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Development of Sustainable Smart City Model using IOT

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ABSTRACT: This project proposes a comprehensive system for enhancing urban livability through real-time monitoring of air quality and efficient management of vehicular traffic. In the contemporary urban landscape, the proliferation of vehicles and industrial activities has led to worsening air quality, posing significant health risks to residents. In response, smart city initiatives leverage advanced sensor technologies and data analytics to create proactive solutions. Our proposed system integrates a network of air quality sensors strategically positioned throughout the city to continuously monitor pollutants such as particulate matter, nitrogen dioxide, and carbon monoxide. Concurrently, the system employs computer vision algorithms to detect and analyze vehicle motion patterns, enabling real-time traffic flow optimization and congestion mitigation.

KEYWORDS: Lidar, Sustainable, Simulation, Sensor, Smart City.

I. INTRODUCTION

Environmental Pollution is the introduction of contaminants into the natural environment that causes adverse change. Pollution has cost. Manufacturing activities that cause air pollution impose health and clean-up costs on the whole society, whereas the neighbours of an individual who chooses to fire-proof his home may benefit from a reduced risk of a fire spreading to their own houses. A gas detector is a device that detects the presence of gases in an area, often as part of a safety system.

This research project aims to detect dangerous gases such as Carbon monoxide which maybe odourless, colourless gas, making it difficult for humans to detect. This handheld gas detecting device can be used to detect gas leaks in industrial as well as household environment using android smart phone application.

Contactless distance measurement can be done by many different methods, according to the selected principle. In various applications, transmitters and receivers use infrared light, the distance being measured by the method of optical triangulation. Other systems for distance measurement are based on laser, a method providing increased accuracy and precision.

Motion detection of objects or living beings might be interesting in many domains, such as security devices, radars, the positioning of industrial robots, liquid levels in tanks, the depth of snow banks and auto guidance systems. Most of these applications require that the detection system to be non-invasive and to not disturb the normal work environment, devices or living beings in the area of detection.

This involves the choice of discrete vectors for information transport, with high immunity to all other factors unless the state of motion. The detection system may be passive, but in this case, the moving object must have a specific property that can be detected, for example, light or infrared radiation.

This conditioning limits the field of system applicability, but presents the advantage of high discretion for detector. There are also active detection systems, consisting of a transmitter and a receiver that does not impose any special condition for the detected object.

II. RELATED WORK

The **HC-SR04 Ultrasonic (US) sensor** is a 4-pin module, whose pin names are VCC, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The range of this sensor is best in 30-degree angle. The sensor works with the simple high school formula that

$$\text{Distance} = \text{Speed} \times \text{Time}$$

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module as shown in the fig.

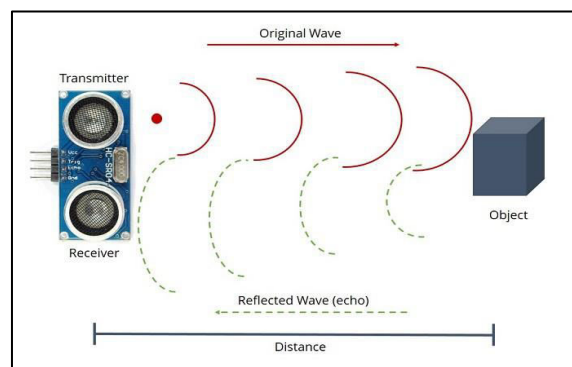


FIG: WORKING OF ULTRASONIC SENSOR

Now, to calculate the distance using the above formulae, we should know the Speed and time. Since we are using the Ultrasonic wave, we know the universal speed of US wave at room conditions which is 330m/s. The circuitry inbuilt on the module will calculate the time taken for the US wave to come back and turns on the echo pin high for that same particular amount of time, this way we can also know the time taken. Now simply calculate the distance using a microcontroller or microprocessor.

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension. ion. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right-hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

SKETCH

1. **Verify/Compile**- Checks your sketch for errors compiling it; it will report memory usage for code and variables in the console area.
2. **Upload** -Compiles and loads the binary file onto the configured board through the configured Port.
3. **Upload**- Using Programmer this will overwrite the boot loader on the board; you will need to use Tools > Burn Boot loader to restore it and be able to Upload to USB serial port again.
4. However, it allows you to use the full capacity of the Flash memory for your sketch. Please note that this command will NOT burn the fuses. To do so a Tools -> Burn Boot loader command must be executed.
5. Adds a library to your sketch by inserting #include statements at the start of your code. For more details, see libraries below. Additionally, from this menu item you can access the Library Manager and import new libraries from .zip files.
6. Adds a source file to the sketch (it will be copied from its current location). The new file appears in a new tab in the sketch window. Files can be removed from the sketch using the tab menu accessible clicking on the small triangle icon below the serial monitor one on the right side to the toolbar.

TOOLS

1. **Format** -This formats your code nicely: i.e. indents it so that opening and closing curly braces line up, and that the statements inside curly braces are indented more.
2. **Archive**-Sketch Archives a copy of the current sketch in .zip format. The archive is placed in the same directory as the sketch.
3. **Fix Encoding & Reload** -Fixes possible discrepancies between the editor char map encoding and other operating systems char maps.
4. **Serial Monitor** -Opens the serial monitor window and initiates the exchange of data with any connected board on the currently selected Port. This usually resets the board, if the board supports Reset over serial port opening.
5. **Board**-Select the board that you're using. See below for descriptions of the various boards.
6. **Port**-This menu contains all the serial devices (real or virtual) on your machine. It should automatically refresh every time you open the top-level tools menu.
7. **Programmer**-For selecting a hardware programmer when programming a board or chip and not using the onboard USB-serial connection. Normally you won't need this, but if you're burning a boot loader to a new microcontroller, you will use this.
8. **Burn Bootloader**-The items in this menu allow you to burn a bootloader onto the microcontroller on an Arduino board. This is not required for normal use of an Arduino or Genuine board but is useful if you purchase a new At mega microcontroller (which normally come without a bootloader). Ensure that you've selected the correct board from the **Boards** menu before burning the bootloader on the target board. This command also set the right fuses.

III. METHODOLOGY

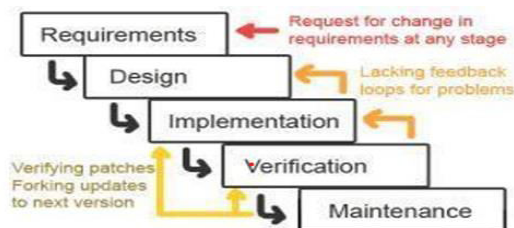


Fig: Iterative Waterfall model

We have used Arduino Mega 2560 as the microcontroller to process the data output from the sensor breakout board. The analog output from the MQ sensor array is amplified using LM-393 and there is also provision for sensitivity adjustment.

The analog output from the respective MQ sensors with breakout is given to analog ports A0, A1 and A2 of the Arduino. A Bluetooth module HC-05 is used to wirelessly transfer serial data to the smart phone with android application installed in it.

The range of the HC-05 Bluetooth is approximately 10 metres (30 feet). By placing the device near the exhaust of the automobile, one can monitor the emission readings on the Smartphone using our android application. A provision is given in the smart phone application to enter the registration number of the vehicle whose emission is being monitored. A graph of time v/s amplitude of the emissions (CO, CO₂ and HC) is plotted.

CO and CO₂ are represented in %vol and HC is represented in ppm according to the present standards in India. Also, a provision is made to display the peak values of these gases.

IV. EXPERIMENTAL RESULTS

A low-cost air pollution monitor is a device that uses one or more than one sensor and other components to detect, monitor and report on specific air pollutants like particulate matter (PM) or carbon dioxide and/or environmental factors such as temperature and humidity. In Intelligent Transportation Systems, vehicle classification and detection in real time is extremely crucial for many applications such as intelligent traffic control, surveillance, public safety and security etc.

AIR QUALITY MONITORING

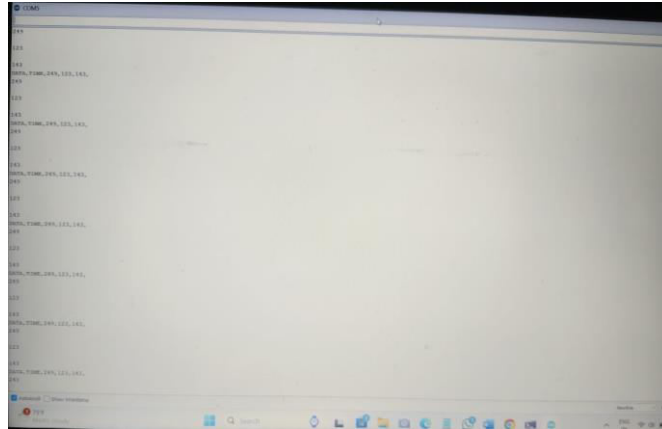


Fig: AIR QUALITY MONITORING MODEL

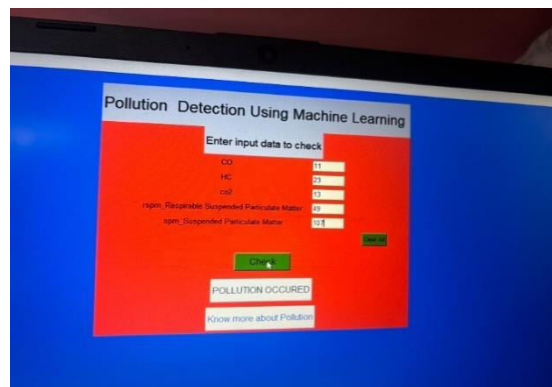
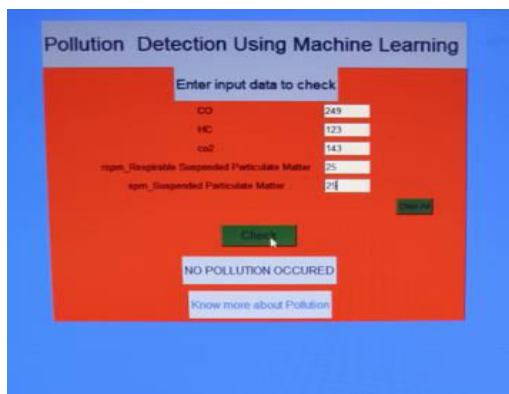


Fig: VALUES MEASURED BY SENSORS

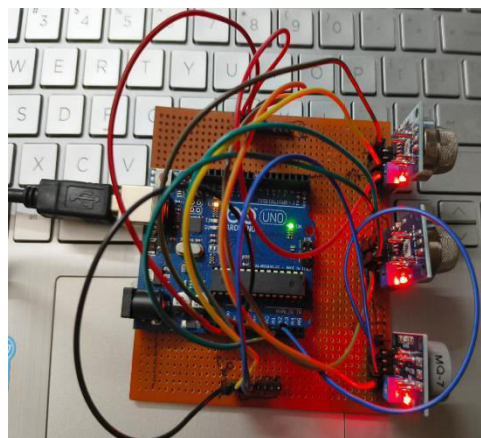


Fig: OUTPUT OF AIR QUALITY MONITORING

The model uses sensors that sense various forms of gases, displays the measured values in parts per million (ppm), and stores this data in the system. The pollution occurrence is also displayed using machine learning.

VEHICLE MOTION DETECTION

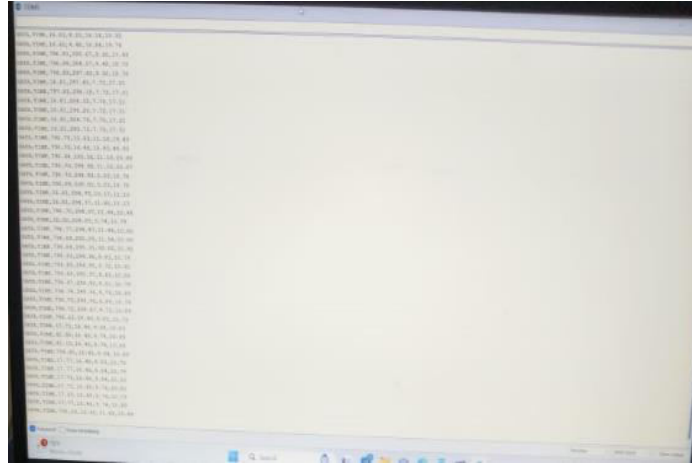


Fig: VEHICLE MOTION DETECTION MODEL

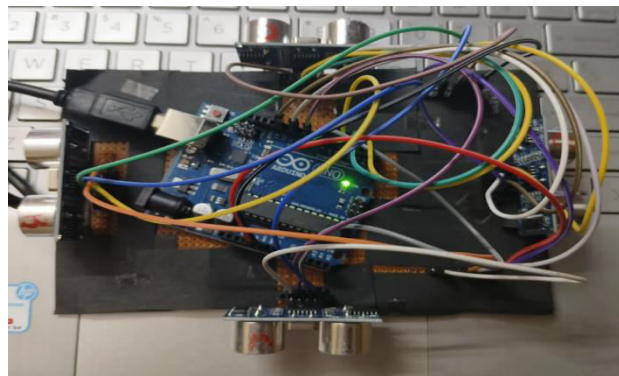


Fig: VALUES MEASURED BY THE ULTRASONIC SENSORS

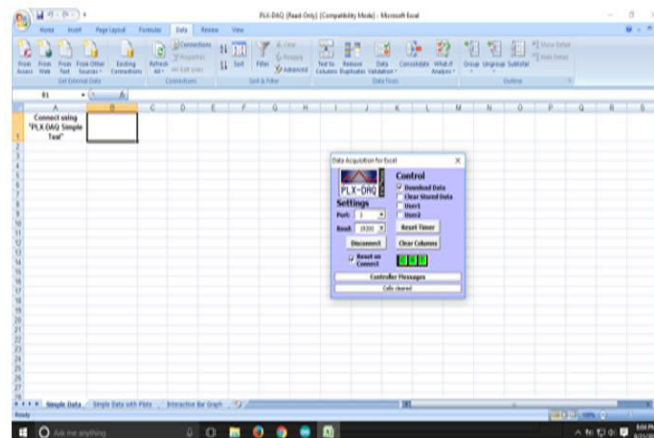


Fig: OUTPUT OF VEHICLE MOTION DETECTION

- └ Use the Arduino IDE to write the code.
- └ Start by defining the pins for the ultrasonic sensor.
- └ In the loop, trigger the ultrasonic sensor by sending a pulse, and then measure the time it takes for the echo to return.

- └ Convert this time into distance using the speed of sound (around 343 meters per second).
- └ Set a threshold distance to detect the motion. If an object is closer than this threshold, consider it as a detected motion.

V. CONCLUSION

There is an increase in the level of air pollution over last couple of decades, leading to several environmental problems, which are resulted in Ozone layer depletion leading to greenhouse effect. Air pollution also affects the human health causing the lungs and respiratory system problems. So, the developed system will be highly beneficial in curbing this problem in the society by detecting the level of pollution and indicating it to the RTO by sending a message. Also, this system will be one of the greatest improvements in technology to keep the Environment free from vehicular emission and bring it to halt if the pollution level is more than the Standards mentioned by the government.

Motion detection is a simple task because of the improvement in the sensor technology and with ever increasing accuracy of the same. The objective of this project was to design and implement an Ultrasonic Distance Measurement device and predict the future. As described in this report a system is developed that can calculate the distance of the tracked object. With respect to the requirements for an ultrasonic sensor, the system can calculate the distance of the obstruction with sufficient accuracy, this device has the capability to interact with other peripheral if used as a secondary device and can also communicate with PC through its serial port.

This offers a low cost and efficient solution for non-contact type distance measurements. The/ major challenge that we have encountered is the prediction of motion of any object with the existing data and runtime data. This can be done by Machine Learning algorithms which allow the machines to learn on their own. Logistic regression is one such Machine Learning algorithm used to model the probabilities for classification problems with two possible outcomes. Ultrasonic sensors were mounted at different orientations, continuously gathering data of the ether. The data acquired is then analysed, visualized and used for future predictions/ conclusions.

REFERENCES

1. Daimei Fu ; Zhihong Zhao, Moving object tracking method based on ultrasonic automatic detection algorithm, 2022.
2. Apurva Rajendra Patkar ; Pankaj P. Tas Gaonkar, Object recognition using horizontal array of ultrasonic sensor, 2023.
3. Karzan A. Raza ; Wray Monnet, Moving object detection and direction-finding with HC-SR04 ultrasonic linear array, 2020.
4. Sweta Pandey ; Pratistha Mathur ; Tejashri Patil Real time traffic signal control using fuzzy logic controller: review, 2019.
5. Jiayang; Sheng Bo; Chang Liu ; Bo Cheng Dynamical tracking of surrounding objects for road vehicles using linearly-arrayed ultrasonic sensors, 2022.
6. Parveen Jain, International Conference on Advances in Communication, Network, and Computing. NC Automatic Traffic Signal Controller for Roads by Exploiting Fuzzy Logic, 2022.
7. MQ-4 gas sensor data sheet with specifications- <https://www.sparkfun.com/datasheets/Sensors/Biometric/MQ-4.pdf>.
8. MQ-7 gas sensor data sheet with specifications- <https://www.sparkfun.com/datasheets/Sensors/Biometric/MQ-7.pdf>.
9. MQ-135 gas sensor data sheet with specifications- <https://www.olimex.com/Products/Components/Sensors/SNS-MQ135/resources/SNS-MQ135.pdf>.
10. The green house effect- facts on climate change- <http://climatechange.gc.ca/default.asp?lang=En&n=1A0305D5-1>.



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