

Raspberry pi and Image Processing based Road Traffic Enhancement and Waste Management

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Abstract - Population increasing day to day due to increasing population creates many problems like air pollution, water pollution, traffic congestion, and continuous use of non-renewable energy sources. The main objective of the system is to save the environment. To reduce above problems and to save the environment describes the specific characteristics of smart city IoT. Such that the system manages traffic congestion, water management, air pollution. In proposed system developed by using Raspberry pi, image processing, VB, sensors. In traffic congestion system will observe LIVE road situation, pit detection, traffic monitoring, accident detection, and CO₂ level in air and display the message to citizen and government authority. Use renewable energy sources like (Solar, Wind, and Biogas) for generating pollution free energy. This energy is utilized for street light, traffic signal and in garden. By using waste material produce biogas. It is utilized for the apartment for cooking and many other things.

Key Words: Raspberry Pi, GSM.

1. INTRODUCTION

The proposed system design by using Raspberry pi, image processing, sensors, GSM, SQL Server and VB software. Raspberry pi is a heart of a system. Which interfaces between sensors and database. Raspberry pi camera module to take high definition video as well as stills photography. The camera module will capture the snap of LIVE situation and update to database (image processing). The temperature sensors (LM35) and CO₂ (MCQ6) sensors are placed on the poll of traffic signal and it gives updates of temperature and CO₂ level to database through the GSM. The Raspberry pi gives this information to the mobile app and database through GSM (SIM900). In database management systems are in charge of storing the large amount of information produced by IoT peripheral nodes such as sensors.

2. SYSTEM DESIGN

The Fig. 1 gives the general description of system block diagram in which each block has following description.

This system is divided into main 3 sections as follows:

- **INPUT:** In which all the sensors are present and sense the appropriate value. This sensed value is then passed to the main processing unit i.e. Raspberry pi.
- **MAIN PROCESSING UNIT:** Which includes Raspberry pi. Raspberry pi having the more range of memory. It also having extra onboard features on board. It's a mini computer.
- **OUTPUT:** In this section two parts consist are
 - VB DATA BASE
 - MOBILE ANDROID APP

In this section all processed input are stored in the VB data base and which stored data is accessed through the mobile app. Citizens can easily access all information which they require. [1][2][3]

3. WORKING

The proposed system implemented by using Raspberry Pi, Image Processing, sensors, GSM, SQL Server and VB software. Raspberry Pi is a heart of a system, which interface between sensors and database. Raspberry Pi camera module is to take high definition video as well as stills photography. The camera module will capture the snap of LIVE situation of road and update to database (Image Processing).

The Temperature Sensors (LM35), CO₂ Sensors (MG811), Ultrasonic Sensors (HC-SR04), IR Sensors (LM393) these sensors are placed on the signal areas and it gives updates of temperature, CO₂ level, Garbage level, Parking

slots status to database through the GSM. The Raspberry Pi gives this information to the mobile app and data base through GSM (SIM900).[4][5][6]

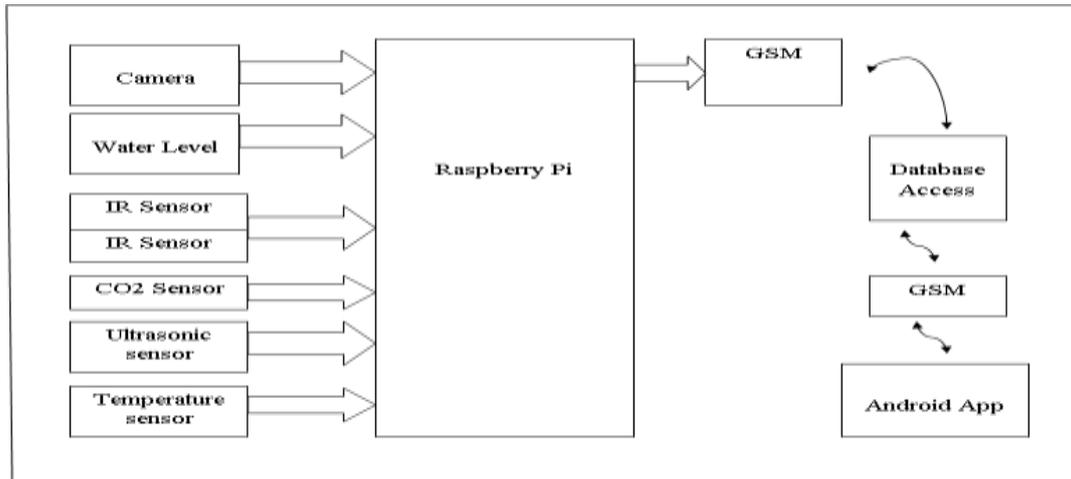


Fig.1 Block diagram of Road Traffic Enhancement based on Image Processing and Raspberry Pi

- **Camera:**In camera will capture the snap of recent conditions of congestion and pits on the street. Then camera send captured snap to Raspberry Pi for further operation.
- **Temperature sensor(LM35), Water level leads, IR sensor :**These sensors sre used to detect respective parameters
- **Raspberry Pi:**The Raspberry Pi is a basic embedded system having a credit card-sized single board computers developed in the UK by the Raspberry Pi Foundation. The Raspberry Pi is based on the Broadcom BCM2835 system on a chip (SOC) which includes an ARM1176JZF-S Core (ARM V6K)700 MHz CPU processor, Broadcom Video Core IV GPU having 17 pins, 3.5W of power, and 512 MB of RAM memory.
- **GSM:**GSM is a mobile communication modem it is stands for Global System for Mobile Communication (GSM). It is widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands. GSM system was developed as a digital system using Time Division Multiple Access (TDMA) technique for communication purpose. In this project GSM is used to communicate wirelessly with the VB server of computer.
- **VB based server:**The server has the all the data related to air pollution and traffic condition with time and area information. The Server can be used to store all the information as well as reply to the enquiry done by the user.
- **Android Mobile Node:**Here we are developing an Android APP. This is a user node which is used to upload as well as download the data from server. The user can upload information such as Traffic density (High/ Low/ Medium), Road Blocked, Traffic Congestions etc along with time and his name and Area name via SMS. The Server has Visual Basic software with an Access Database. The VB software will update the database sent by the user via Android APP. When someone sends an enquiry SMS he just has to type the area name and he will get all the info uploaded to the SERVER.

4. SYSTEM REQUIREMENT ANALYSIS

The main aim of the purposed system is save the environment. System is based on IoT. In IoT implements various ideas and applications. All those various ideas and application built in single app. This app is useful for every citizens and government authority. This purpose system mobile app is maintain all data like water level ,air pollution, traffic congestion, road conditions for the specific area. In Fig.4.1 shows, the exact flow of the system .When system is starts initialization of the system is started then data is collected from different sensors .This

collected data then start compare with the pervious data collect from different sensors .When rang changes data base is updates and informs to respective authorized person and the also requesting citizens through android app.[7][8][9]

Waste Management: Waste management is a primary issue in many modern cities. The use of intelligent waste containers, which detect the level of load and allow for an optimization of the collector trucks route, can reduce the cost of waste collection and improve the quality of recycling. To realize such a smart waste management service, the IoT shall connect the end devices, i.e., intelligent waste containers, to a control center where optimization software processes the data and determines the optimal management of the collector truck fleet.

Traffic Congestion: IoT consists in monitoring the traffic congestion in the city. Even though camera-based traffic monitoring systems are available. Traffic monitoring may be realized by using the sensing capabilities and GPS installed on modern vehicles and adopting a combination of air quality and acoustic sensors along a given road. This information is of great importance for city authorities and citizen. .[1][2][3]

The services provided like water level controller, temperature sensors, pollution sensors, image processing these services have number of application .The water level controller it is a single application use in various way at the time of rainy season due to heavy rain fluid condition are possible that time water level controller alert system about the water level. We can also used in underground water tunnels, water tanks, drange pipes ,water pipeline system and also we can use water level controller as liquid level indicter in food industries.Camera module with image processing gives LIVE situation on the main system which is helpful for traffic management, accident reorganization and pit detection on road. We can also understand the exact situation on road for informing message to citizens. It’s monitoring the traffic congestion in the city. This information is of great importance for city authorities and citizens for the former to disciple traffic and to send officers where needed and which gives the other road.

Water is very essential thing for human. Due to water level controller we can manage the water supply, like when water level above the critical level system will alert to block the road and suggest the other way to travel. Similarly we can use this application in underground water pipe line, when the pipe line is over flow or damage the system will give message to stop the water supply. Because of this we can save the water as well as overcome unpredictable conditions generated in rainy season.[4][5][7]

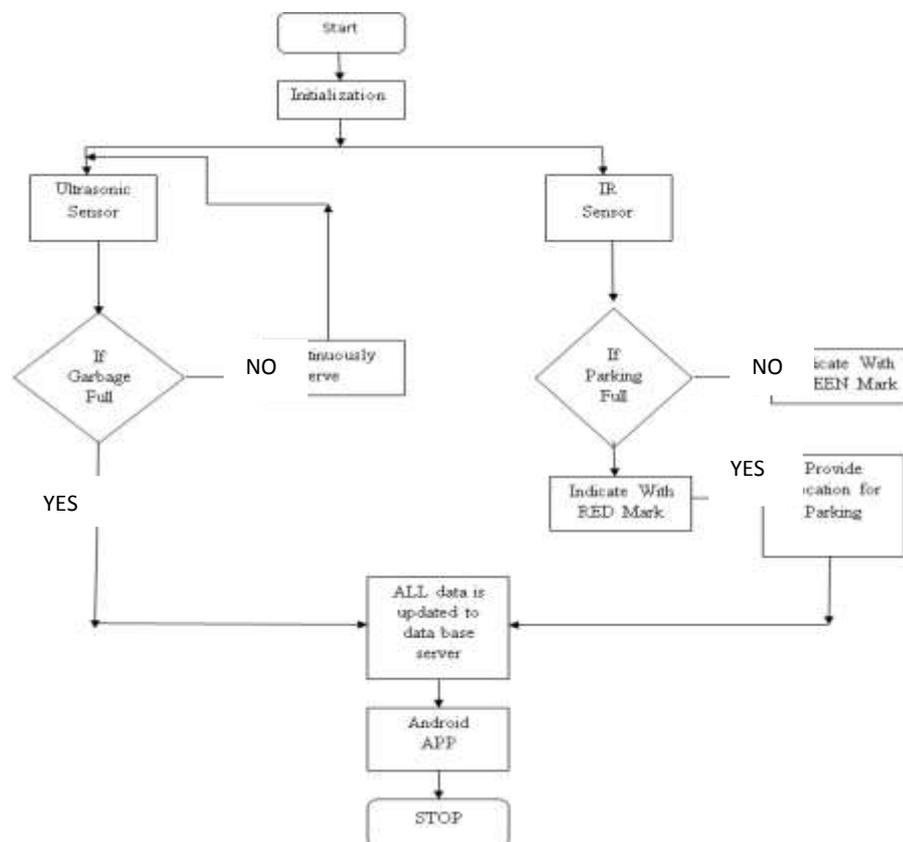


Fig.4.1 Parking and Garbage Alert Flow Chart

Camera module is used to give the live updates to main system and citizens an their single application. It is useful for accident detection. Due to live updates traffic monitoring possible. When traffic are jam on single road pollution also increase that time pollution sensor give the update to system and again suggest the other free way to travel. The Fig.4.1 gives the flow of image processing. Camera takes the snap on the regular road save images into the database. When after some days road will damages due to the condition road will damage. These two captured images are stored into the database and then compared with each other. When pit will detected then this will inform to the authorized person like municipal officer, respective area engineer supervisor and respective area representative. Which will able to take action to recover the problem. This stored images on the road, which will also useful for the Police to find the thief's and other respective search. The stored data is useful for defense or police departmental to grab the thief

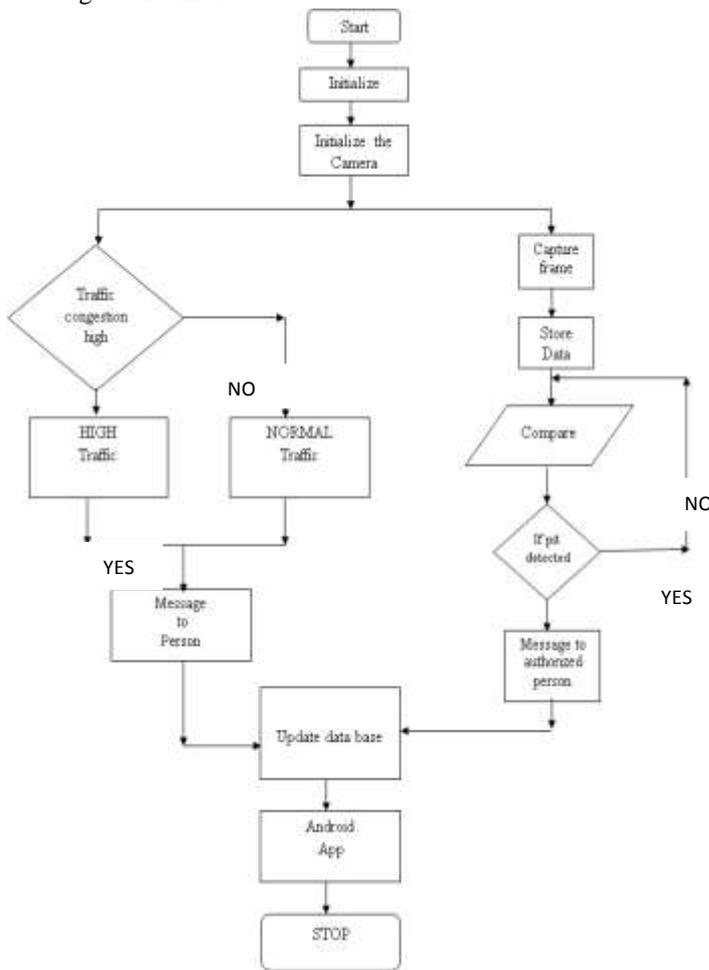


Fig.4.2 Camera update to data base flow graph

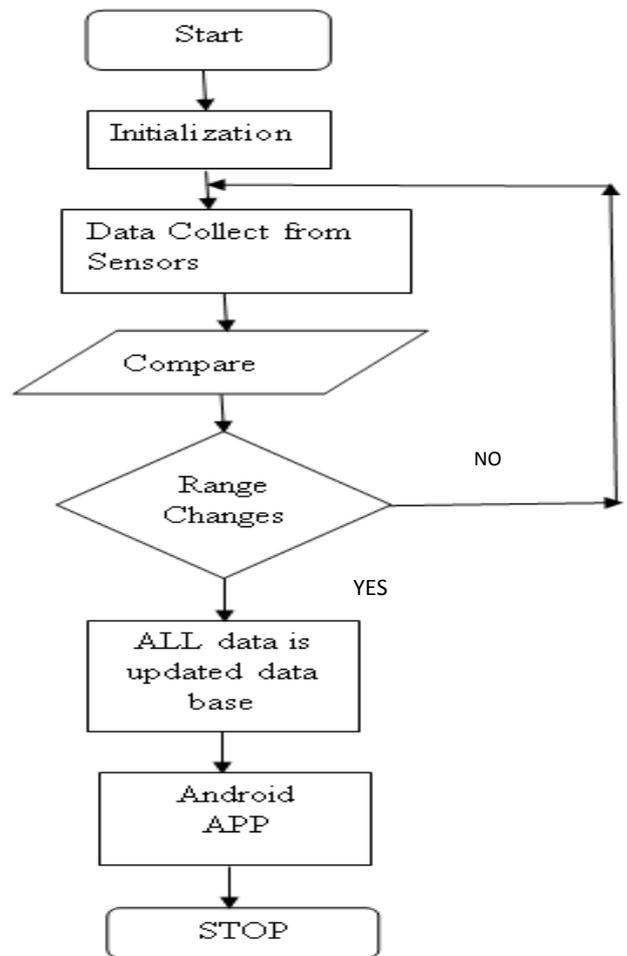


Fig.4.3 sensors changes value flow graph

5. RESULTS

The system will divided into main three parts that is input section, main processing unit, output section. The sensors at the input side will sense the temperature, water; CO₂ and camera will take the snap and gives the LIVE updates to the system. The all collected data that will stored into the database. The database is in the VB.

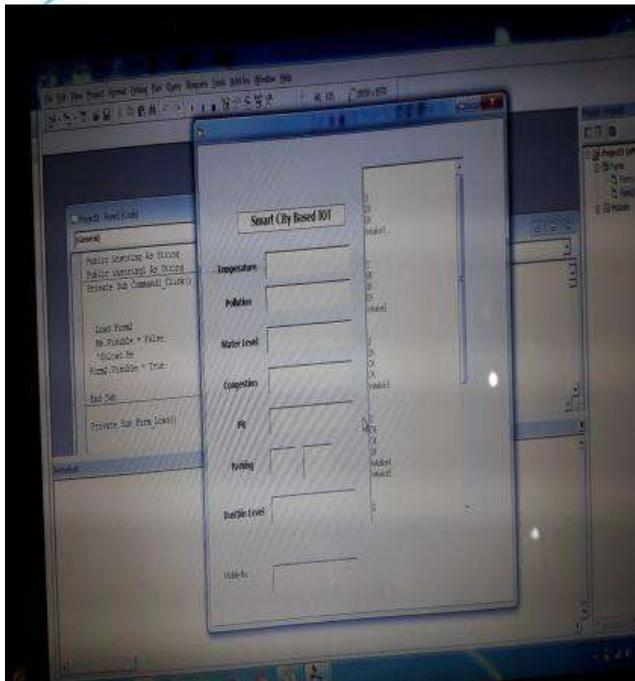


Fig. 5.1 VB Database initial

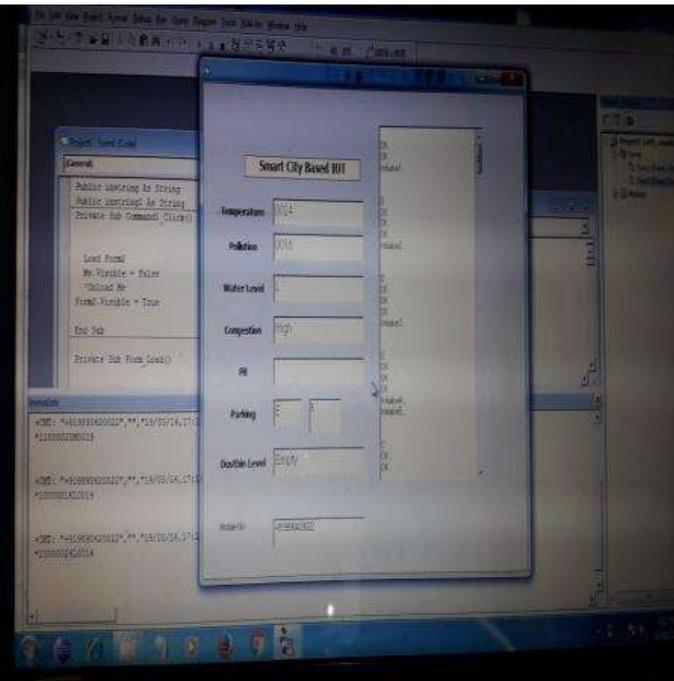


Fig. 5.2 VB Database Update

Fig.5.1 shows the VB data base initial satage.they also shows the congestion on the road .The all values which shows in the Fig 5.2



Fig. 5.3 Mobile app initial



Fig .5.4 Mobile App Update

The system will available to the citizens to check the all-LIVE situation on the road .The camera module is placed on the road that will detect the traffic on the road and gives updates. The android app is designed for the citizens. When they will requested to information like “GET STATUES” in shown in fig 5.3 the all information is on the mobile app as shown in Fig.5.4.When traffic is very high on the road they will find shows the message to find another way to travel.

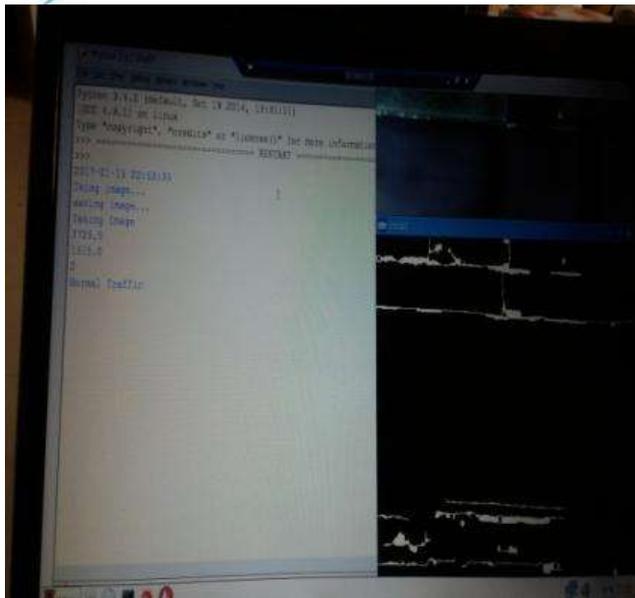


Fig.5.5 Image Processing of Normal Road

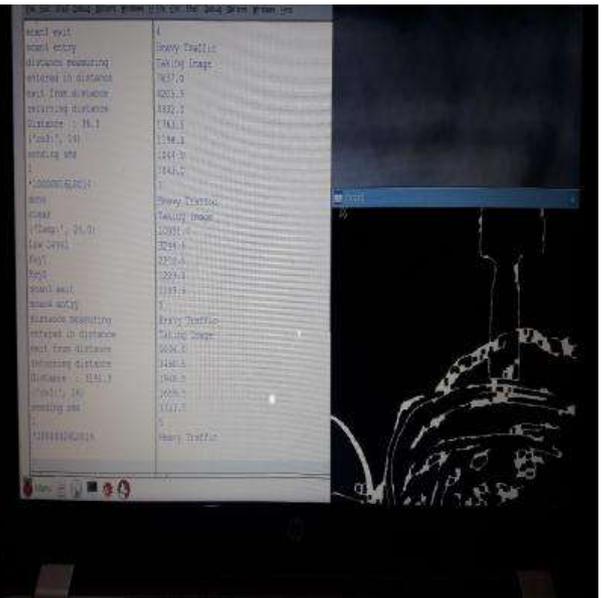


Fig.5.6 Image Processing of Traffic Congestion

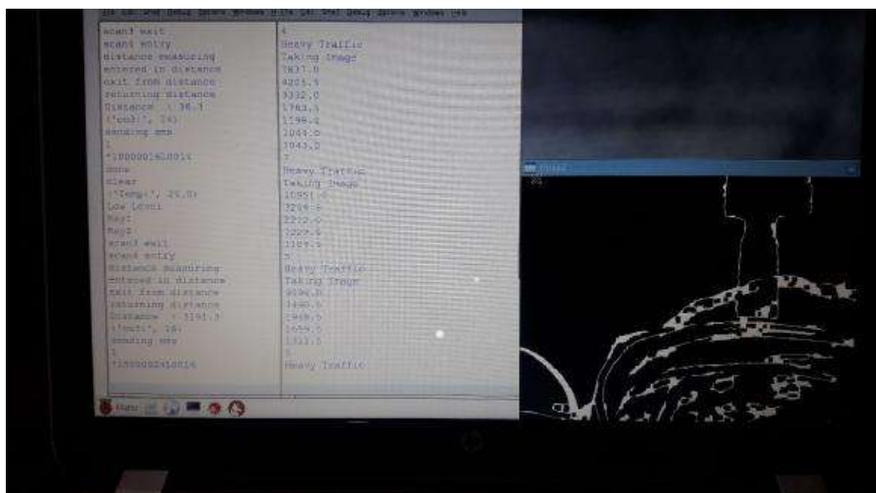


Fig.5.7. Water level, CO2, Temperature, Dustbin, IR Sensor on Server

6. CONCLUSION

In this paper, we analyzed the solutions currently available for the implementation. The system is developed for the multiple use of parameter. The water level leads are used to detect the water level medium, high, low level. LM35, MQ6, IR sensor, Ultrasonic sensor are used to measure temperature, CO₂ level, Parking Alert, dustbin level respectively. Using Image processing the Camera module is used for detection of road traffic and Pit detection. All these system achieve the smart use of technology. Android app is easily available to everyone for updating the all data on single click. For the better use we can use the complete system wireless and cloud based.

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