Chapter 3:-SYSTEM REQUIREMENT STUDY

3.1 User Characteristics:

Access Level	Available Features
System	lpg level monitoring lpg leak monitoring Automatic lpg booking
User	see the level of lpg gas book th cylinder leakage of gas monitoring

Table 3: User Characteristics

3.2 Hardware and Software Requirements:

Two types of requirements are necessary to define initial stage:

3.2.1 Hardware Requirements:

Recommended hardware is:

1. Lcd display
2. Arduino Uno or Nano
3. Buzzer
4. Load cell or sensor
5. MQ2 gas sensor
6. Wifi Module ESP8266
7. HX711 Module

3.2.2 Software Requirements:

- Android Studio
- Arduino Ide
- Language :
  - C++ for iot coding
  - Java for app development

firebase for Database

3.3 Hardware and Software Component Description And Usage:

Hardware Components:

1)Arduino Nano:

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328P released in 2008. It offers the same connectivity and specs of the Arduino Uno board in a smaller form factor.

The Arduino Nano is equipped with 30 male I/O headers, in a DIP30-like configuration, which can be programmed using the Arduino Software integrated development environment (IDE), which is common to all Arduino boards and running both online and offline. The board can be powered through a type-B micro-USB cable or from a 9 V battery.

Technical specifications:

- Microcontroller: Microchip ATmega328P[4]
- Operating voltage: 5 volts
- Input voltage: 6 to 20 volts
- Digital I/O pins: 14 (6 optional PWM outputs)
- Analog input pins: 8
- DC per I/O pin: 40 mA
- DC for 3.3 V pin: 50 mA
- Flash memory: 32 KB, of which 0.5 KB is used by bootloader
- SRAM: 2 KB
- EEPROM: 1 KB
- Clock speed: 16 MHz
- Length: 45 mm
- Width: 18 mm
- Mass: 7 g
- USB: MicroUSB Type-B [5]
- ICSP Header: Yes
- DC Power Jack: No

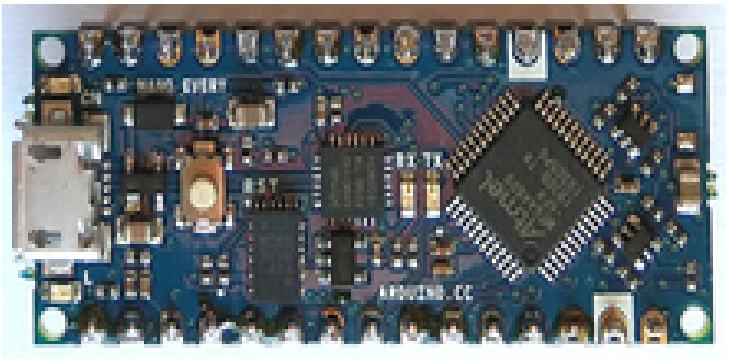

Figure 2:Arduino Nano Board

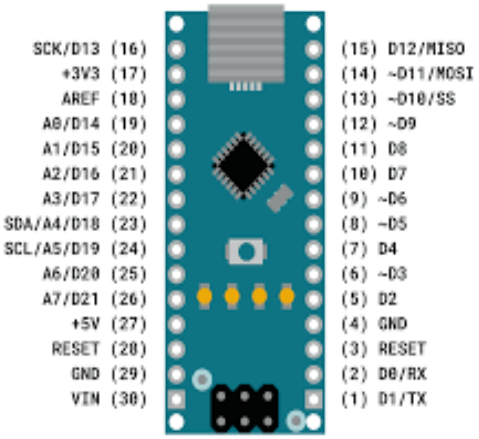

Figure 3:Pin Diagram Arduino Nano

In our project Arduino Nano board will be connected to the weight sensor and Gas sensor .It will process the data coming from the weight sensor and MQ11 gas sensor and then send it to the Node MCU8266 wifi module.

2)Node MCU ESP8266

NodeMCU is an open-source Lua based firmware and **development board** specially targeted for IoT based Applications. It includes firmware that runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which is based on the ESP-12 module.

The **NodeMCU ESP8266 development board** comes with the ESP-12E module containing the ESP8266 chip having Tensilica Xtensa 32-bit LX106 RISC microprocessor. This microprocessor supports RTOS and operates at 80MHz to 160 MHz adjustable clock frequency. NodeMCU has 128 KB RAM and 4MB of Flash memory to store data and

programs. Its high processing power with in-built Wi-Fi / Bluetooth and Deep Sleep Operating features make it ideal for IoT projects.

NodeMCU can be powered using a Micro USB jack and VIN pin (External Supply Pin). It supports UART, SPI, and I2C interface.

NodeMCU ESP8266 Specifications & Features

- Microcontroller: Tensilica 32-bit RISC CPU Xtensa LX106
- Operating Voltage: 3.3V
- Input Voltage: 7-12V
- Digital I/O Pins (DIO): 16
- Analog Input Pins (ADC): 1
- UARTs: 1
- SPIs: 1
- I2Cs: 1
- Flash Memory: 4 MB
- SRAM: 64 KB
- Clock Speed: 80 MHz
- USB-TTL based on CP2102 is included onboard, Enabling Plug n Play
- PCB Antenna
- Small Sized module to fit smartly inside your IoT projects

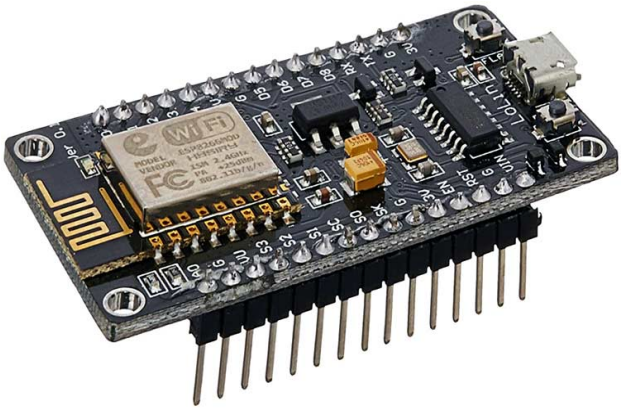

Figure 4:Node MCU ESP8266 Board

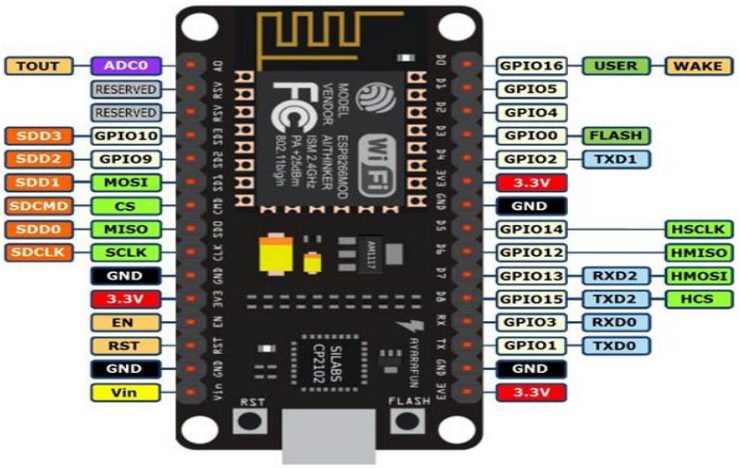

Figure 5:Node MCU 8266 pin diagram

It is used to send the weight and leak values from Arduino nano board to database.

3) HX711 Module:

HX711 module is a Load Cell Amplifier breakout board for the HX711 IC that allows you to easily read load cells to measure weight.

How does the HX711 work?

The HX711 uses a two wire interface (Clock and Data) for communication. Any microcontroller's GPIO pins should work and numerous libraries have been written making it easy to read data from the HX711. Load cells use a four wire wheatstone bridge to connect to the HX711.

Figure 6: HX711 Analog to Digital Converter Module

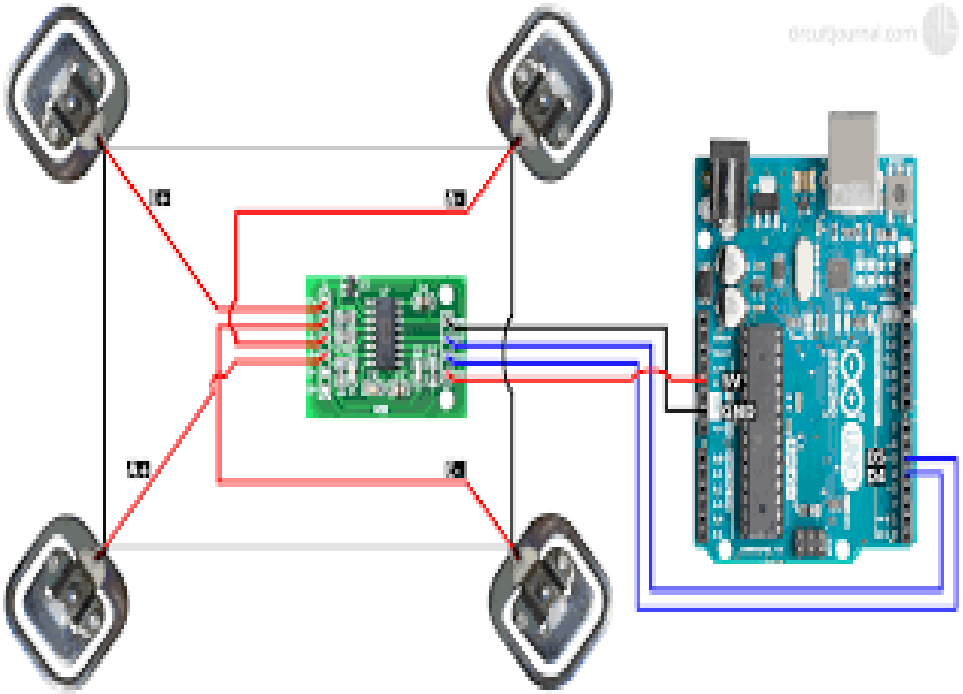

Figure 7: HX711 Module connection with Weight Sensor

As shown in the figure 7 it is used to convert the analog signal to digital of weight sensors and send it to the arduino nano.

4)LCD Display

The term LCD stands for liquid crystal display. It is one kind of electronic display module used in an extensive range of applications like various circuits & devices like mobile phones, calculators, computers, TV sets, etc. These displays are mainly preferred for multi-segment light-emitting diodes and seven segments. The main benefits of using this module are inexpensive; simply programmable, animations, and there are no limitations for displaying custom characters, special and even animations, etc.

Features of LCD16x2

The features of this LCD mainly include the following.

- The operating voltage of this LCD is 4.7V-5.3V
- It includes two rows where each row can produce 16-characters.
- The utilization of current is 1mA with no backlight
- Every character can be built with a 5×8 pixel box

- The alphanumeric LCDs alphabets & numbers
  - Is display can work on two modes like 4-bit & 8-bit
  - These are obtainable in Blue & Green Backlight
  - It displays a few custom generated characters

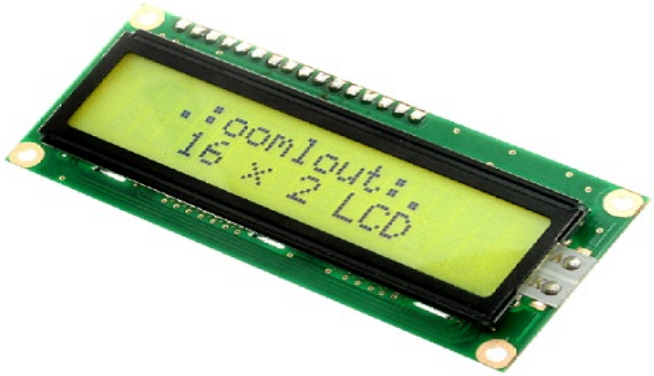

Figure 8:16 x 2 LCD Display

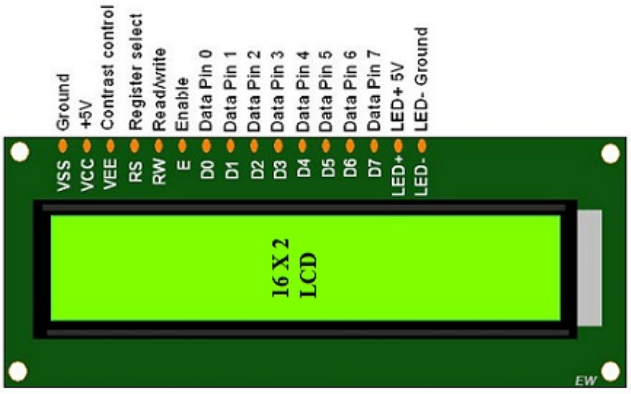

Figure 9:16 x 2 LCD Pin Diagram

It will be used to display the weight value obtained from the weight sensor to the user as well as it will also display the leak information.

5) Load Cell

A load cell is a force transducer. It converts a force such as tension, compression, pressure, or torque into an electrical signal that can be measured and standardized. As the force applied to the load cell increases, the electrical signal changes proportionally. The most common types of load cell used are strain gauges, pneumatic, and hydraulic.

The 50kg Half-bridge Experiments Body Scale Load Cell Sensor is measuring; the correct force is applied to the outer side of the strain E-shaped beam portion of the sensor (i.e., a strain gauge affixed to the intermediate, adhesive coating with white beam arms); and the outer edges to form a shear force in the opposite direction, i.e., middle strain beam bending necessary changes can occur under stress, strain beam side by another force should not be a barrier.

The sensor can be used with the following three methods

1. Using a sensor with an external resistors full bridge measurement range of a sensor range: 50kg. Higher requirements for an external resistor.
2. The uses of only two full-bridge sensors measuring range are the range of the two sensors and: 50kgx2 = 100kg.
3. The use of four full-bridge sensors measuring range is the range of four sensors and: 50kgx4 = 200kg.

Specifications:

Capacity (Kg)	50
Output Sensitivity (mv/v)	1 ± 0.1
Nonlinearity (%FS)	0.03
Repeatability (%FS)	0.03
Input Resistance (Ω)	
Insulation Resistance (MΩ)	5000
Length (mm)	34
Width (mm)	34
Height (mm)	8
Weight (gm)	20
Cable Length (cm)	30
Shipment Weight	0.022 kg

Figure 10:Half Bridge Load Cell

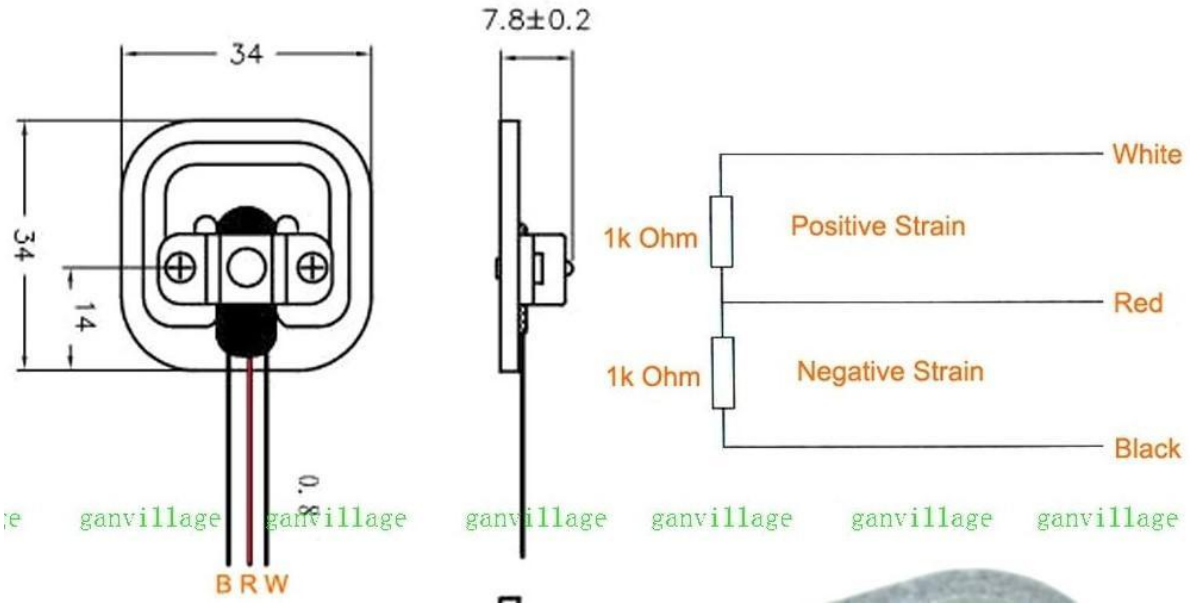

Figure 11:Circuit diagram of Half Bridge Load Cell

In our project we will be using the Half Bridge Load cell as shown in the figure 10 to sense the weight of the cylinder and by joining this load sensor to the HX711 a/d module it will be send the weight values to the Arduino Nano board.

6)MQ2 Gas sensor

The gas sensitive material used in the MQ-2 gas sensor is SnO2, a low electrically conductive material in clean air. When there is combustible gas in the surrounding air, the electrical conductivity of the sensor will increase with the higher intensity of the combustible gas.

Here, we can convert the changing electrical conductivity into output signal by building a simple circuit.

Main Features

- Detected Gas: Combustible Gas, Smoke

- Detection Intensity: 300 ~ 10000ppm(Combustible Gas)
- Working Voltage: 5.0V±0.1V AC or DC
- Preheating Time: ≥2 minutes

Pins

- VCC: 5V Working Voltage
- GND: Ground.
- D0: Output Interface of Digital Switch (0 and 1).
- A0: Analog Output Interface

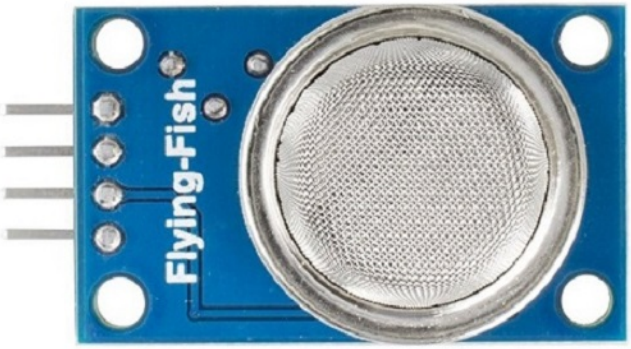

Figure 12: MQ2 Gas Sensor

MQ-2 Pin diagram :-

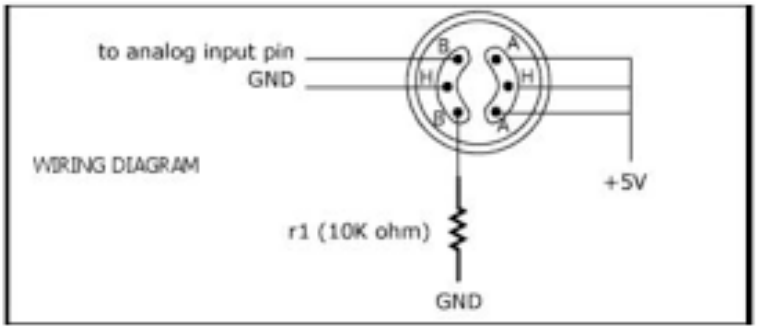

Figure 13 MQ2 Gas Sensor pin diagram

In our project it will be used to sense the leakage of the gas if the leakage will be sense by the sensor it will send the data to the arduino board and the buzzer will start to ring and user will be sended the notifoication of gas leakage.

7)Buzzer :

A buzzer or beeper is an audio signaling device,[1] which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

Figure 14: Buzzer

The Buzzer will be used as an alarm when the Leakage of the Gas will be there the buzzer will be ring and if there is no leakage the buzzer will be off.

Software Components:-

1)Android Studio:-

Android Studio is the official Integrated Development Environment (IDE) for Android app development, based on IntelliJ IDEA . On top of IntelliJ's powerful code editor and developer tools, Android Studio offers even more features that enhance your productivity when building Android apps.

Figure 15 : Android Studio Symbol

There are even multiple IDES where we can develop the app for iot projects or fro sensor networks but as the Android studio is easy to use so we are using this IDE.

We are using this IDE to develop the mobile app for our system in which we can monitor the level the Lpg cylinde rand can even get he data of the lpg gas leakage and further more we can even book the cylider.

2)Arduino IDE:-

The Arduino Integrated Development Environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in functions from C and C++.[3] It is used to write and upload programs to Arduino compatible boards, but also, with the help of third-party cores, other vendor development boards.

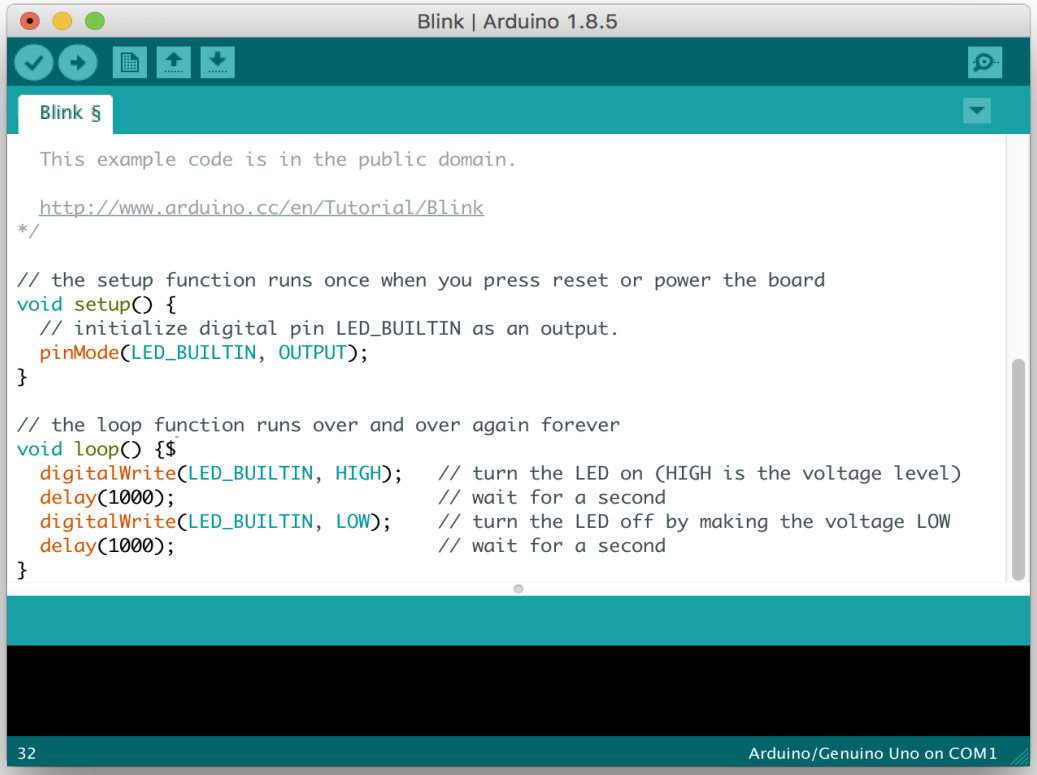

Figure 16: Arduino IDE Programming window

The Arduino IDE supports the languages C and C++ using special rules of code structuring.[6] The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU toolchain, also included with the IDE distribution.[7] The Arduino IDE employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.[8] By default, avrdude is used as

the uploading tool to flash the user code onto official Arduino boards.In Arduino Ide program is known as sketch.

In our project we are using the Arduino Ide for programming the Arduino Nano and NodeMCU ESP8266 Wi-Fi Module.

3)Language:

i)C++

Arduino code is written in C++ with an addition of special methods and functions. C++ is a human-readable programming language. When you create a 'sketch' (the name given to Arduino code files), it is processed and compiled to machine language.

As we are using the Arduino IDE and the Arduino board Arduino Nano and ESP8266 module it will be better to code them in the C++ language which is used in the Arduino IDE for programming the Arduino Boards Used in our project.

ii)Java

Java is one of the powerful general-purpose programming languages, created in 1995 by Sun Microsystems (now owned by Oracle). Java is Object-Oriented. However, it is not considered as pure object-oriented as it provides support for primitive data types (like int, char, etc). Java syntax is similar to C/C++. But Java does not provide low-level programming functionalities like pointers. Also, Java code is always written in the form of classes and objects. Android heavily relies on the Java programming language all the SDKs required to build for android applications use the standard libraries of Java. If one is coming from a traditional programming background like C, C++, Java is easy to learn.

In the Backend of our Android app development we are using the Java programming language to code in the backend.

4)Firebase database:-

Firebase: Realtime Database

Figure 17:Firebase database

The Firebase Realtime Database is a cloud-hosted database in which data is stored as JSON. The data is synchronized in real-time to every connected client. All of our clients share one

Realtime Database instances and automatically receive updates with the newest data, when we build cross-platform applications with our iOS, and JavaScript SDKs.

The Firebase Realtime Database is a NoSQL database from which we can store and sync the data between our users in real-time. It is a big JSON object which the developers can manage in real-time. By using a single API, the Firebase database provides the application with the current value of the data and updates to that data. Real-time syncing makes it easy for our users to access their data from any device, be it web or mobile.

The Realtime database helps our users collaborate with one another. It ships with mobile and web SDKs, which allow us to build our app without the need for servers. When our users go offline, the Real-time Database SDKs use local cache on the device for serving and storing changes. The local data is automatically synchronized, when the device comes online.

Real-time

The Firebase Real-time database uses data synchronization instead of using HTTP requests. Any connected device receives the updates within milliseconds. It doesn't think about network code and provides collaborative and immersive experiences.

Offline

The Firebase Database SDK persists our data to disk, and for this reason, Firebase apps remain responsive even when offline. The client device receives the missed changes, once connectivity is re-established.

Accessible from client devices

There is no need for an application server to access the Firebase Real-time database. We can access it directly from a mobile device or web browser. Data validation and security are available through the Firebase Real-time Database Security Rules, expression-based rules executed when data is read or written.

Scaling across multiple databases

With the Firebase Real-time Database on Blaze Pricing Plan, we can support the data needs of our app by splitting our data across multiple database instances in a single Firebase project. Streamline authentication with Firebase authentication on our project and authenticate users in our database instances. Controls access to data in each database with custom Firebase real-time database rules available for each database instance.

We are using the firebase database due to the vast advantages of using it we dont have to as we have to monitor the level of the cylinder through the app so as the firebase is the realtime

database due to which if ther will be change in the weight of the cylinder it will be directly reflect on the app .

we are connecting the firebase with the Esp8266 module so it will send the data of the weight sensor and the gas sensor on the realtime bases and use will get the data as the app will be connected to the firebase.

3.2.3 Documentation:

- Microsoft word for documentation
- PowerPoint for presentation
- EDGE diagram, and UML diagram for diagram

3.3 Constraints:

Power consumption

It is monitoring the level of the cylinder on the real time basis so if we use the battery then we have to change the battery of the machine regurly ,and if the person will not insert the battery properly the the machine will not work properly.and we are using plug power .

No safety mechanism

As my system can only detect the leakage but it does not have any combat system for that leakage.So if there is the chance when there is no user at house then no precautions can be taken

Active Internet Connection

The user require the active Internet Connection and should have the WiFi in the house to send the data if the internet connection will break the user cannot receive the real-time data in app.

Assumptions And Dependencies:

The project was started with the assumption that we would be give the necessary support from of hardware and software resources.

- User has the basic knowledge of the using Android app
- The project design is mainly created by keeping mind.