact with the external environment, all via the Internet [1].

Wireless Sensor Networks (WSNs) is a network consisting of spatially distributed autonomous devices using sensors to monitor physical or environmental conditions. A WSN system incorporates a gateway that provides wireless connectivity back to the wired world and distributed nodes. A large number of sensor nodes deployed randomly inside of or near the monitoring area (sensor field), form networks through self-organization. The major application domains of Wireless Sensor Networks are Industrial Automation,

Civil Structure monitoring and Agricultural Management.

Traffic congestion is a growing problem worldwide causing time and fuel waste, pollution and even stress. Everybody is impatient to reach their destination in minimal time. The problem becomes really severe when any VIP enters to the city. All the traffic is stopped suddenly and huge resources of police and public are used. Managing these situations especially when it is a metropolitan city is a tough nut to crack. In Indian road-traffic, the problems like congestion, unpredictable travel time are taking a serious shape which is also chaotic and noisy and it becomes worse when the traffic is made at halt for even few minutes. Many kilometers of traffic jams takes places within few minutes [2].

User Interface Design Principles:

a) The simplicity principle: The design should make simple, common tasks easy, communicating clearly and simply in the user's own language, and providing good shortcuts that are meaningfully related to longer procedures.
b) The visibility principle: The design should make all needed options and materials for a given task visible without distracting the user with extraneous or redundant information. Good designs don't overwhelm users with alternatives or confuse with unneeded information.
c) The feedback principle: The design should keep users informed of actions or interpretations, changes of state or condition, and errors or exceptions that are relevant and of interest to the user through clear, concise, and unambiguous language familiar to users.
d) The tolerance principle: The design should be flexible and tolerant, reducing the cost of mistakes and misuse by allowing undoing and redoing, while also preventing errors wherever possible by tolerating varied inputs and sequences and by interpreting all reasonable actions.
e) The reuse principle: The design should reuse internal and external components and behaviors, maintaining consistency with purpose rather than merely arbitrary consistency, thus reducing the need for users to rethink and remember.

Transportation Challenges:

- More efficient application of inputs
- Better efficiency
- More effective utilization of equipment
- Decrease in travel time
- Provides more information about traffic

2. LITERATURE SURVY

A smart traffic management system that is partially deployed in Cambridge city where queue detectors are buried in the roads that detect the traffic queue and inform the central control unit which takes decision accordingly. Since the system is centralized that can slow down due to networking issues. The researcher used surveillance cameras to detect traffic and OCR to identify the vehicles through number plate recognition which is a simple detection method but the system will fail in Pakistan as there are different kinds of traffic including cycles, donkey carts which have no number plate.

This chapter gives a brief description of the list of papers referred for the paper. This chapter consists of Review on the Internet of Things (IoT), Review on Data Mining and Machine Learning Techniques, Review on Prediction Algorithms, Review on Temperature Prediction Algorithms.

Objecive Of Literature Survey:

- To study about IOT with improved information and communication processes.

- To study about the Wireless Sensor Networks in the aspect of retrieving the traffic information.
- To study about the sensors and Microcontrollers and how to collect the data from them and display the information into the digital phone.

Survey On Traffic Information System:

Laura Munoz , et.al , proposed a system to estimate traffic density with the cell transmission model. This uses cell densities as state variables instead of cell occupancies, and also accepts non uniform cell lengths, and allows congested condition to be maintained at the downstream boundary of a modeled freeway section. Using cell densities instead of cell occupancies permits to include uneven cell lengths, which leads to greater flexibility in partitioning the highway.

M. Vargas, et.al ,proposed a system for video based traffic density estimation. Successful video-based systems for urban traffic monitoring must be adaptive to different conditions. They should include algorithms for detection of moving vehicles and short term stood-still vehicles (especially important in urban environments).
H.S. Mohana, , et.al ,developed a new approach in detecting and counting vehicles in day environment by using real time traffic flux through differential techniques. Counting object pixel and background pixel in a frame leads to the traffic flux estimation. The basic idea used is variation in the traffic flux density due to presence of vehicle in the scene. In this paper a simple differential algorithm is designed and tested with vehicle detection and counting application. Traffic flux estimation will play vital role in implementing vehicle detection and counting scheme [4].

Thanes Wassantachat , et.al , proposed a system to find the traffic density Estimation with On-line SVM Classifier according to the system. Traffic congestion has significant impacts on both the economy and environment. Reducing traffic congestion can improve traffic flow, reduce travel times and the environmental impact. Automatic determination of traffic congestion status is thus introduced to reduce the cost of human resource and the traffic congestion delay.

This automatic determination can also establish an effective traffic solution to the traffic light controllers.

Guohui, Zhang , et.al , proposed a Video-based Vehicle Detection and Classification (VVDC) system for collecting vehicle count and classification data. The proposed approach can detect and classify vehicles using uncelebrated video images. The ability to use uncelebrated surveillance cameras for real-time traffic data collection enhances the usefulness of this prototype VVDC system.

Dragoi, et al. presented a congestion avoidance model for traffic control over a vehicular ad-hoc network created between the sensors and cars in traffic. The road side wireless equipment (also called wireless traffic lights, WTLs) collects the data from cars in different road segments and accumulates it to form a road map and its costs.

They evaluated the proposed model using a VNSim simulator. Their evaluation results showed that the average time desired for the vehicle to reach its endpoint recorded a significant decrease of up to 40%.

Ahmad, et al. developed a test bed for the evaluation of traffic signal control algorithms using a microscopic traffic simulator (SUMO) and AVR micro- controller. They implemented four scheduling algorithms, i.e., the shortest remaining processing time (SRPT), the Fair SRPT, the minimum destination distance first (MDDF) and minimum average destination distance first (MADDF) in SUMO, studied their effect on traffic networks and measured their execution times.

Their experimental results indicated the execution time is constant and independent of traffic intensity for SRPT, decreases with increase in traffic intensity for Fair SRPT, increases rapidly with traffic intensity for MADDF and increases with traffic intensity for MDDF, but not as rapidly as MADDF.

Abishek, et al. proposed a WSN-based solution for Indian city traffic. Their aim was to make the traffic signals adapt to the dynamic traffic flow. The proposed system is simulated using the C++ language. They found that the existing infrastructure can handle 7% more vehicles.

3. PROPOSED SYSTEM

This proposed system, Traffic information system aims to make the traffic signal and its conditions more efficient and feasible to the customers by providing the traffic information. The traffic information system focuses on the communication between vehicles, processing unit and traffic lights using Wi-Fi connection. The Traffic information system provides commuters with accurate, timely and reliable traffic information which will influence travel behavior and ultimately result in reduced journey time and traffic congestion along with reduced vehicle emissions and fuel consumption.

Here the customer or the user will use his/her own device (mobile) to receive information about traffic by sensors. Using this information he/she can beat the traffic and chose the best route to travel. In the Traffic information system, traffic lights are connected with the sensors which we use. These sensors will help in adjusting the traffic lights from time to time by using the traffic density in particular roads. Information provided by Traffic Information System are traffic density, temperature, live traffic signal [5].

Advantages of proposed system:

- Improving traffic safety: Unsafe speeds, dangerous weather conditions and heavy traffic can all lead to accidents and the loss of life; traffic information systems help with all of these.
- Reducing infrastructure damage and protects public health: Heavy vehicles can put a lot of strain on the road network, particularly when they're overloaded in delayed traffic. By using traffic information system the traffic can be controlled, so there will be no delay in traffic and reduces the strain of waiting in the traffic to the public.
- Traffic control: Here, Large numbers of adaptive intersections working together produce a system in which lights change in response to traffic patterns rather than on a fixed schedule, reducing weight times and keeping traffic moving smoothly.
- Gathering traffic data: Proper traffic planning is impossible without detailed data about road use patterns. The commuters need to plan the way he/she travel in advance by using the traffic information. The traffic information system provides the traffic data to the user/driver through their mobile application.

Functional Requirements:

- The system shall include traffic sensors to perceive traffic as well as the traffic signals and provide the perceived information to the customer.
- The system shall notify the temperature present at the particular traffic place and display to the user in his/her digital phone.
- The system shall also specify the live traffic signal light on the individual's device.
- The system shall notify about the distance of traffic present over the particular traffic position.

Non Functional Requirements:

- **Cost:** The cost of this system is low when compared to other traffic informative systems.
- **Storage capacity:** Most of the systems use a lot of space to store the data but in this Traffic Information system storing the data is not a complex task. It uses the less storage.
- **Environmental Impact:** As this system is providing the information to the users correctly at the right way so, it reduces the stress for the uses in the traffic congestion and have no health impacts.
- **Security:** Since, this system provides the traffic information to the users on their personal device. The

system should be secure enough and shouldn't allow intruders to make changes or install bugs in it because the user will directly connect to the system with his/her Wi-Fi by of his own user id and password.

Hardware Requirements:

- Processor : i3
- RAM : 4GB
- Microcontroller : ESP8266
- Devices : Mobile or Laptop
- Sensors : Ultrasonic HC-SR04

DHT11 Temperature and Humidity Breadboard
LED Lights Jumper wires

Software Requirements:

- Operating System : Windows 10
- Software : Arduino IDE 1.8.12
- Programming Language : Arduino
- Drivers : Silicon USB Port
- Web Design : Html, CSS
- Additional Libraries : ESP8266
  Json file for Board Manager

DHT Header File

In this chapter, the design of the proposed system, proposed system architecture, modules of the proposed system and its use cases has been discussed.

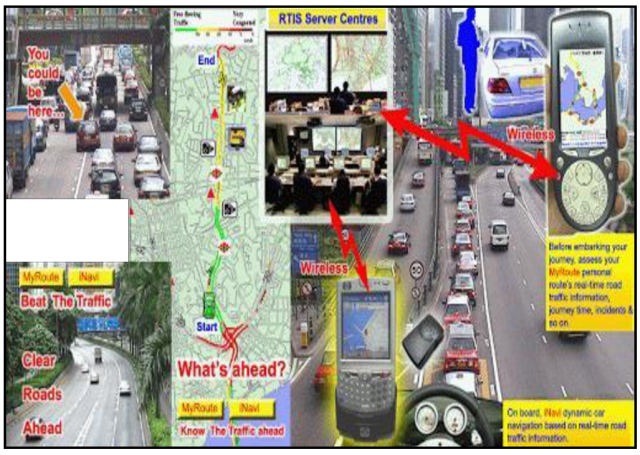


Figure.1: IoT based Smart Traffic system.

Figure 4: shows the overall design of the IoT based Traffic system. Physical view Traffic sensors deployment like ultra sonic, temperature and humidity sensors etc. Sensors senses the environmental conditions and information about the traffic and send the signal to Arduino – NodeMCU. Arduino – NodeMCU has inbuilt processor which process the data and send it to the android device through Wi-Fi.

Proposed System Architecture:

The proposed system makes use of three parameters namely – temperature, Traffic signals and Traffic distance. These four parameters are extracted from the environment using the respective sensors. This data is then sent remotely to the receiver which in turn sends the data to system through the serial port. The data thus collected will be sent to the users mobile.

Presently, advanced Traffic Information System (TIS) is extensively used in the developed countries and is regarded as an important component for road traffic control and management. It uses Information and Communication Technology (ICT) to broadcast Traffic information to commuters to help them in scheduling their trips and also offer directions on the road.

Information provided by TIS may include:

- information about the traffic density,
- inclement weather temperature and humidity,
- information about traffic lights,
- Best route to travel.

Providing commuters with accurate, timely and reliable traffic information will influence travel behavior and ultimately result in reduced journey time and traffic congestion along with reduced vehicle emissions and fuel consumption. Here there is the usage of mobile to receive information about traffic by sensors. Using this information we can beat the traffic and chose the best route to travel [6].

Traffic lights play an important role in the IoT based traffic control system**.** The traffic lights are connected

with the sensors which we use. These sensors will help in adjusting the traffic lights from time to time by using the traffic density in particular roads. As mentioned above the commuter will receive information about the traffic density and traffic lights. The smart traffic lights are nothing less than a boon for the cities as they will help in various ways.

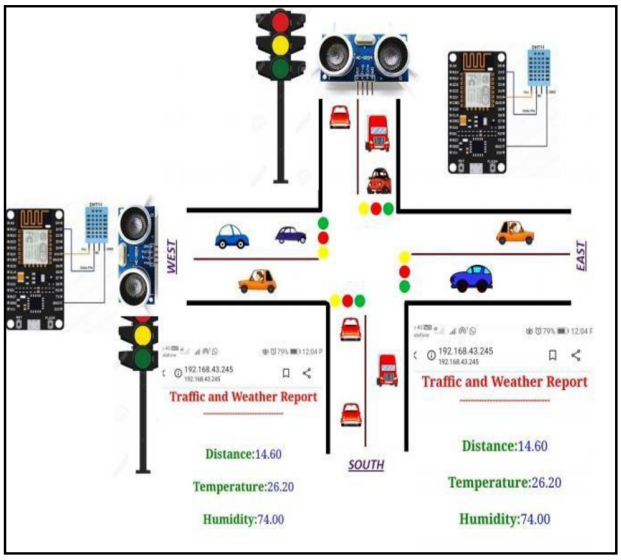
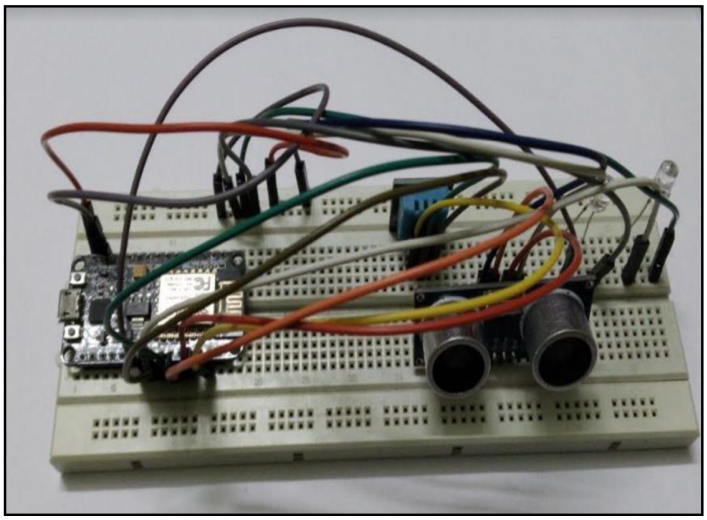


Figure.2 :Architecture of Traffic information System.

Hardware setup:

The core of this unit is the data acquisition and data transfer is the microcontroller. Arduino NodeMCU Esp8266 is the microcontroller used in the system to which the sensors are interfaced to it using the breadboard and connecting wires. The sensors used to monitor the Traffic are as follows:



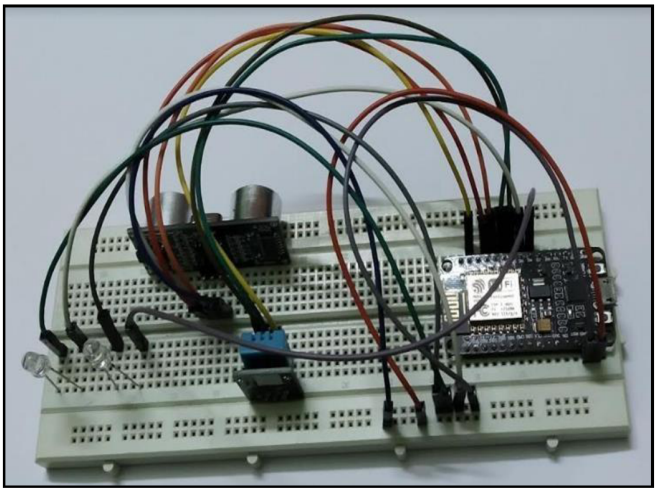


Figure .3: Hardware setup

User Interface (UI) Design:

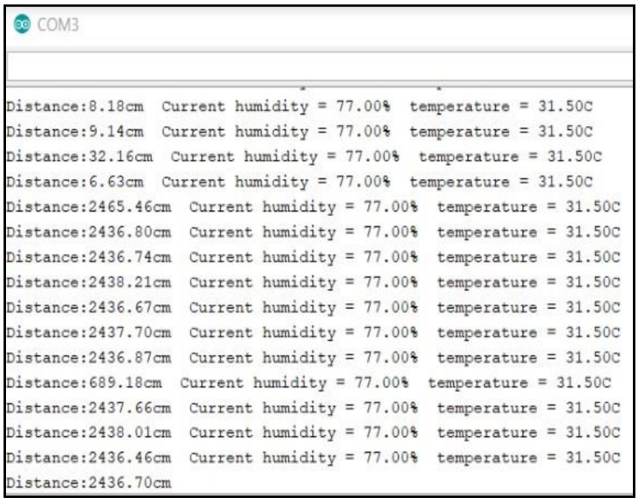
- The job of the user interface is to exchange information between the end user and sensors.
- The user watches the sensor results in a graphical view.
- The GUI window also shows the temperature and live Traffic signal.
- This GUI is developed using html and css.
- The function of the UI is to present the information about the Traffic to the user.
- The output of the result is based on the sensors.
- The user can retrieve temperature, Traffic signal and distance of traffic at traffic signal.

4. RESULTS

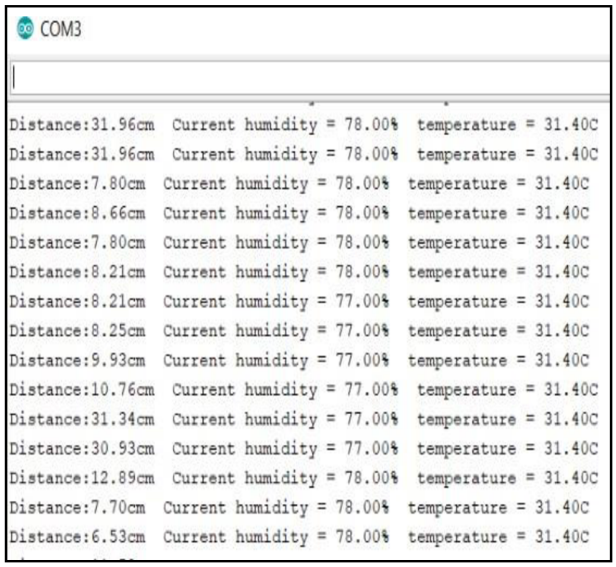
Graphical User Interface

- Screenshots Of The Results Acquired:
- Various sensor readings at serial monitor

Results of temperature, traffic signals and traffic density:



Results of temperature, traffic signals and traffic density:



5. Conclusion and Future Enhancements

In this project, sensors are used to collect the data related to parameters- temperature, humidity, traffic signals, and traffic density. The data collected from the sensors and transferred to the driver's android mobile using Wi-Fi. In data display unit, the data from sensors will be displayed to the driver. Using this feature the driver can view these parameters by checking the data values when necessary. The data trends have been observed and are recorded accordingly. Considering the data from the respective sensors automation will be carried out by using automation techniques.

Predictive analysis can be done with the data provided by the sensors and using the data collected and therefore applying various artificial intelligence and machine learning algorithms on this data may bring a great revolution in field of smart traffic.

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