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High Speed Carry Look Ahead Adder and Subtractor using Xilinx ISE

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Abstract: An integrated system for traffic management that combines environmental monitoring and pollutant detection using Raspberry Pi. The system interfaces with MQ7 and MQ135 gas sensors via an ADC module to measure air quality parameters such as carbon dioxide and other pollutants. Additionally, DHT11 and BMP sensors are incorporated to monitor weather conditions including temperature, humidity, and atmospheric pressure. The Raspberry Pi serves as the main processor, gathering information from the several sensors. To evaluate the environmental conditions, the gathered data is compared to predetermined threshold values through analysis. If the sensor data surpasses these thresholds, indicating adverse weather or elevated pollutant levels, the system triggers an alert mechanism.

Keywords: Threshold Level, Conversion , Microsd, Pollutants, Raspberry Pi.

1. Introduction

In urban areas, there are about 1.4 billion people who live in air pollution levels higher than advised. Annually, air pollution causes around 7 million deaths worldwide, according to World Health Organisation (WHO) data. Seasons of the climate are being impacted by the unequal rise and fall of pollution and weather. People are now more aware of air pollution both inside and outside of their homes as a result. Cardiovascular disorders may arise when living things are exposed to contaminated air. Heavy traffic in metropolitan areas is an issue because of inadequate traffic management, which leads to the release of additional pollutants and poisonous air in many places. Such traffic-heavy regions ought to be on the observatory's radar. In order to measure various meteorological characteristics and pollutants, the Meteorological Department has established a number of costly weather and air quality monitoring stations throughout India; however, the stations are hundreds of miles apart.The current method uses an Arduino board in conjunction with a variety of sensors, and in order to transport data to the cloud, a separate internet connection component is required.

The primary aim of the suggested system is to monitor several parameters at designated locations, such as temperature, humidity, air pressure, and levels of carbon monoxide and carbon dioxide. Authorities can take the necessary actions to reroute traffic through alternative routes if the measured readings are higher than the safe level. This facilitates safe and healthful riding while aiding in traffic management. Redirecting traffic causes the various parameters to stabilise and return to a safe level. The system aids in providing the local population and those on the streets with reasonably excellent air quality[1]. The present research presents a prototype system designed for specific use in small-scale industries, homes, or offices. Using reasonably priced sensors, it aims to provide accurate and consistent readings of temperature, humidity, CO, CO2, and other potentially hazardous gases in the air.[2]. Information is sent to the cloud server while various atmospheric conditions outside the house or any other structures are examined[3]. There are five sections in this research. The introduction and reasons for the system's design are provided in Section I. The Literature survey all covered in Section II. The proposed system's theory & calculations is explained in Section III. Section IV displays hardware architecture, a description of the major system components, and the software requirements. Section V provides the system's

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real-time results. The proposed task is concluded in Section IV.

2. Literature Survey

A system for modelling, regulating, and tracking environmental characteristics in urban environments. The system is implemented to adapt efficient urban infrastructure and provides a framework for monitoring the urban environment after evaluating the urban microclimate. The technology is implanted using a low-cost Raspberry Pi. Temperature, pressure, carbon monoxide, and other parameters are monitored, however particulate matter is not given enough attention, leaving the environment monitoring lacking. The suggested prototype has sensors that give the values for many parameters, including pressure, temperature, humidity, and harmful gases. Thingspeak, a cloud service that offers both data storage and a clear visualisation of the collected data, was utilised in this work.

Shete, Rohini, and Sushma Agrawal [4] use Raspberry Pis to monitor the climate by implementing a particular protocol known as message queueing telemetry transport (MQTT). Customers can publish data to the broker over MQTT by using a publish-subscribe architecture. The data can then be obtained by interested clients subscribing to the broker.

In their study, Kumar, Somansh, and Ashish Jasuja [5] talk about tracking air quality with Raspberry Pis. In this, the MQTT protocol is also utilised. In this case, consideration is given to temperature, humidity, air pressure, and other common hazardous gases. The data is sent to the cloud server via the Raspberry Pi, which is connected to a router. The IBM Bluemix platform is used for data analysis and storage. In the process of creating a prototype, Marinov, Marin B., Ivan Topalov, Elitsa Gieva, and Georgi Nikolov[6] use a Microchip PIC18F87K22 microcontroller to monitor the air quality. Ten minutes are allotted to the collection and transfer of data. This prototype makes use of a GPS module to determine the modules' geographical location, a Wi-Fi module to transmit the data to the cloud server, and a variety of gas sensors to identify harmful gases. In locations without the ability to install a Wi-Fi router, it provides an optional GPRS module option.

The weather monitoring system offered by Krishnamurthi, Karthik, Suraj Thapa, Lokesh Kothari, and Arun Prakash [7] makes use of measures of temperature, humidity, dew point, heat index, and light intensity. An Arduino Uno microcontroller is utilised in this model. The DHT11 and LM35 are two sensors that are used to measure temperature. It may display the readings on an LCD panel. Analysis of the data will only be possible if it is linked to a computer that has a text file recorded with the readings. The communication or transmission module of this model cannot be used to send data to a server. As a result, remote monitoring is not supported by this model.

Pal, Poonam, Ritik Gupta, Sanjana Tiwari, and Ashutosh Sharma[8] integrated sound pollution detection and air pollution sensor to create a prototype. The Arduino Uno is used in the model, and all other parts are connected to it. Toxic gases are detected by means of the MQ135 sensor. The data is transferred from the system to the cloud server using the ESP8266 Wi-Fi module for data transmission purposes. Local values are shown on an LCD panel, and in the event of an emergency, a buzzer serves as an alarm.

B. Karthikeyan, C. M. Vidhyapathi, K. Vivek Babu, and K. Anudeep Reddy. A Raspberry Pi-based weather forecasting model is described [9]. Specifically, farmers' needs and agricultural uses were considered during the creation of the prototype. Examining the model's sensors—such as the moisture and rain sensors—makes this conclusion clear. A prototype is a type of model that can have sensors added or removed to suit varied needs. Data is transmitted to the cloud server via a Wi-Fi network by means of the Wi-Fi adapter that has been fitted to the model. For optimal data transfer, the Wi-Fi adapter's proximity to the router is crucial.

In order to accomplish environmental monitoring, Jaladi, Aarti Rao, Karishma Khithani, Pankaja Pawar, Kiran Malvi, and Gauri Sahoo[10] attempt to concentrate on the aspect of a wireless sensor network (WSN). In order to communicate with the server, it makes use of several data transfer components. The sensors of the prototype are connected to an Arduino Mega board. Multiple ZigBee modules are used to transport data. One ZigBee module receives the data sent by the microcontroller through another ZigBee module. The data eventually reaches the Raspberry Pi, which transmits it to the cloud server.

Jaladi, Aarti Rao, Karishma Khithani, Pankaja Pawar, Kiran Malvi, and Gauri Sahoo[10] try to focus on the feature of a wireless sensor network (WSN) in order to achieve environmental monitoring. It uses multiple data transmission components to communicate with the server. An Arduino Mega board is attached to the prototype's sensors. To transfer data, many ZigBee modules are utilised. Data provided by the microcontroller is received by one ZigBee module via another ZigBee module. After some time, the data arrives at the Raspberry Pi, which sends it to the cloud server.

The work includes an air pollution monitor system made especially to find dangerous chemicals including methane (CH4) and carbon monoxide (CO) [1].. The air quality data is captured by two sensors, processed by a Raspberry Pi, and sent to a cloud server. To improve

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road safety, create a complete traffic control system with a Raspberry pi that can remotely monitor meteorological conditions and pollution levels. This work's goal is to examine bad weather and pollutants affect transportation flow and safety. The Raspberry Pi will use sensors to gather data in real time on parameters including air quality. In order to impose speed limits, dynamically modify traffic signals, and give drivers real-time alerts, this data will be analyses The system encourages the effective use of road infrastructure depending on current weather and pollution conditions in an effort to maximize traffic flow, minimize accidents, and promote environmental sustainability.

Real-Time Monitoring: Utilizing a Raspberry Pi with suitable sensors, this system is able to remotely gather and monitor data on pollutants and meteorological conditions in real-time. The process of developing algorithms for data analysis involves analysing the gathered information to determine how pollution and weather affect traffic flow and road safety.

3. Implementation of Proposed Method

A Broadcom BCM2835 system-on-a-chip (SoC) with an ARM1176JZF-S 700 MHz CPU, a Video Core IV GPU, and 256 MB of RAM powers the Raspberry Pi. 512 MB of RAM was added to later models B and B+. The Model B+ employs a Micro SD card for booting and permanent storage in place of a built-in hard drive or solid-state drive.SoC memory can create a cache hierarchy and memory hierarchy based on the application. In the mobile computing sector, this is commonplace; however, many low-power embedded microcontrollers do not require it. Among the memory technologies for System on a Chip (SoC) are flash memory, random-access memory (RAM), read-only memory (ROM), and electrically erasable programmable ROM (EEPROM).

The MQ7 gas sensor is a member of the MQ Gas Sensors family, which also consists of other Metal Oxide Semiconductor (MOS) type gas sensors, MQ2, MQ7, and MQ135. Its primary objective is to detect carbon monoxide. The component parts of this sensor consist of a ceramic detecting element, primarily composed of aluminium oxide, covered with tin dioxide (SnO2) and enclosed in a stainless steel mesh. The sensing element's resistivity is affected anytime CO gas comes into contact with it. The change is then measured to ascertain the concentration of the gases present.

The MQ-135 gas sensor is intended to detect hazardous gases such as smoke. Numerous hazardous gases, including CO2, NH3, NOx, alcohol, benzene, smoking, and so forth, can be detected by it. High sensitivity to ammonia, sulphur, and benzoene steam, as well as susceptibility to smoke and other dangerous gases, characterises the MQ135 gas sensor. This module uses the hazardous gas detector chip and MQ-135 air quality detector. This module's LM393 analogue comparator chip and other circuit components make it simple to incorporate it into a project that may detect hazardous gases.

The DTH11 sensor has two possible uses: as a module and as a sensor. In any case, the sensor operates in the same way. While the module will have three pins, the sensor will be supplied in a 4-pin package, of which only three will be used.The DHT11 is a well-liked temperature and humidity sensor. The sensor has a dedicated NTC for temperature measurement in addition to an 8-bit microprocessor that outputs temperature and humidity values as serial data.

A GSM modem is a device that allows computers and other processors to communicate over a network. It can be used as both a modem and a mobile phone. A GSM modem requires a SIM card and a network range that has been subscribed to by the network operator in order to operate. It can be connected to a computer via Bluetooth, USB, or serial connection.

4. Experimental Method/Procedure/Design

Designing an extensive traffic management system with a Raspberry Pi that can remotely monitor pollution and weather conditions in order to improve road safety. The purpose of this project is to investigate whether pollutants and unpleasant weather affect traffic flow and safety. The Raspberry Pi will use sensors to gather data in real time on variables including air quality, visibility, and road surface conditions. In order to impose speed limits, dynamically modify traffic signals, and give drivers real-time alerts, this data will be analyses.

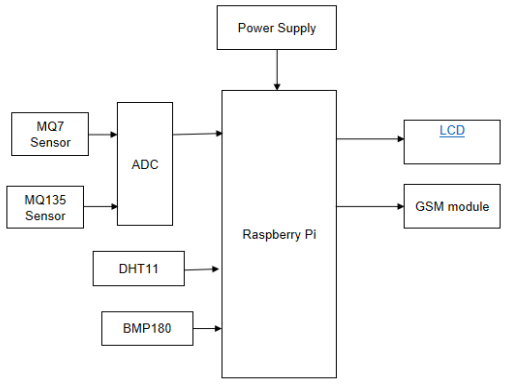

Fig.1 Block Diagram.

The system encourages the effective use of road infrastructure depending on current weather and pollution conditions in an effort to maximize traffic flow, minimise accidents, and promote

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environmental sustainability. The Raspberry Pi's capabilities combined with a variety of sensors. In addition to DHT11 and BMP sensors, the system has MQ7 and MQ135 gas sensors, which are interfaced with the Raspberry Pi through an ADC module. The constant monitoring of environmental parameters and pollutant levels is ensured by this automated approach. As a central processing unit, the Raspberry Pi gathers, processes, and displays data instantly. Since the Raspberry Pi is small and can be widely deployed, it is possible to create a dense network for thorough monitoring by using inexpensive sensors. When unfavorable situations are observed, the system can rapidly trigger alerts because predetermined threshold values have been incorporated.

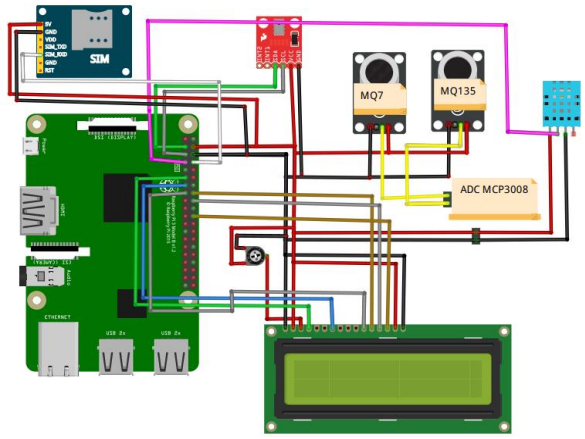

Fig.2 Circuit Diagram

5. Results and Discussion

The amount of pollutants generated during vehicle combustion and the meteorological conditions have an effect on the temperature, humidity, carbon dioxide, carbon monoxide, and light intensity readings that are taken in real time.The flow of traffic can slow down the movement of vehicles, which increases pollution emissions and raises readings since the density of vehicles varies during the day.The same process is performed at several sites to determine the quantity of pollutants released at different times of the day.

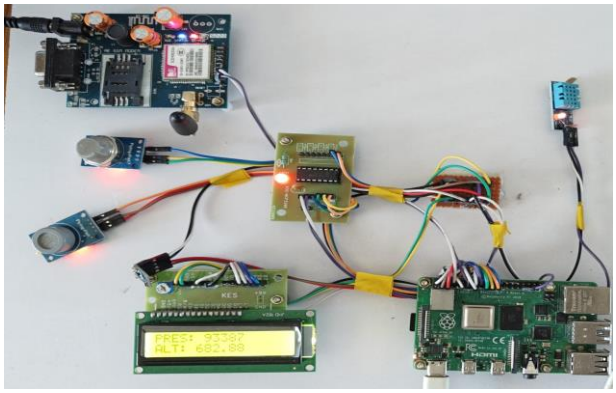

Fig.4 Showing results of Pressure and Alt

As a result, if there is a lot of slow-moving, heavy traffic on this road, the concentration of carbon particles will rise, endangering the health of those who routinely travel it.It was also noted that there was a correlation between the rise in pollution and meteorological factors like humidity and temperature.

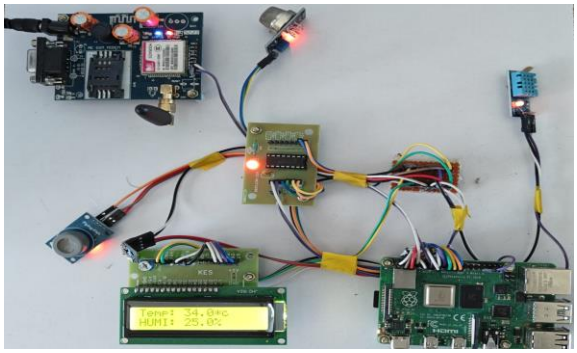

Fig.5 Showing results of Temperature and Humidity

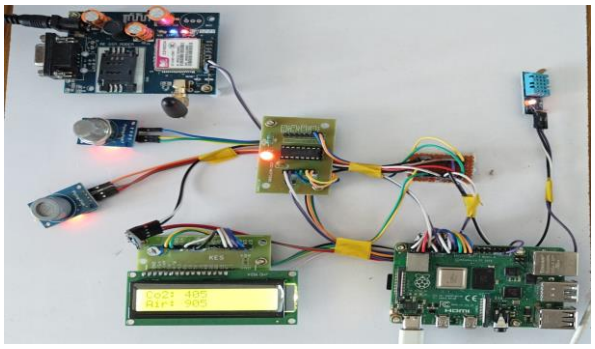

Fig.6 Showing results of CO2 and Air

The average carbon dioxide and carbon monoxide readings on the graphs show that they are within safe bounds. On the other hand, the average concentration of contaminants may surpass the allowable threshold mark in numerous other heavily trafficked areas; for these reasons, the designed system will contribute to the availability of clean, fresh, and good air.Use the Save As command to make a duplicate of the template file while adhering to the naming standard.The system will support traffic control.The authorities may also take action if the values exceed the safe level mark.

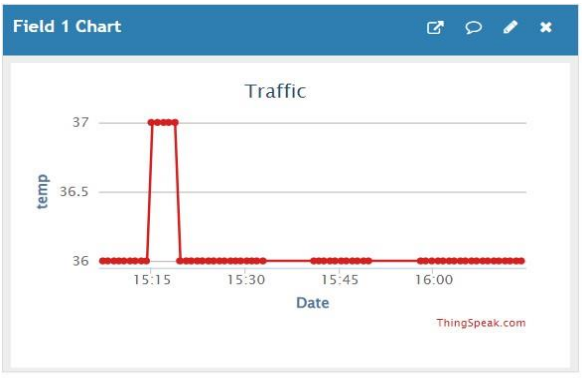

Fig.7 Graph showing Temperature

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Fig.8 Graph showing Humidity

Fig.9 Graph showing CO2

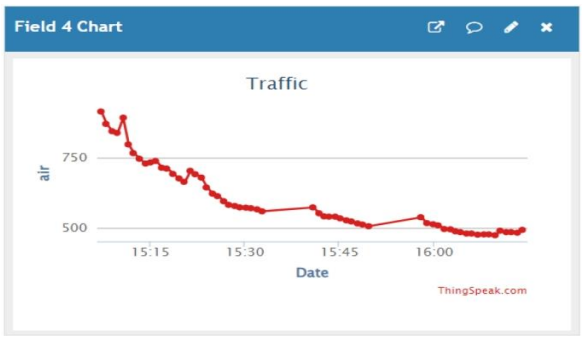

Fig .10 Graph showing Air

Fig .11 Graph showing Atmospheric Pressure

Fig.12 Graph showing Alt

6. CONCLUSION AND FUTURE SCOPE

To sum up, this work offers a forward-thinking remedy for the shortcomings of conventional manual monitoring techniques. The system uses a variety of sensors and the Raspberry Pi's capabilities to provide continuous, real-time monitoring of environmental factors and contaminant levels. Cost and responsiveness concerns are addressed by the integration of reasonably priced sensors and the automation of data collecting and analysis. The use of this technology is expected to improve traffic management by providing precise and fast information on pollution levels and weather. An efficient and successful reaction mechanism is ensured by the pairing of a GSM module for instant alerting and an LCD for visual feedback. In addition to increasing road safety, this project develops automated monitoring technologies that may find use in a variety of industries. The topic of pollution management greatly benefits from weather forecasting. IoT weather monitoring is useful for keeping an eye on the weather in areas with high traffic and temperatures. A human person finds it quite challenging to remain in such locations for an extended period of time. or even regions that experience radioactive temperature exposure. The IoT-supporting controller for the weather monitoring system is entirely automated. It can receive a pre-warning of the weather and doesn't need human intervention.

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