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An Approach of IOT Based Air Pollution Monitoring and Control System

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Abstract— Nowadays, Air pollution is a major crisis in the current scenario which creates adverse effects on climatic conditions, humans and other living beings. Hence, it is essential to control the pollution from creating an imbalance in the nature. The existing model involves the pollution control of a particular vehicle. In this project, a new technology called Internet of Things (IOT) has been incorporated to continuously monitor the pollutants level of every vehicle in a particular area and control them. Each vehicle is fitted with gas sensor to measure gas level. The PIC microcontroller reads the data and the output are updated in the webpage cloud server created using LABVIEW. These data are been continuously monitored. Whenever the amount of pollutants of any vehicles crosses the threshold value, intimation will be sent to the owner through a text message. In case after two or three times, if the owner fails to care about it, a message will be sent to the RTO office and necessary action would be initiated. Additionally, this project also concentrates on automatic AC ON/OFF by use of humidity sensor. And with the help of DC motor and temperature sensor, the system automatically pumps the water to radiator, when it gets heated up. Thus an efficient control method has been shown in proposed method.

Index Terms— IOT, Gas Sensor, Temperature Sensor, Humidity Sensor.

I. INTRODUCTION

The air pollution is the process of dispersion of unnecessary and harmful pollutants in the earth atmosphere. This contamination of air substances may lead to diseases, serious allergies, human deaths and a threat to all living organisms including flora and fauna. The air pollution may originate from natural sources or manmade sources. This problem assumes an alarming role, when toxic gases get mixed with the atmospheric gases.

In general, there are two types of pollutants namely primary and secondary. The former refers to direct emission of pollutants in the air from vehicle or factories. The latter type of pollutants is not directly emitted. One such example is Ground level Ozone.

Hence, it becomes very important to prevent the contamination of air, by chemical pollutants. The vehicular pollution is one such type, which can be minimized to maximum extent, by suitable methodologies. There are several methods devised to check the pollution caused by vehicles and to punish the vehicle users, who are responsible for this. In this project, the disadvantages of above said methods are overcome by employing suitable sensors in the vehicle, combine with IOT based Cloud computing system, which is found to be more reliable and efficient[1].

In [2], the monitoring of pollution with the help of Mq135 sensor is proposed. Here the sensors are automated and controlled with help of PIC Microcontroller. Pollution level is displayed in LCD. MATLAB software is to use simulate this project. This provides a control over the pollution monitoring to make the smart environment.

In [3], the author describes the way of monitoring and controlling the pollution in the vehicle. A simple wireless embedded chip is inserted in the personal vehicle. Here the pollution is monitored by the traffic monitor station remotely, by placing a series of gas sensor connected to WIFI based control system. Depending on the pollution level measured from the sensor, the operator will send the command to traffic pollution control system. This control system broad cast the message to all vehicles to turn on/off ignition automatically. The proposed monitoring and controlling of pollution at traffic light will reduce the air pollution at cities.

In [4], the author describes smart air pollution monitoring and control system. Sensors like temperature, gas are interfaced with ARM microcontroller for monitoring the air pollution released from vehicle. The sensor values are

displayed in LCD. All the values are transferred to mobile through Bluetooth. The system will be more feasible as all the values are sent by microcontroller to mobile. Mobile application stores the sensor values in form of database. User can able to see the pollutants value in LCD display. Each pollutant values are compared to threshold value of the air pollution. If pollution value is above threshold value, alerted message will be sent to the user.

In exixting technique, the level of air pollution monitoring using smart phone, sensors are interfaced with ARM microcontroller. The amount of pollutants are measured from vehicle. All pollutant values are displayed on the LCD and simultaneously pollutants values are transmitted through Bluetooth. This is a transmitter section.

Another one is receiver section, which receive the pollutants value emitted from Bluetooth. Bluetooth is receiving pollutant value from the microcontroller. The gas sensor sends the values to ARM Microcontroller. The pollutants value is compared to the threshold value set by the RTO officer. If pollutants value above the threshold value then the message is conveyed to user on mobile phone. The disadvantages of this method are Bluetooth range, because Bluetooth range work with particular region. The large amount pollution cannot be detected from this method. This method cannot be accessed from everywhere [5].

II. PROPOSED SYSTEM

In proposed technique, the level of pollutants emitted by the vehicles is monitored continuously using sensors. The complete details of pollution level were updated in IOT based cloud server monitor page. The block diagram of the proposed system is shown in figure 1.

The gas sensor placed on the vehicle measures the pollutants level and cautions the vehicle user through a message. When pollutants level reaches above threshold value, admin will send first warning to user. If user ignores about the pollutants released from vehicle for one day, again admin will be send the second warning to user. If user doesn't care about warning within two hour, Admin will send final warring to user; about ceasing of vehicle.

The humidity sensor used in this project, is to measure temperature level inside the vehicle. If the temperature value is above 15 percent, AC will be turned OFF, as a result of dehumidification. If the temperature value is below 15 percent, humidity is low so AC will be turned ON.

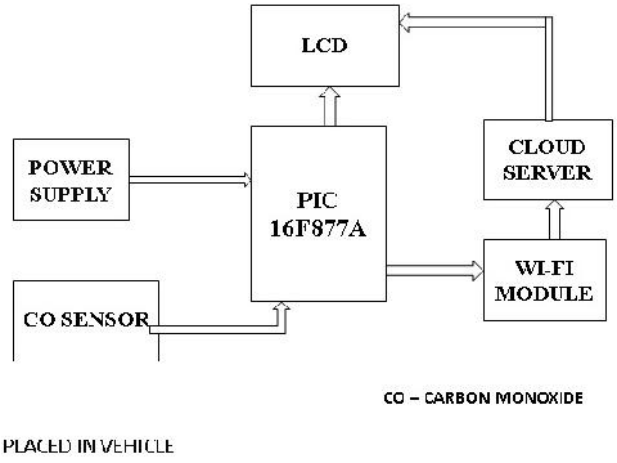

Fig 1. Proposed Block Diagram

The temperature sensor used to measure heat released from the radiator. If the temperature value is above 30 degree, motor should be automatically turned OFF. In the event that the temperature value is below or equal to 30 degree, heat will be low so radiator will be ON.

It is simple and efficient method to reduce pollution in vehicle using IOT based cloud server. The implementation of this module successfully monitors pollution and automatically sends information to the IOT based cloud server.

The advantages of this technique are that each vehicle is monitored and rules violating vehicles are identified. In this technique using IOT, we can view pollutants value at any place.

In this paper, three things are monitored. First one is to monitor the air pollution level, where if pollutants value is above 300 ppm, set d equal to 1. When d equal to 1, send warning to user. If final equal to 1, first warning will be sent. If final equal to 2, second warning will be sent. If final equal to 3, third warning will be sent.

Second one is to measure the temperature in radiator. Motor is turned OFF, when temperature is high and motor is turned ON, when temperature is high. Last one is to measure the humidity inside the vehicle. If the humidity is high, AC is turned OFF and if the humidity is low, AC is turned ON. The overall block diagram of the proposed system is shown in figure 2.

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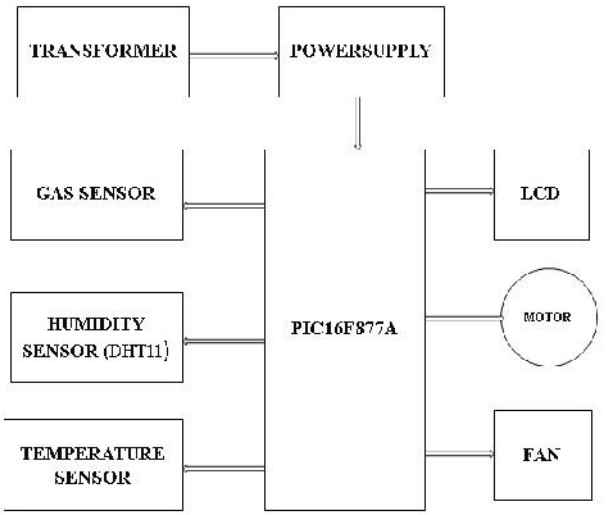

Fig 2. Overall Block Diagram of the Proposed System

III. PROPOSED HARDWARE MODEL

LABVIEW software is used to create the webpage, for sending the warnings to user.

Labview has two panels, namely front panel and block diagram. Block diagram is used to create a new blank VI . The components are draged from palette and placed in front panel, after which the block diagram was created. Here we create the front panel by dragging the boolean component from the control palatte.

First the values are initialized, which is connected to shift register. Here shift register is used to for loop or while loop, which repeat the block of operation on the block diagram. Shift register is connected to case structure, where a case structure is wired through enum. The "?" sign is used on case structure. In case structure there are four operations, which are initialize, wait for event, admin and stop.

Initialize is used to introduce the value. Wait for event operation consists of source, time and type, using whichtime delay,source and time are created. Inside the wait for event, it consists of timeout and value change. The two types value are changed, 1 for type the first value change and -1 for the second value change. Stop function is used by the positioning tool terminator, whose terminals are entry and exit ports, which is inside the stop function. It is used to represent front panel controls and indicators. The terminal is used to exchange the information between front panel and block diagram.

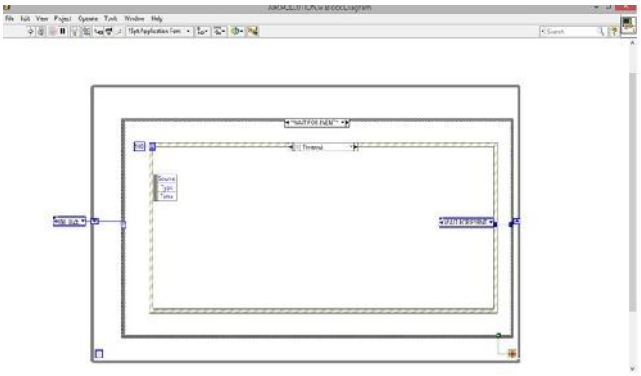

Fig 3. Front Panel VI

After finishing the program the front panel is opened which is shown in figure 4. The blocks are displayed in the front panel by pressing the block and then clicking run button, which is given in the top of front panel.

After pressing the run button, an indication about running VI is displayed. Again the block (block named as admin) is clicked, which opens the sign in page. If we want to stop the program, nearer to the admin block stop button is present, which can be used to stop the VI after completion of current iteration or abort the current iteration.

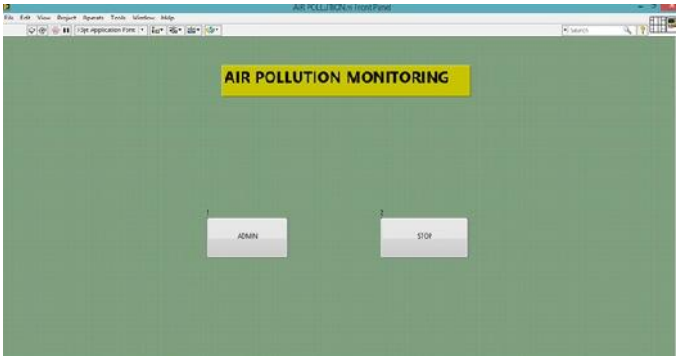

Fig 4. Front Panel

After opening the front panel, the login page is shown. First initialize the values in login page, which is connected to case structure. The case structure has four conditions, which are initialize, wait for event, login and logout. Initialize the variables same as front panel. Wait for event consists of the source, time, type. Source is used to specify timing source.

Inside the event has timeout function, which is used to specify maximum of time in millisecond. Timedloop which is used in wait for event, can be

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made to wait for trigger from the time source. Login structure is used to create the user id and password. User id is named as ADMIN using indicator and password is set as 12345. If password needs to be changed, it can be changed from the login function.

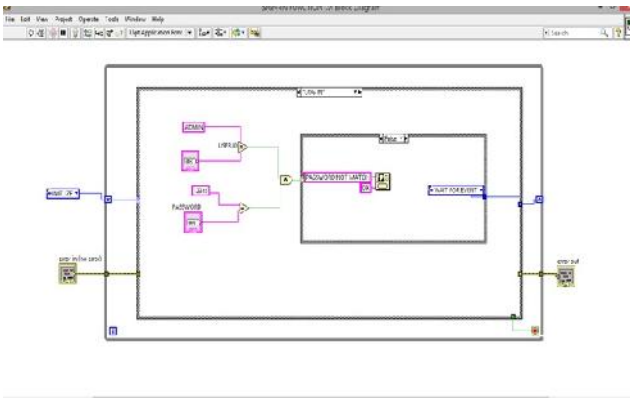

Fig 5. Login Page VI

Using "AND" gate, the user id and password are connected to another case structure. If user id and password are correct, true operation is executed in case structure, and then opens the result page. If user id or password is incorrect, the false operation is executed in case structure and then a pop up message will show in login page as "password not match". Log out is generally sign out function. Error in and error out function are used in program, which are used to fix the error in programs. Error out is used to fix programming error and erase the error in wire. Error in is used to clear error in VI and sub VI function. Generally error function is used for debugging and clearing the errors in programs.

After completing the program, Two Boolean functions for user id and password are created. The State machine architecture is used to code the program between login pages and block diagram.

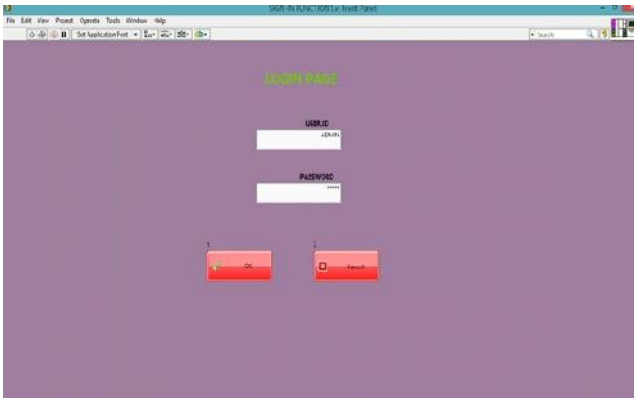

Fig 6. Login Page VI

When the user id and password are entered in the front panel, after validation, the result page gets opened which is shown in figure 8. The result page consists the queue, which is based on message handler architecture. Queue based architecture has more advantage than the state machine, because of easily enqueue and dequeue of the data. If the state machine is used to execute one function at a time, with out completing the one function, it doesn't goes to next function, but queue based machine executes more number of function at a time.

VI Result consists of the queue, wait for event, input and out.Initialize the variable connected to the queue. Queue has two function called as enqueue and dequeue. Queue is used to communicate the data between block diagram to another VI. Enqueue is used to insert the new data in queue and dequeue is used to remove the data in queue. Queue consits of queue in, queue out, remaining elements, error in and error out. Queue in contains the array input and queue out consists the reference of the queue. Remaining elements consists of removed elements,which are from front element and last element.

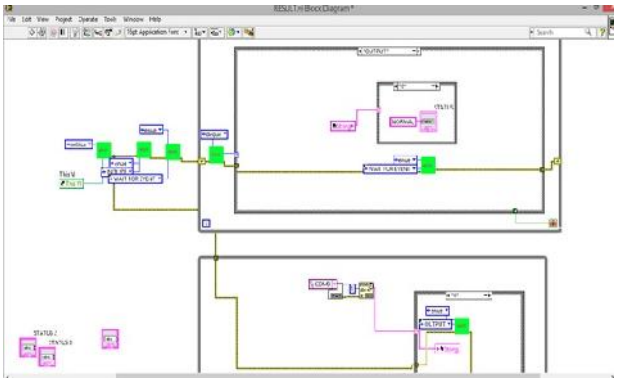

Fig 7. Result Page VI

Case structure consists of wait for event, input and output. Wait for event contains the warning message, where warning 1 input is enqueued in queue. Similarly warning 2 and warning 3 are also enqueued in queue. Input case has serial visa information, it is transferred from system to user module via port C. Input of case structure contains the string value (gas value) obtained from working module, Ouput of case structure consists 0 or 1, where 0 indicates "normal" and 1 for "abnormal" level of pollutants. Here parralelly data can be transferred.

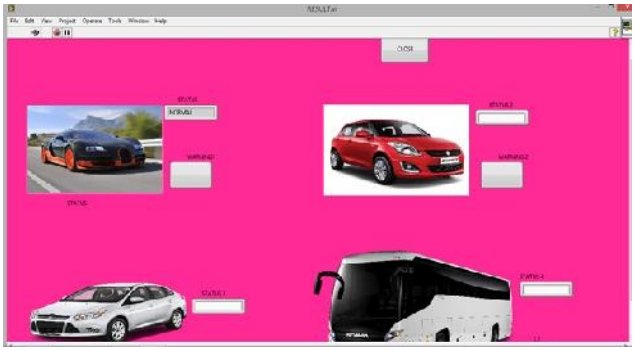

Fig 8. Result Page

In this webpage, we are controlling only one vehicle. For which, if the gas pollutants falls below the 300 ppm the value equals 0 and the page displays "normal" as status. For values above 300 ppm, the case value equals to 1, and "abnormal" status is displayed. If the status is abnormal, 3 levels of warning messages are sent to the user. If the user ignores the third message, intimation will be sent to the RTO Office, for taking further actions on the user.

IV. CONCLUSION

The proposed system employed with sensors, displays the sensed output of the pollutant contents, humidity present inside the car and the temperature of radiator. The gas sensor output is then pushed to cloud and can be viewed through internet. Based on the reference check, warning messages can be delivered to the owner. Also, using IOT the data of pollution level can be monitored anywhere using a computer or phone. This is a robust system and it is very useful in helping out to control the vehicular pollution. Additionally the system monitors the humidity level in the car and automatically controls the AC system. A separate temperature sensor attached to this setup, helps in pumping water to the radiator, when the temperature exceeds the pre-set value. The system is user friendly and the cost of the product is affordable. The results of the project are accurate and can be implemented in any area for the safety of the people and environment. In this system, monitoring is done using IOT based cloud server computing, which makes the air pollution check simple and efficient.

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