Implementation of System for Air Quality Monitoring with Respect to Atmospheric Parameters using Raspberry Pi

A.Narendra Babu , E.V.Krishna Rao, G.Srinivas Rao, S.V.Jagadeesh Chandra, B.G.V Pushpanjali, V.Kranthi Vardhan Reddy, N.Srikanth, and B.Guravaiah,

Abstract: Air pollutants are a prime trouble being looked via the overall populace of the prevailing length. Air pollution activates helpless effects for the human well-being, climatic situations and furthermore makes unrecoverable harm the biological system. Air is infected through the appearance of risky gases into the climate from the industries, vehicular emissions simply as residue. Ceaseless checking is required to monitor the necessities on time. Keeping this in the view, we proposed a simple circuit, which gives non-stop measurements of dangerous gases, temperature, and pressure. Information originating from various sensors, collected into the records logger utilizing low ARM primarily based minicomputer raspbery pi. on this unique situation, the kind of unwanted dangerous gasses regarding parameters like temperature, pressure and moistness is should be investigated simply as to understand the reasonable picture of air range. The quantities are accumulated for higher know-how.

KEYWORDS: Arduino Uno, Raspberry Pi, Sensors.

I. INTRODUCTION

The existing global city regions are unfavorably prompted by way of pollutants that essentially decay the personal satisfaction of human beings. Late examinations show that traffic is the major wellspring of urban air pollution. Street transport is growing in large part up to 25% of every single unsafe emission. The loss of ecological quality, together with the impact of air great, specifically in substantial urban areas, both on the properly being and the welfare of people is one of the unsafe threats of this century. Air quality can range after a while and crosswise over different areas of a metropolis, and it is additionally impacted through different factors, for instance, climate conditions (e.g., dampness, temperature and atmospherically weight), Human adventures (e.g., traffic streams, individuals' versatility), gave administrations and the nearness of focal points in urban territories. Analysts, using raspberry pi and Arduino we have measured atmospheric parameters like Temperature, Atmospheric gases, CO, SO2. Using raspberry pi, which consumes less power and is more affordable, extremely adaptable minicomputer. It is an upcoming fashion for interfacing with numerous gadgets in the mean time. Developing patterns of consumer programming offer the threat to non-proficient and give up-customers of making augmentations to gadgets,

As indicated by way of their particular desires. There are many items available these days that allow end-client programming. Moreover, programming with dialects like python and php meets the current slants and will likewise be efficiently obtained for future purposes.

II. RELATED STUDY

Our study includes interfacing of raspberry pi with different sensors, it also includes the disadvantages of employing the raspberry pi 2[2] module for air quality monitoring i.e. it doesn't have inbuilt Wi-Fi module. Our study also includes efficient usage of raspberry pi. We have also studied the process of uploading of the acquired data to the cloud and retrieve it by using an app. In addition to these we have also studied how to monitor the data continuously. Our study also includes the techniques to measure the conc of hazardous gases and particulate matter in the environment. We have also studied the usage of Arduino. In addition to that we have seen Particulate Matter and Air Pollution detection Using Raspberry Pi providing notifications by using IoT.

III. SYSTEM DESIGN

The schematic outline of the proposed framework is illustrated in Figure 1.It represents the chain of connections of the proposed system Raspberry pi acts a major controlling unit of our proposed system.[5]Air The sensors are utilized for monitoring the atmospheric parameters like Temperature, Carbon Monoxide (CO), Carbon Dioxide(CO2), and pressure. The sensors for measuring the above parameters are interfaced with Arduino Uno and the Raspberry pi is interfaced with Arduino Uno through a USB link. The data detected with the sensors is continuously transmitted via Raspberry pi to cover the sensors, MQ7 (Gas sensor) and MQ135 (air quality sensor) are used for estimating Carbon monoxide and carbon dioxide. Arduino Uno is a microcontroller board dependent on ATMEGA-328P which can be efficiently interfaced with Raspberry pi. Since Raspberry pi 3B have inbuilt Wi-Fi connector, it is easy for providing the internet to our proposed model. The user can get to the records that are being provided in the dashboard by using the raspberry pi.

Revised Manuscript Received on June 05, 2019
   E.V Krishna rao, Department OF Electronics & Communication Engg, Lakireddy Bali Reddy College of engineering, Mylavaram, India.
   A.Narendra Babu, Department OF Electronics & Communication Engg, Lakireddy Bali Reddy College of engineering, Mylavaram, India.
S.V.Jagadeesh Chandra, Department OF Electronics & Communication Engg, Lakireddy Bali Reddy College of engineering, Mylavaram, India.
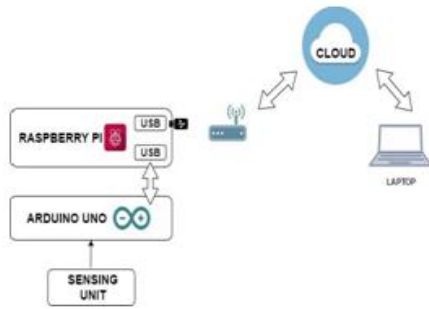
Fig 1: System Model

IV. PROPOSED MODEL

Our proposed model consists of raspberry pi , MQ7, MQ135, BMP 180 , with these we can collect the data from the atmosphere at every instance.

A. Raspberry Pi 3b

Raspberry Pi is a PCB board. It consists ARM Cortex A7 CPU and 1 GB RAM which makes it more efficient then its previous model. It consists of Broadcom BCM2836 quad processor that operates at 900 MHz clock. A Separate slot for Micro SD card is provided for the storing Operating systems, different software's, drivers required for running raspberry pi. This software runs on different operating systems like Ubuntu, rasbiean, Linux etc.

B. Sensing Unit

Sensing Unit consists of four sensors for monitoring the concentration of hazardous gases in atmosphere. MQ7 is used for measuring [6] carbon monoxide concentrations in the range of 100ppm-300ppm. MQ135 is used for measuring carbon dioxide Concentrations in the range of 10ppm-400ppm and also detects NH3, benzene, alcohol smoke and many others. BMP 180 is another sensor used for measuring atmospheric air pressure and temperature.

C. *Software Architecture Integrated Development Environment*

Arduino programs can be written in any programming language because it has a complier for changing any type of code in to its language. It is best for students as performing any kind of operations using this is very easy and simple as well, Arduino IDE is a programming structure which has commenced from the integrated advancement. As Integrated Development Environment is level very light weighted and works on less speed, it can preserve strolling on Windows, Linux or Mac OS. Some of the important functions of IDE encompass is the textual content console, and message location toolbar for common functions. For any programming in Arduino we can use IDE platform as its supports different languages like C,C++.

V. IMPLEMENTATION OF AIR QUALITY SYSTEM

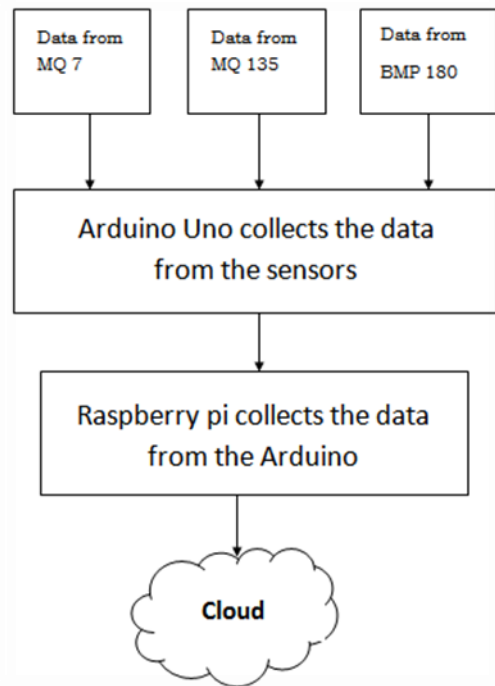The working of our proposed model can be best understood from the below flow chart.

Fig 2: flow chart

Each of these three sensors are connected to the analog pins of Arduino Uno board which is in turn is connected to raspberry pi through a USB cable. [4]The sensors MQ 7, MQ 135, monitor the concentration of hazardous gases like CO and CO_2 [1] in the atmosphere respectively. Temperature and pressure sensors (BMP 180) give the corresponding temperature (^{o}C), pressure(in milli bars) values of a particular location. All these collected data from the sensors is transferred to the raspberry pi module from the Arduino and is continuously updated in the cloud at every instance of time.
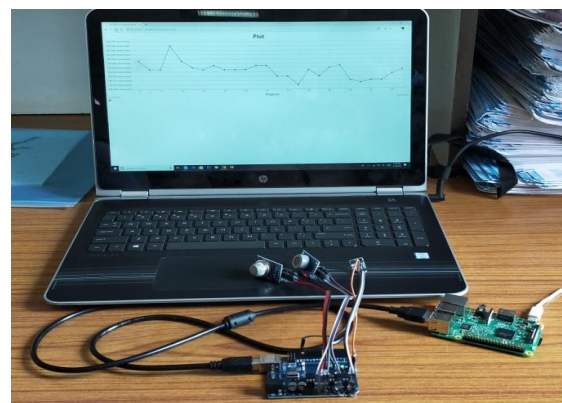
VI. EXPERIMANTAL SETUP

Fig 3: Schematic View

Figure 3 shows the schematic view of experimental setup and the assembly of sensors connected to raspberry pi and Arduino Uno.

VII. RESULTS

The experimental setup is tested by taking continuous measurements of one day i.e. 26-03-2019 from 6:00 AM to 27-03-2019, 6:00 AM, in the study region, Mylavaram (16.16 N, 81.13 E). The diurnal variation of the weather parameters, Carbon dioxide, carbon monoxide, Pressure and Temperature are shown below. The plots clearly show the variation of weather parameters consistently.
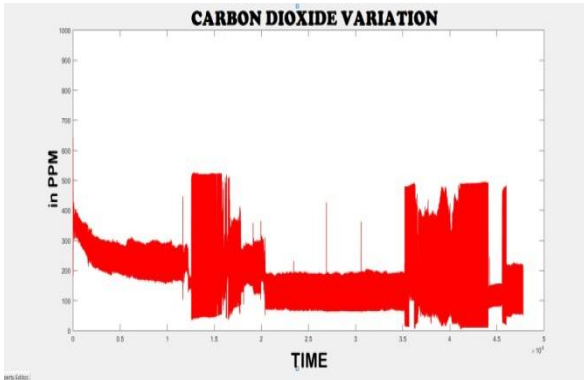

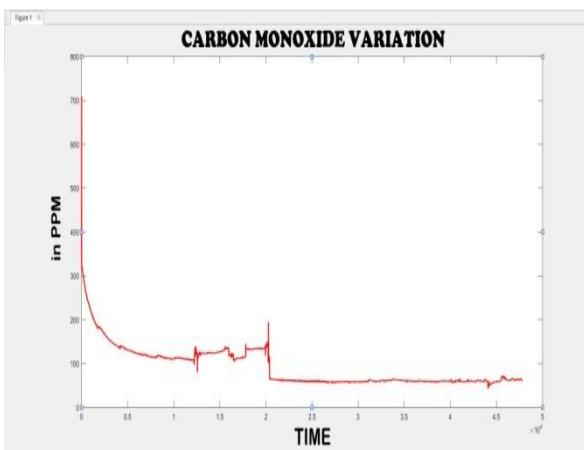**Figure 4: CO$_2$ Variation**
X axis –TIME   Y axis - PPM

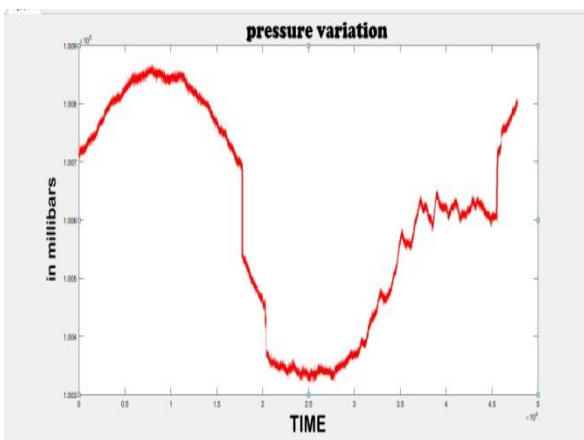**Figure 5: CO Variation**
X axis –TIME   Y axis – PPM

Figure 6: PRESSURE VARIATION
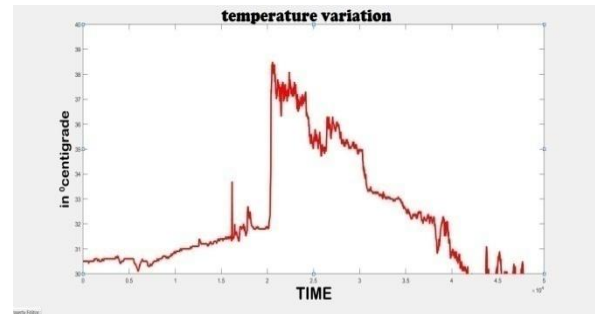**X axis –TIME   Y axis – millibars**

Figure 7: TEMPERATURE VARIATION
X axis –TIME   Y axis – ^{0}C

Figure 4 shows the CO$_2$ variation for 24 hrs starting from 26-03-2019 6:00 AM to 27-03-2019 6:00AM.The graph shows the variation of CO$_2$ in the day time

Figure 5 shows the CO variation for 24 hrs starting from 26-03-2019 6:00 AM to 27-03-2019 6:00AM.The graph shows the variation of CO in the day time

Figure 6 clearly indicates the pressure variation showing two maxima and two minima in 24 hr period from 26-03-2019 6:00AM to 27-03-2019 6:00 AM, which indicates that are able to follow the trend of present.

Figure 7 gives the variation of temperature in a span of 24 hrs. Temperature will be maximum at noon time and minimum around at midnight. This clearly indicates that this circuit is able to pick the exact readings of weather parameters

VIII. CONCLUSION

The proposed model uses minimal effort, very conservative and is very précised to observe the atmospheric parameters. There is an ideal trade off between the precision and cost because of using raspberry pi and suitable sensors. Data sheets accessible on the dashboard analysing the weather parameters of a particular location [3]. The premature parameters like temperature, pressure, CO$_2$, CO and many are consistent with the variation in the atmosphere. The weather parameters are rounded at ground level. Hence it is proved that weather along with pollutants can be analysed with cost effective system.

REFERENCES

1. Phala, Kgoputjo, Simon Elvis, Anuj Kumar and Gerhard P Hanckie." Air quality monitoring system based on ISO/IEC/IEEE 21451 STANDARDS. "*IEEE sensors journal* 16, 2016.
2. Air pollution and particulate matter detector using raspberry pi with IoT based notification by Meo Vincent C.Caya; Angelina P.Bablia; Alyssa moya M.bais; seo iJin V.Im; Rafael Maramba
3. Marinov, Marin B., Ivan Topalov, Elitsa Gieva, and GeorgiNikolov,"Air quality monitoring in urban environments", 39th *IEEE International Spring Seminar In Electronics Technology (ISSE),* pp. 443-448, 2016
4. IOT based pollution monitoring system using raspberry pi by kavitha B.C, Deepa Jose, Vallikannu.R at International Journal of Pure and Applied Mathematics.
5. Air quality monitoring system based on IOT using Raspberry pi from *International Conference on Computing, Communication and Automation (ICCCA).*
6. A paper by Anand nayyar, Vikaram puri and Dac-Nhuong Le from *Review of computer engineering research*, 2016,3(3):55-64.

AUTHORS PROFILE

A.Narendra Babu obtained his B.Tech, M.Tech and Ph.d in ECE from SV University. He authored more than 30 articles in reputed journals, conferences. His main research interests include Speech processing, Data mining, Machine learning. He executed several Projects from DST, SERB

E.V Krishna rao obtained his B.Tech in ECE from Nagarjuna Univ, M.Tech ECE. from University of delhi and Ph.d in the ECE from JNTU. He authored more than 40 articles in reputed journals, conferences. His main research interests include Speech processing, Data mining, Machine learning.

S.V.Jagadeesh Chandra obtained his B.Tech, M.Tech and Ph.d in ECE from SV University. He authored more than 30 articles in reputed journals, conferences. His main research interests include Speech processing, Data mining, Machine learning. He executed several Projects from DST, SERB