Department of Electrical and Computer Engineering

North South University

Senior Design Project

LPG Distribution Management Automation Using Load Cell and PHP

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DECLARATION

This is to certify that this Project is our original work. No part of this work has been submitted elsewhere partially of fully for the award of any other degree or diploma. Any material reproduced in this project has been properly acknowledged.

Students' Names & Signatures

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APPROVAL

We, **Sany Mohammad Khaled** (ID# 1711853042) and **Shahidul Alam** (ID# 1530790042), members of CSE: 499(Senior Design) from the Electrical and Computer Engineering department of **North South University;** have worked on the project titled **"LPG Distribution Management Automation Using Load Cell and PHP"** under the supervision of Dr. K.M.A. Salam as a partial fulfillment of the requirement for the degree of Bachelors of Science in Computer Science and Engineering has been accepted as satisfactory.

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ACKNOWLEDGEMENT

By mercy of the Almighty we have completed our senior design capstone project entitled “ LPG Distribution Management Automation Using Load Cell and PHP”.

Foremost, we would like to express our sincere gratitude to our advisor Dr. K. M. A. Salam for his continuous support in our capstone project progress throughout the whole 499A and 499B, for his patience, motivation, enthusiasm, and immense knowledge. His guidance helped us in all the time of research, writing and completing of this project.

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Last but not the least, we would like to thank our family as their inspiration and guidance kept us focused and motivated

ABSTRACT

LPG is the next generation of fuel. LPG consumer is increasing gradually in the country. LPG distribution is a large management system with an analog system. The biggest headache of LPG is refilling system. Consumer have faced plenty of problems regarding LPG refill. This paper purposes about a smart solution for Liquified Petroleum Gas distribution management with refill automation using load cell and php. Our system is designed with hardware and software. Hardware device will be placed under the LPG cylinder. The data will be sent to a remote server from where admin can monitor all the users and user can monitor and order cylinder by few clicks. People don't need to worry about the LPG cylinder order and refill again.

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Chapter 1: Overview

1.1 Introduction

LPG is the next generation of fuel. Bangladesh is one of the densely populated countries in the world. Energy consumption is increasing gradually in the country. The key energy source in the country is natural gas but the supply is less than the demand. The government is no longer allowing the pipeline gas connection for household chores. Demand for LPG is growing exponentially in the country. [1] Electronic commerce or E-commerce is the fastest-growing B2C business in this country. Distribution management depends on E-commerce. E-commerce is still young and emerging in our country. The whole world is experiencing a major transformation in the retail business, and Bangladesh does not differ from the global trend. [2] According to Bangladesh telecommunication regulatory commission (BTRC), the latest statistics (June 2018) shows that the number of Internet users is 52.77%. Another report shows that there are more than 2500 e-commerce websites and around 8,000 e-commerce pages on Facebook that operating business. [3]

Till last year, the number of LPG consumers was 38 Lakh. against 2.5 lakh in the year 2009, according to the annual report of the Energy and Mineral Resources Division (EMRD) of 2018-19. It will go up to around 90 Lakh by the time of 2025. [2]

This sector needs proper distribution management. With, these kinds of huge consumers, this business is running-with old analog system. We will build an automated web application to manage and increase the business of this sector. So, we wanted to develop a system where we can bring on LPG distribution under E-commerce to grow this business, make people not worry about Cylinder supply, and refill them.

We used a load sensor to measure gas level and send the data to the database using ESP Module. From the website, this data is used for refill automation. The user will be notified as soon as a low level is touched. He/she just needs to confirm the payment. We are using the SSLCOMMERZ for the payment gateway. SSLCOMMEREZ is a Bangladeshi Payment Gateway. Like every e-commerce system, our system will be mostly the same. We tried to make a proper management system from dealer to customer. There is an admin dashboard for the dealer shop and a customer

dashboard for the customer to order or to make a query or to compare the prices of different companies LPG.

1.2 Project Definition

To design the system, we used Load sensor, ESP microcontroller for the hardware part. This part will be attached with the LPG cylinders and send the data to the database. We used MySQL database, SMTP mail server and PHP for the website. There is a dashboard for admin and user where admin can monitor all the data, cylinder data, user data, payment data and send notification. User can order cylinder with online and offline payment. Refill system is fully automated.

1.3 Purpose of our project

At this moment, there is no Automated system for Liquefied Petroleum Gas distribution management. Till last year, the number of LPG consumers was 38 Lakh. It will go up to around 90 Lakh by the time of 2025. With these kinds of huge consumers, this business is running-with old analog system. After talking with providers and users, we have found out the motivation for this project. Users and the providers, wanted a hassle-free management and refill system for the LPG Cylinders. So, after talking with providers and end users, we gathered information, studied some techniques and finally took the initiative and built a system that removes all the hassle in this sector with help of hardware and software components.

1.4 Project Goal

- ✓ Build a device that can measure gas level
- ✓ Build a system that can send data to database
- ✓ Create a website where user can order LPG
- ✓ Write a script for payment method
- ✓ Create a dashboard for admin to monitor user data
- ✓ Create a script for automating gas level notifier
- ✓ Create a database for sensor data, user data and admin data
- ✓ Write script for sending SMS notification

- ✓ Write script for SMTP mail server to send email notification

1.5 Summary

In this chapter, we discussed about the background of the problem, proposed solution, importance of the system, the goals, features of the system and basic functionality of the system. The objective of the system is to bring the growing LPG sector under one system. LPG distribution is a large management system with an analog system. Our main goal is to develop a smart LPG distribution management system with refill automation.

Chapter 2: Existing system and solution adopted

2.1 Introduction

LPG is the next generation of fuel. LPG consumer is increasing gradually in the country. LPG distribution is a large management system with an analog system. People need to go to the place of the providers to buy or refill the cylinder. Providers also do not have any track of the customers. Customer is not aware of the remaining gas level in the cylinder in the local distribution system. The biggest headache of LPG is refilling system. Consumer have faced plenty of problems regarding LPG refill. This system purposes about a smart solution for Liquified Petroleum Gas distribution management with refill automation People don't need to worry about the LPG cylinder refill again. With e-commerce functionality and hardware, we are going to make a "smart LPG distribution management and automate the refill system."

2.2 Existing Solution

LPG distribution chain is the biggest pain to grow this business in Bangladesh. LPG business is entirely different than FMCG business or any sustenance and drinks like a one-time business. This business is all about a close relationship with the client, merchants, retailers, and transporters. The regional distributer sells LPG to local distributor, local distributor to local seller, local seller to local customers.

Figure 1 LPG Distribution

2.3 Problem with Current System

To do a good business by following all this criterion some challenges have come forward:

1) Managing cylinder supply chain:

Managing cylinder supply network is the most down to earth challenge in LPG business, which is a considerable amount overwhelming in weight and cost too is the way to fortify the organization to do the business easily.

2) Growing up the safety culture among the distributors and retailers:

Growing up the safety culture among the distributors and retailers is also a big challenge to grow the business in a sustainable manner.

3) Lacking awareness:

Lacking consciousness of doing good faith business among wholesalers and companies is also a challenge in recent days.

4) Malpractices by ill-motivated executive

5. Refill system hassle

No one can when the cylinder will be emptied or when to refill them.

Main challenge is to keep the track of cylinders, user, gas level, price hiking and payment tracking at the local seller and distributor level. We tried to develop a system to maintain and track all the information from user to local seller, to local distributor.

2.4 Proposed solution

We are making an analog system smart with the help of latest technology. We are using both hardware and software solution for this project.

- **Ecommerce Website**

  A full functioning ecommerce website with User & Admin panel. User can purchase and make payment. Admin can monitor all the purchases, monitor cylinder level and send user a notification about gas level.

- **Cylinder Tracking**

  Both admin and user can track the remaining level of gas in the cylinder.

- **Refill Automation**

  With a simple payment confirmation from user, The cylinder gets refilled instantly

- **Payment Gateway**

  A full functioning payment gateway is integrated using SSL COMMEREZ

We have adopted this solution to make the system easy to use for both user and providers. The system can track all the user data, sensor data, gas level data and payment information. This data can be used for future prediction of LPG uses for a user.

2.5 Summary

In this chapter, we discussed about the old model for the distribution management of the LPG, challenges faced in old model, our proposed idea and the motivation to choose the method we used. We are automating the refill system with weight sensor data and payment method by SSL COMMEREZ. We are storing all the data for future study and to keep track of the users.

Chapter 3: System Design

3.1 Introduction

After studying a lot of research paper and talking with LPG providers we found out exactly what we need to build and what we need to use to make this user friendly.

We have made an analog system, smart with the help of latest technology. We are using both hardware and software solution for this project.

3.2 Overview of the total system

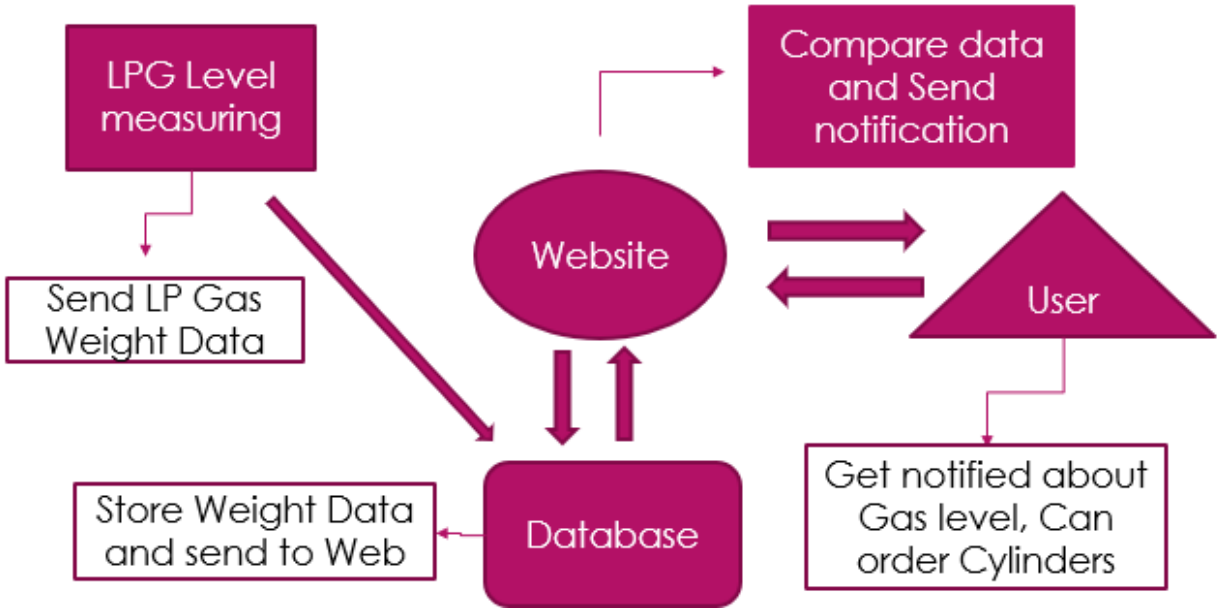

Figure 2: Block Diagram of the system

Features of our system:

A full functioning ecommerce website with User & Admin panel. User can purchase and make payment. An admin can monitor all the purchases, monitor cylinder level and send user a notification about gas level. Both admin and user can track the remaining level of gas in the cylinder. With a simple payment confirmation from user, The cylinder get refilled instantly. A full functioning payment gateway is integrated using SSL COMMEREZ

We have implemented load sensing device using microcontroller, loadcell and connected that to a server using WIFI module. We used a sensor with a stand which will remain in the back of a cylinder. It will send data to the database using WIFI module and ESP microcontroller. These data go to database.

We have developed an Ecommerce Website for user where he/she can purchase cylinder. User can register and Login. User can also check the remaining gas level We have developed an admin panel.

Most of the ecommerce business only have product list updated and shows the pricelist. But there is no payment gateway to pay digitally. We used the SSLCOMMERZ to overcome this situation. SSLCOMMEREZ is Bangladeshi Payment Gateway. Bangladeshi people mostly like to have a COD (Cash on Delivery). We are also applying that.

We have developed a notification system. Store Admin can see all the user, payment, gas level and can send email automatically to user for refill and payment. User get the notification and just need to confirm the payment to refill the cylinder without any hassle.

3.3 Summary

In this chapter, we discussed about the system we developed, how it works, how it performs tasks and how it helps people to decrease their hassle thinking about gas level or carrying a cylinder rom providers shop. We also talked about the digital payment method we used for the project. There is also cash on delivery system for our system. All the data will be saved through website, only payment data will be saved manually for cash on delivery service. User will get the gas level or payment notification via SMS and email.

Chapter 4: Technical Description

4.1 Introduction

In this chapter, we will discuss about the components used for technical functions of this project. Hardware used, hardware functionality, software used, software functionality, admin functionality, user functionality all things will be discussed in this section. We will discuss everything one by one along with description and roles in this project.

4.2 System Description

The entire multilevel software and hardware parts consists of several parts which supports the project to be useful in every aspect. The components are discussed below for the better understanding of the system.

4.2.1 Load Cell

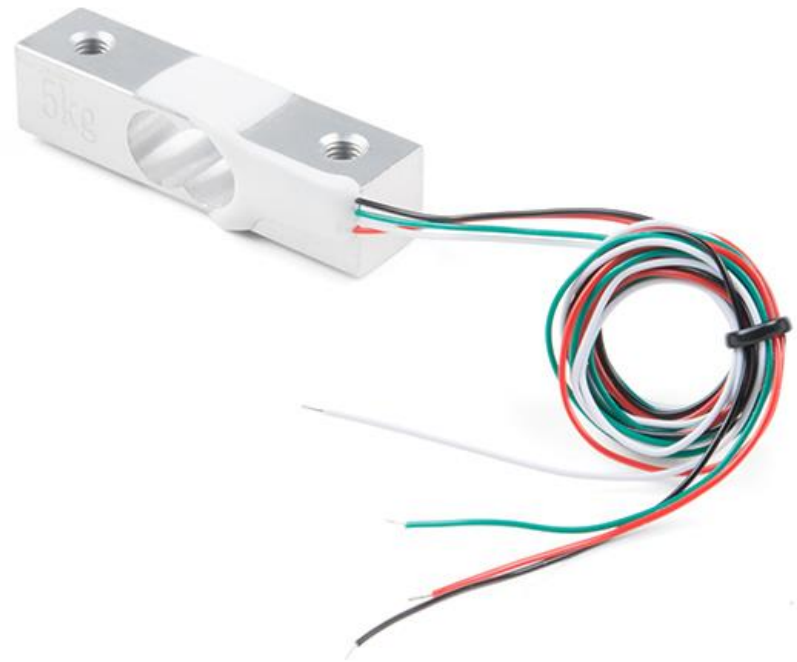

Figure 3: Load Cell

Load cells generally consist of a spring element on which strain gauges have been placed. The spring element is usually made of steel or aluminum. That means it is very sturdy, but also

minimally elastic. This straight bar load cell (sometimes called a strain gauge) can translate up to 5kg of pressure (force) into an electrical signal. Each load cell can measure the electrical resistance that changes in response to, and proportional of, the strain (e.g. pressure or force) applied to the bar. With this gauge you will be able to tell just how heavy an object is, if an object's weight changes over time, or if you simply need to sense the presence of an object by measuring strain or load applied to a surface. Each straight bar load cell is made from an aluminum-alloy and can read a capacity of 5kg. These load cells have four strain gauges that are hooked up in a wheatstone bridge formation. The color code on the wiring is as follows: red = Exc+, green = Sig+, black = Exc-, and white = Sig-. Additionally, these load cells offer an IP65 protection rating and features two M5 sized through-holes for mounting purposes. [4] More details of our used load cell:

- Accuracy: ±0.05%
- Operating Force: 5.00kgf (11lbs)
- Sensor Type: Load Cell
- Operating Temperature: -10°C ~ 55°C
- Output: Analog Voltage
- Voltage - Supply: 3V ~ 10V

4.2.2 Load cell Amplifier

The Load Cell Amplifier is a small breakout board for the HX711 IC that allows you to easily read load cells to measure weight. By connecting the amplifier to micro-controler you will be able to read the changes in the resistance of the load cell, and with some calibration you'll be able to get very accurate weight measurements. This can be handy for creating your own industrial scale, process control or simple presence detection.

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.

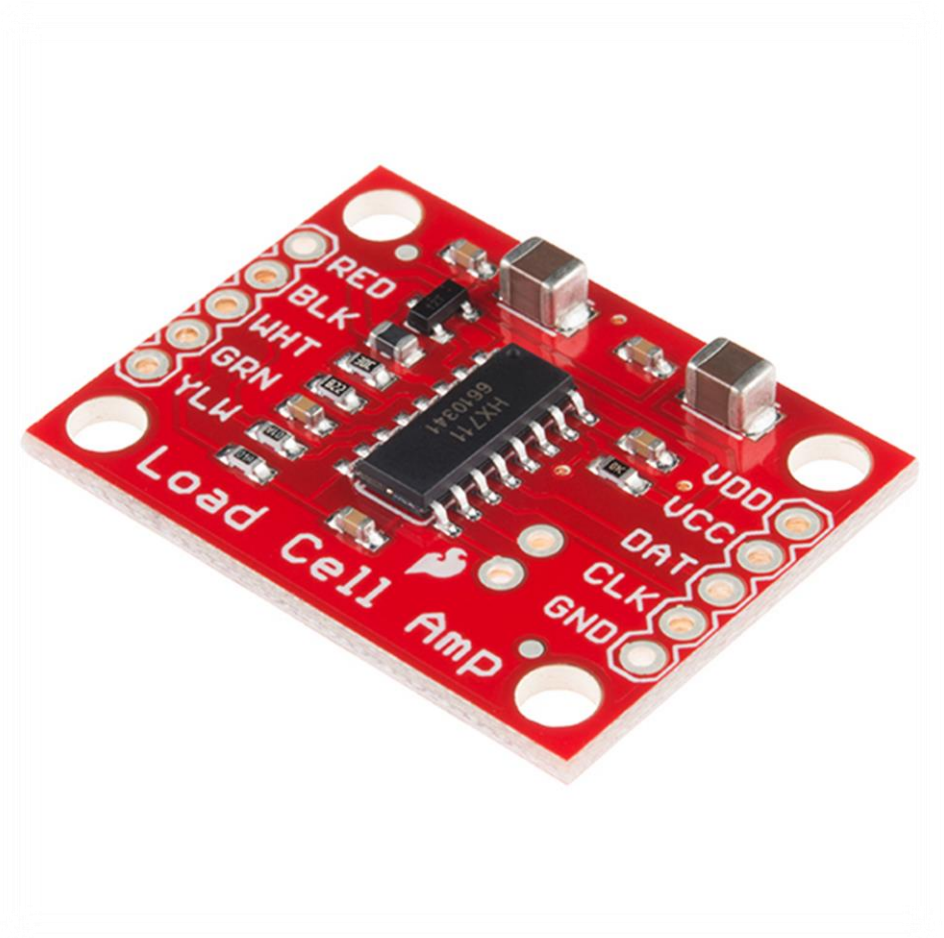

Figure 4: Load Cell Amplifier

Load cells use a four-wire Wheatstone bridge configuration to connect to the HX711. These are commonly colored RED, BLK, WHT, GRN and YLW. Each color corresponds to the conventional color coding of load cells:

- Red (Excitation+ or VCC)
- Black (Excitation- or GND)
- White (Amplifier-, Signal- or Output-)
- Green (A+, S+ or O+)
- Yellow (Shield)

The YLW pin acts as an optional input that is not hooked up to the strain gauge but is utilized to ground and shield against outside EMI (electromagnetic interference). Please keep in mind that some load cells might have slight variations in color coding. [5]

4.2.3 NodeMCU Module

NodeMCU is an open-source firmware for which open-source prototyping board designs are available. The name “NodeMCU” combines “node” and “MCU” (micro-controller unit). The term “NodeMCU” strictly speaking refers to the firmware rather than the associated development kits. Both the firmware and prototyping board designs are open source. Nodemcu ESP8266 and Nodemcu ESP32 are becoming very popular and are almost used in more than 50% IoT based projects today. The firmware uses the Lua scripting language. The firmware is based on the eLua project and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson and SPIFFS. Due to resource constraints, users need to select the modules relevant for their project and build a firmware tailored to their needs. Support for the 32-bit ESP32 has also been implemented. [6]

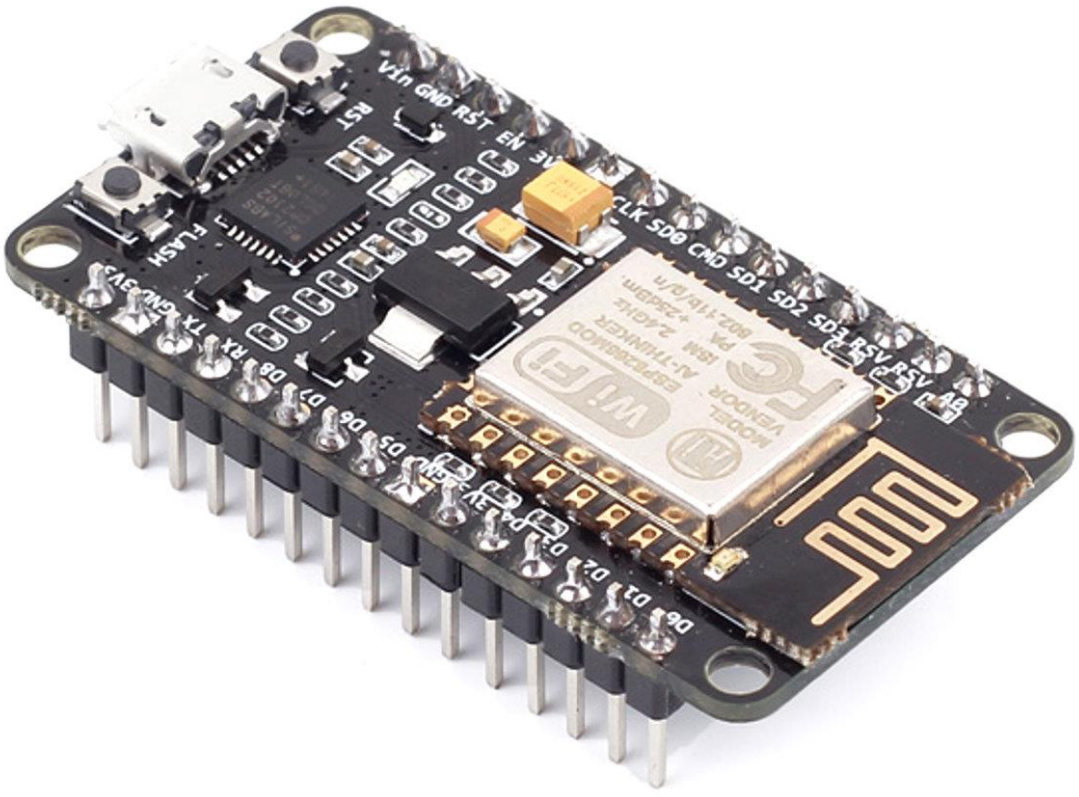

Figure 5:NodeMCU Module

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; Wifi module. For practical purposes ESP8266 NodeMCU V2 and V3 boards present identical pinouts. While working on the NodeMCU based projects we are interested in the following pins > Power pins (3.3 V); Ground pins (GND); Analog pins (A0); Digital pins (D0 – D8, SD2, SD3, RX, and TX – GPIO XX). Most ESP8266 NodeMCU boards have one input voltage pin (Vin), three power pins (3.3v), four ground pins (GND), one analog pin (A0), and several digital pins (GPIO XX). The Nodemcu Development Board can be easily programmed using the Arduino IDE since it is easy to use. All you need is the latest version of the Arduino IDE, a USB cable, and the Nodemcu board itself. [7]

4.2.4 Web Programming Language

We used HTML, CSS, JS, Bootstrap for the front-end part to design the outlook of the website. We used HTMLv5 and CSSv3.

Figure 6: Web language for front-end

4.2.5 PHP for Backend

We have used PHP for backend development of the data. PHP is a server scripting language, and a powerful tool for making dynamic and interactive Web pages.

4.2.6 MySQL Database

MySQL is the most popular Open Source Relational SQL database management system. MySQL is one of the best RDBMS being used for developing web-based software applications.

We have used MySQL database to store the sensor data, user data and admin data.

Figure 7: MySQL Database

4.2.7 XAMPP Server

XAMPP is a free and open-source cross-platform web server solution stack package developed by Apache Friends, consisting mainly of the Apache HTTP Server, MariaDB database, and interpreters for scripts written in the PHP and Perl programming languages.

For the software part. We used XAMPP as server to run our script.

Figure 8: XAMPP Local Server

4.2.8 SMTP Mail Server

SMTP stands for Simple Mail Transfer Protocol, and it's an application used by mail servers to send, receive, and/or relay outgoing mail between email senders and receivers.

We have used SMTP mail server to send and receive the mail from the user to providers and from providers to users. [8]

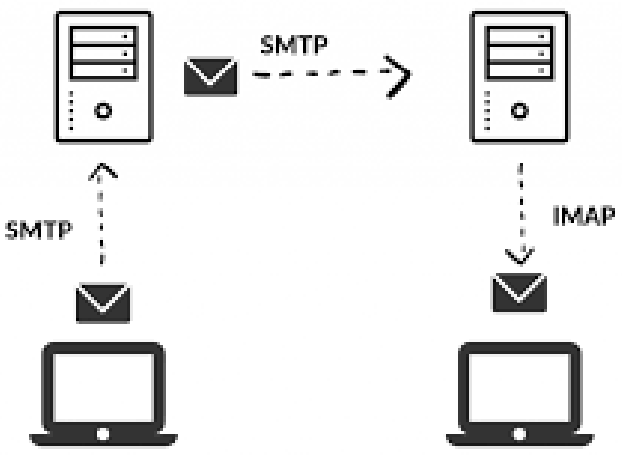

Figure 9:SMTP Mail Server

4.2.9 SSL COMMEREZ

"SSLCOMMERZ is the first payment gateway in Bangladesh opening doors for local businesses and entrepreneurs to receive payments over the Internet via their online stores, websites or apps. Customers of these businesses will be able to pay for purchases online using their credit/debit cards, internet banking and mobile financial services or wallets. SSLCOMMERZ is authorized by Bangladesh Bank as a Payment Systems Operator (PSO) and complied to PCI DSS v3.2 Level 1 Service Provider, which is the highest rating for data security of an organization worldwide." [9]

We have integrated SSL COMMEREZ to out system for the payment method along with cash on delivery.

Figure 10: Payment Gateway

4.3 Summary

In this chapter, we discussed about the technical stuffs we used in our system. We used both hardware and software for the project. For hardware part, we have used ESP8266 microcontroller, load cell, load cell amplifier. For software, we used HTML, CSS, JS, Bootstrap, PHP, SMTP server, XAMPP server, MySQL database. We have also used Arduino code to send the sensor data to the database.

Chapter 5: Design Implementation

5.1 Introduction

In this chapter, we will discuss about the design of the technical functions of the project. Implementation is the action that must follow any preliminary thinking in order for something to happen. Our project features required perfect design implementation in order to run in harmony with other features. We have discussed the entire design implementation in this chapter.

5.2 List of necessary hardware components

In our system, we use gas level data by measuring the weight of the cylinder. We have to use a sensor, microcontroller and wifi module to send the data to server.

5.2.1 Required Tools for Design Implementation

- Loadcell (10KG)
- HXT11 Amplifier Module
- ESP8266 Microcontroller

5.2.2 Required Material and components for internal circuitry

- ✓ Breadboard
- ✓ Connecting wires
- ✓ Resistors(1k)
- ✓ Soldering device
- ✓ Wooden stand for sensor to put on

5.3 Description of the Software

In this section, we will talk about software we used to build our system. We used web programming language to make our website. We used microcontroller code to run our hardware part.

5.3.1 Programming software

- ✓ VS code
- ✓ Arduino IDE

5.3.2 HTML Editor

- ✓ Notepad++
- ✓ ATOM

5.3.3 Simulation Software

- ✓ Fritz
- ✓ Proteus

5.3.4 Server Used

- ✓ XAMMP Server
- ✓ SQL Server
- ✓ SMTP Mail Server

5.4 Hardware Implementation

In this section we will talk about the hardware component of our system.

5.4.1 Building the Chassis

Load Cell and HXT Amplifier module connection is very important for the system. The amplifier amplifies the signal and sends it to the microcontroller

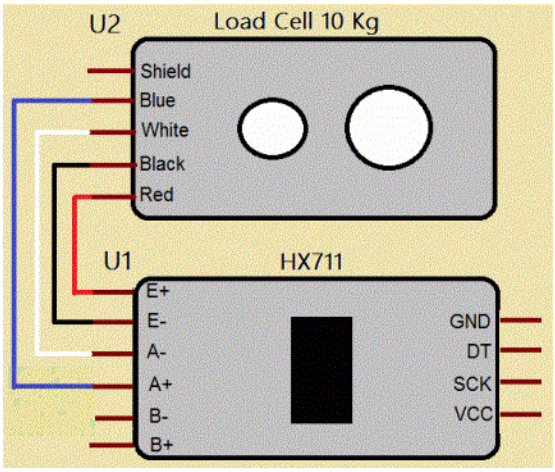

Figure 11: Load cell and Amplifier module connection

The connections are:

- ✓ RED Wire is connected to E+
- ✓ BLACK Wire is connected to E-
- ✓ WHITE Wire is connected to A-
- ✓ GREEN Wire is connected to A+

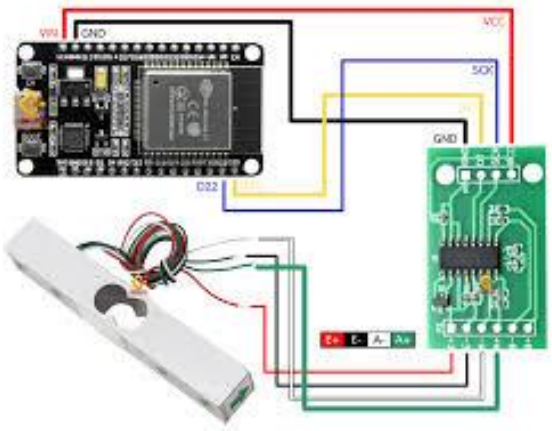

Figure 12: Hardware connections

Amplifier to load cell connection: Connect D5 and D6 to the DT and SCK pin of the amplifier module. The HX711 is a 24bit analog to digital converter "ADC". Which has an amplifier, that gives a maximum gain of 128 as per the Datasheet. The Gnd of the HX711 is connected with the NodeMCU's ground, the DT pin of the HX711 is connected with the NodeMCU's pin number D5, the SCK pin is connected with the NodeMCU's pin number D6, and the VCC pin of the HX711 breakout board is connected with the NodeMCU's 5 volts.

- ✓ NodeMCU 5v to HXT11 VCC
- ✓ NodeMCU gnd to HXT11 gnd
- ✓ NodeMCU D5 to HXT11 DT
- ✓ NodeMCU 5v to HXT11 SCK
- ✓ NodeMCU power to USB power device

After creating all the connections and made base for sensor, we simulate the program in proteus. Using USB cable to the PC, we have written program code for the sensors and the microcontroller. We used 2 resistors in the circuit to keep the circuit run smoothly. One base is below the sensor and other base in above the sensor.

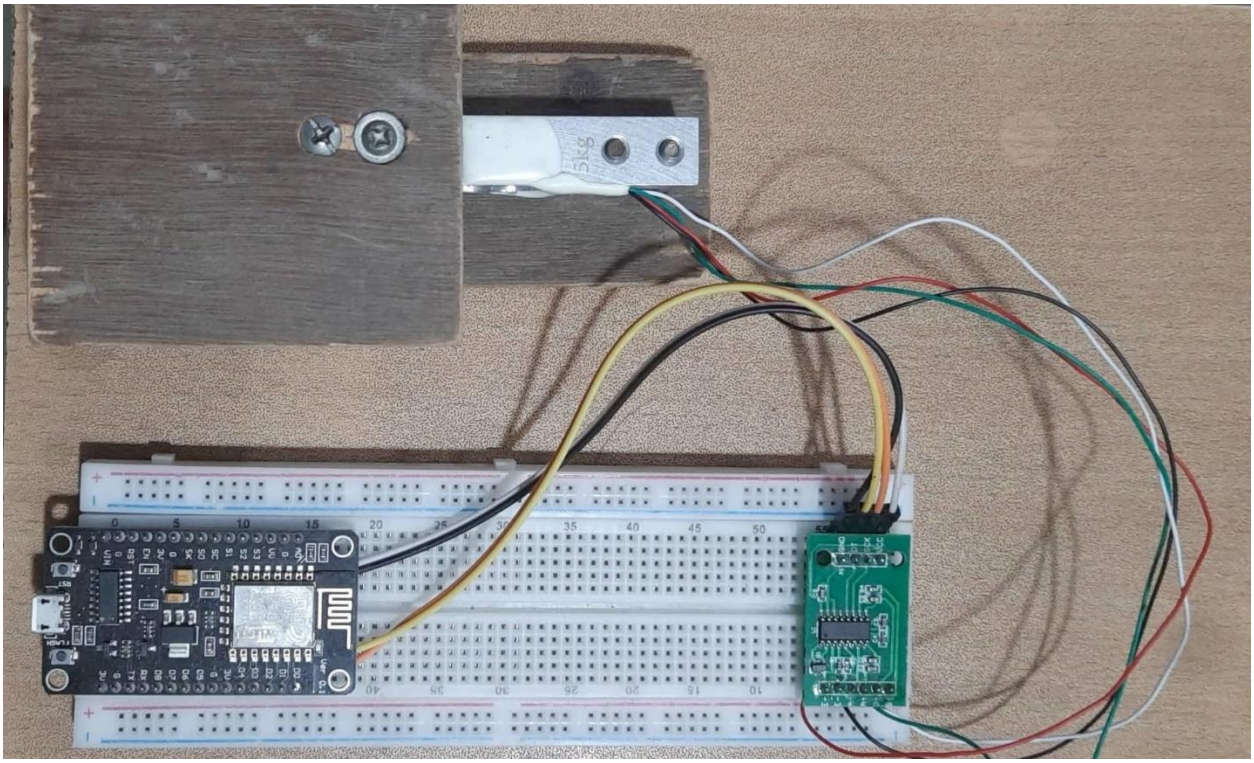

Figure 13: Complete Hardware implementation

5.4.2 Internal Circuitry Setup

A load cell is based on an electrical circuit called Wheatstone bridge.

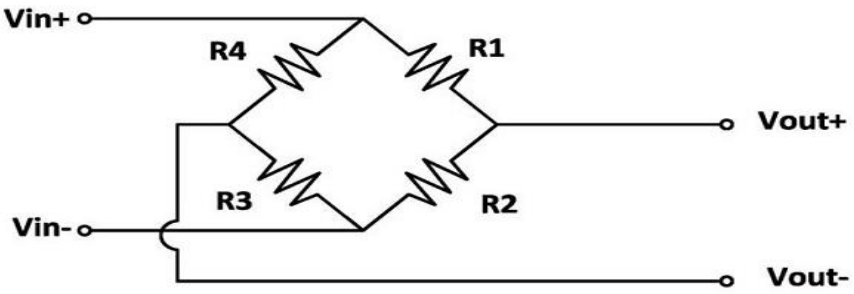

Figure 14: Load Cell Internal Circuit

Being Vin the power supply of the bridge or input excitation (V=Volts) and Vout the output signal (mV=milivolts). This arrangement allows to measure very small changes in the resistance ΔR, which occurs in the

strain gauges placed in the arms of the bridge: R1, R2, R3 and R4. When the load cell has no load, the four gauges are at rest and have the same ohmic value, the nominal value of the strain gauge Rg: R1=R2=R3=R4=Rg

Then, the output signal Vout, differential between Vout+ and Vout-, is 0 Volt (zero of the load cell).

When loading the load cell, the strain gauges changes its resistance value in a very small ratio ΔR:

R1=Rg-ΔR; R2=Rg+ΔR; R3=Rg-ΔR; R4=Rg+ΔR

Then, we will obtain an output signal Vout, proportional to the resistance variation of the strain gauges. This is at the same time proportional to the deformation of the elastic body of the cell, which is proportional to the applied force. Thereby obtains a force transducer with an electrical output signal proportional to the applied force.

output of the load cell it is usually expressed in mV/V, milivolts per volt (supply).

5.5 Software Implementation

Our system depends on the software. Our website reaches to the user, admin and to the LPG cylinder through various part. Our software part has 3 different sections.

I. Webpages
II. Database
III. API for hardware data
IV. Notification Using SMS and Email

5.5.1 Developing Webpages

Our developed system has 2 different system for user and admin. User panel is for user and admin panel is for shop admin. Both those website uses the same database.

User Panel functionality:

i. User Registration
ii. Login and password reset
iii. Product View
iv. Order Cylinder
v. Make Digital payment
vi. Keep track of the Gas Level

User Registration & Login Functionality: We have implemented a webpage for user registration with basic information and login to shop from our site.

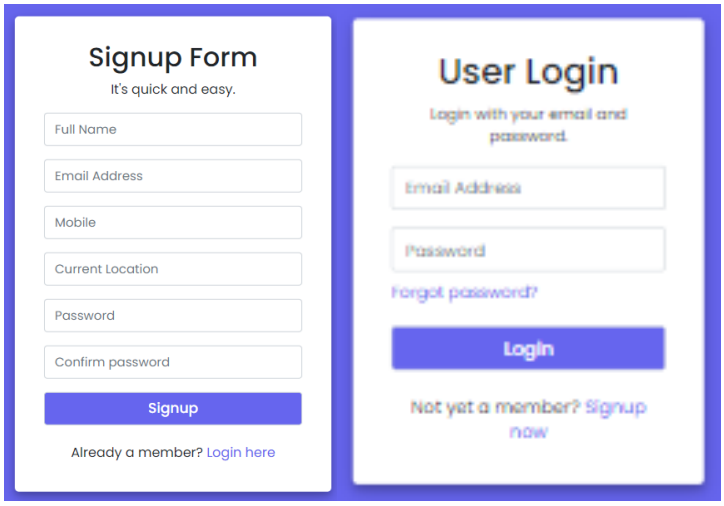

Figure 15: User Registration & Login

User profile page: We create a functionality where user can view his own information as well as the remaining gas level of the cylinder.

Welcome Sany Mohammad Khaled

Your Profile

User ID	1
Name	Sany Mohammad Khaled
Phone	01953604877
Email	sanymohammadkhaled@gmail.com
Status	verified
Remaining Gas(ltr)	258.9 Ltr.
Location	Gazipur

Figure 16: User Profile Page

Product Page: A product page to the products saved in database.

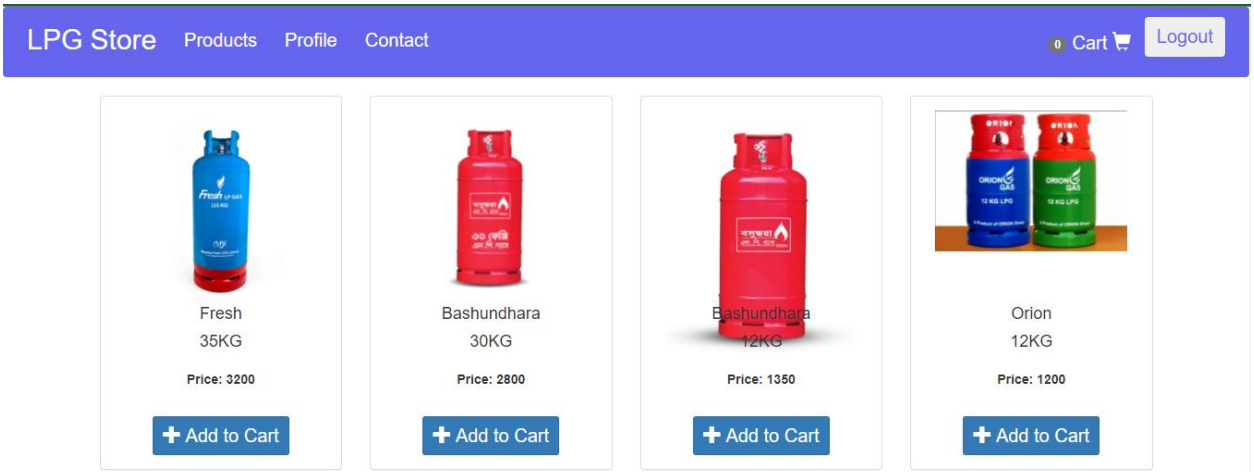

Figure 17: Product Page

Cart: We also integrated a cart page like ecommerce webpage where user can update or delete products, save the cart and can procced to checkout. This page shows all the product data and the price and the quantity.

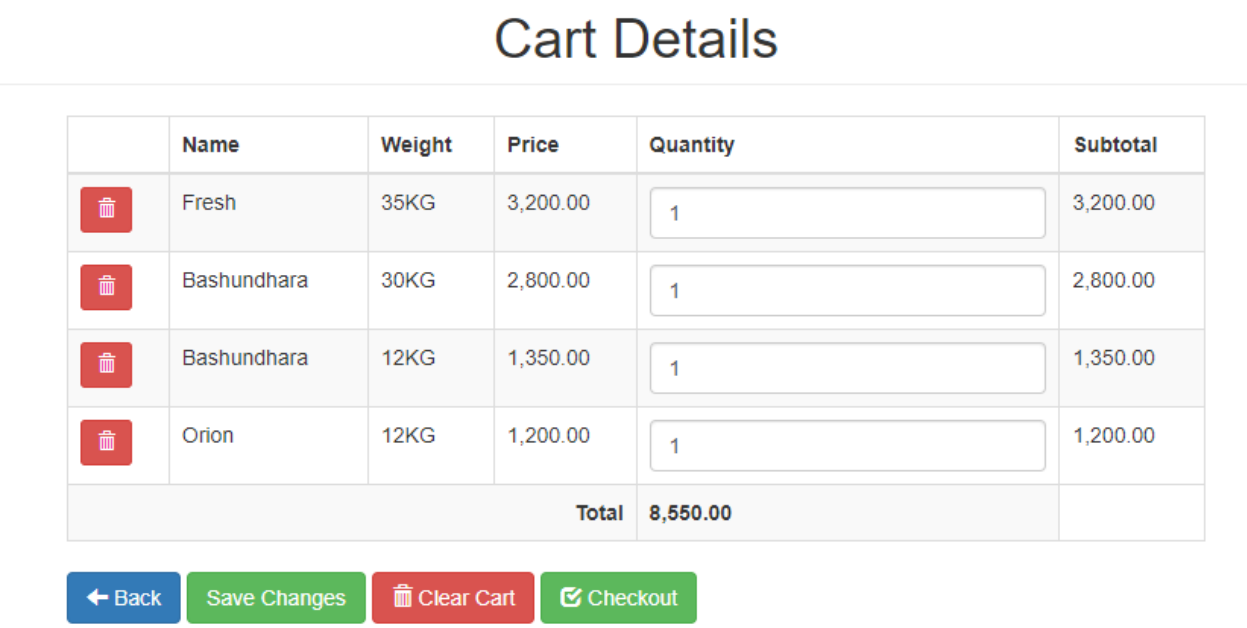

Figure 18: Cart Page

Payment Gateway: We have implemented SSL COMMEREZ payment gateway. This is the first payment gateway of Bangladesh which includes all the bank transaction, credit card transaction

and mobile banking transactions. We have taken the help of SSL COMMEREZ GITHUB page to integrate the payment method in our system.

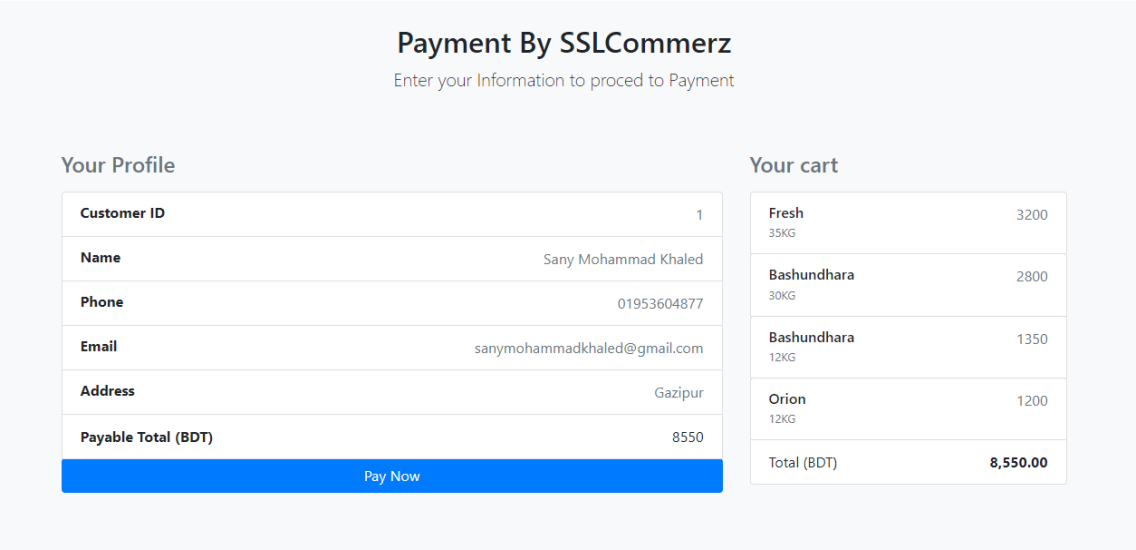

Figure 19: Payment Method

Admin Panel: We have developed a full functioning admin panel to monitor user, payment, gas level and send notification over SMS and Email to the user

Admin Login: We have created a static super admin for maintaining the shop.

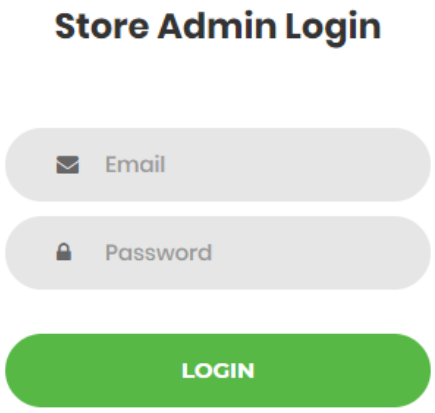

Figure 20: Shop Admin Login

Admin Dashboard: We created a functionality for admin to check the system, user, payment, verification, gas level, user complaint and user notification.

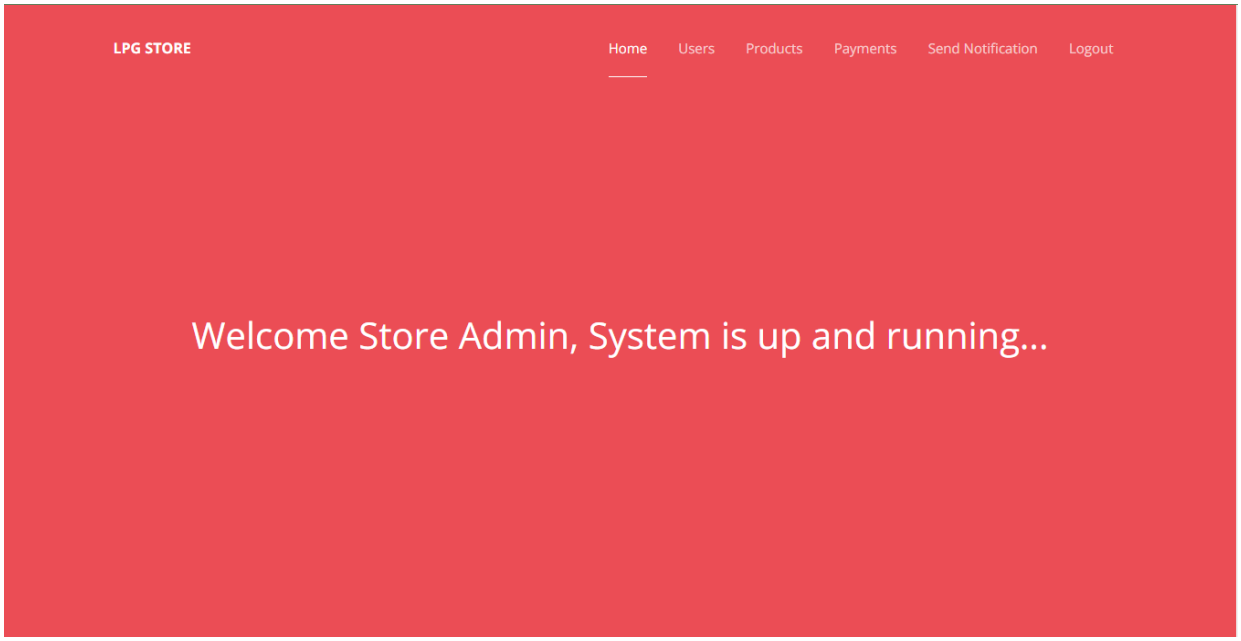

Figure 21: Admin Dashboard

Users: A developed section for admin to view users and their details including,

- Name
- Phone
- Email
- Location
- Cylinder Status

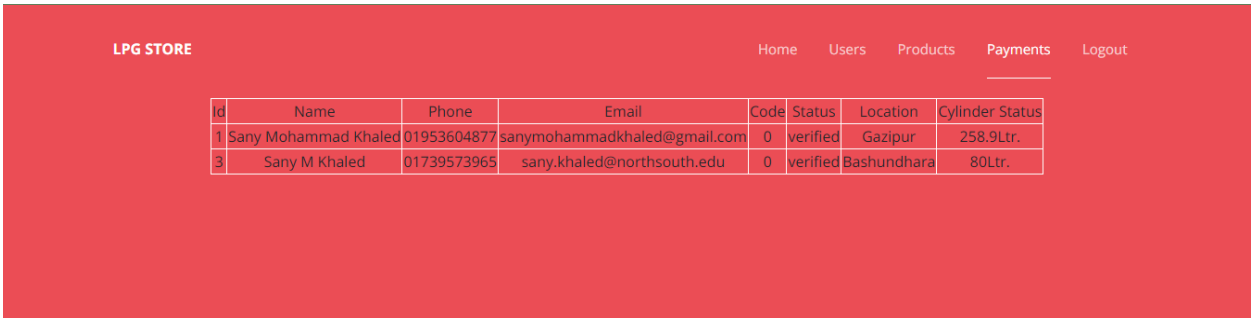

Figure 22: User Details

Payments: A functionality to track the order of every order and the transaction made the user for LPG cylinders which includes, Personal Details, Order ID, Customer ID, amount of transaction, details of products and contact information

Customer ID	Order Id	Name	Email	Phone	Amount	Address	Status	Trx ID	Currency
1	5	Sany Mohammad Khaled	sanymohammadkhaled@gmail.com	01953604877	2800	Gazipur	Processing	SSLCZ_TEST_61cc3c4e62d90	BDT
1	6	Sany Mohammad Khaled	sanymohammadkhaled@gmail.com	01953604877	6000	Gazipur	Processing	SSLCZ_TEST_61cc5776264dc	BDT
1	7	Sany Mohammad Khaled	sanymohammadkhaled@gmail.com	01953604877	4150	Gazipur	Processing	SSLCZ_TEST_61cc596b426c2	BDT
3	8	Sany M Khaled	sany.khaled@northsouth.edu	01739573965	7300	Bashundhara	Falied	SSLCZ_TEST_61cc5a1b19930	BDT
3	9	Sany M Khaled	sany.khaled@northsouth.edu	01739573965	7300	Bashundhara	Processing	SSLCZ_TEST_61cc5ab9609ed	BDT
1	10	Sany Mohammad Khaled	sanymohammadkhaled@gmail.com	01953604877	6000	Gazipur	Pending	SSLCZ_TEST_61cd3dc495648	BDT

Figure 23: Order Details

5.5.2 Designing Database:

For our system, we are using MySQL database. We have created a database named sdata and created 5 tables.

1. Admin: To keep the super user data
2. Orders: To keep track of all the orders
3. Products: To save the products of the website
4. Sensor data: To keep the sensor data
5. User: To keep the user information

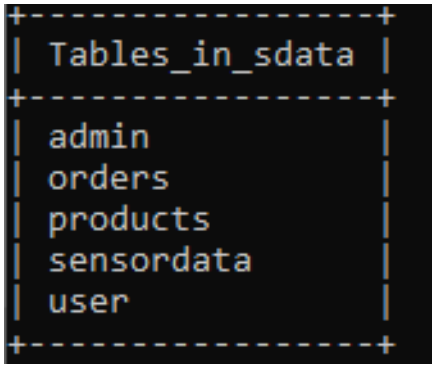

Figure 24: Database Tables

Database table details with connection details,

In admin table there is admin username and password stored for admin login. In the orders tables, there is customer id, order id, email, phone, name of the product, quantity of the products are stored. In the sensordata table, there are information bout the sensor, user of the sensor, measurement level, API key for the website, time of the data read are stored, in the user section,

there are information about user, name, email, phone, cylinder number, location, username and passwords are stored.

Connections:

Admin to User: One to Many

User to product: One to many

User to sensordata: One to one

User to orders: One to many

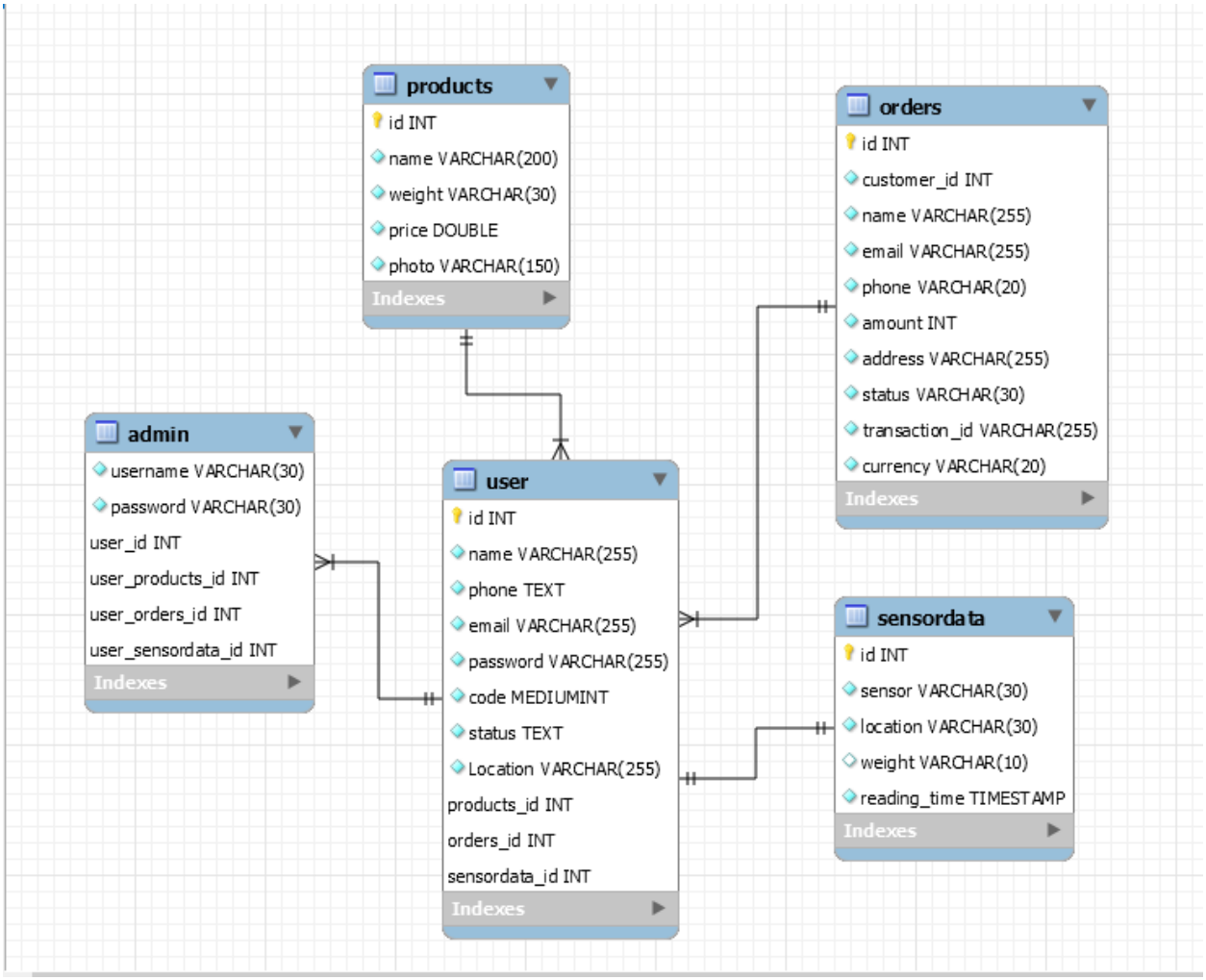

Figure 25: Database Schema

5.5.3 API for hardware data

For our system, we have developed an API for our system. We have used a WIFI module to send the data to the server. We have established public area network using the WIFI module.

The ESP8266 client creates its own wireless network So, it can discover other Wi-Fi devices to connect to that network. After connecting to the network, it starts to send the data to the server in every 30 minutes.

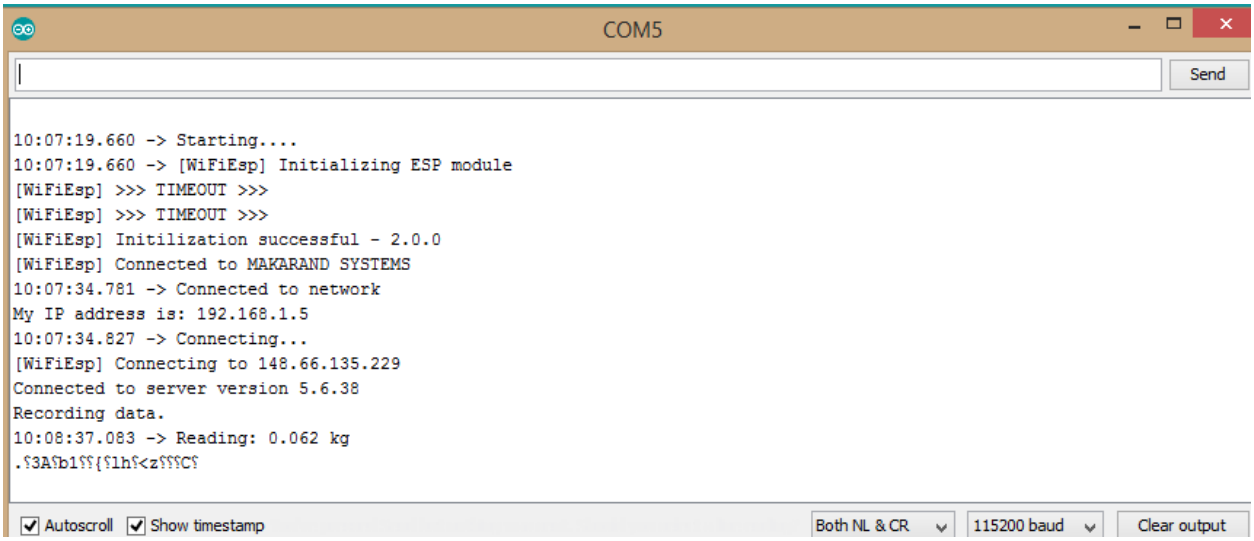

Figure 26:ESP Module Connection to the Database

5.5.4 Notification using SMS and Email

We have hosted our system to the local server. So, we need some basic configuration to the local machine to set up the server. Then we took the help of Gmail and SMTP mail server to send and receive the mail from or to the user or admin. Simple Mail Transfer Protocol (SMTP) is based on end-to-end message delivery.

A Simple Mail Transfer Protocol (SMTP) client contacts the destination host's Simple Mail Transfer Protocol (SMTP) server on well-known port 25, to deliver the mail. The client then waits for the server to send a 220 READY FOR MAIL message.

Upon receipt of the 220 messages, the client sends a HELO command. The server then responds with a "250 Requested mail action okay" message. After this, the mail transaction will begin with a MAIL command that gives the sender identification as well as a FROM: field that contains the address to which errors should be reported.

After a successful MAIL command, the sender issues a series of RCPT commands that identify recipients of the mail message. The receiver will the acknowledge each RCPT command by sending 250 OK or by sending the error message 550 No such user here. [10]

We have written php code for sending the mail only to those users whose gas level data is too low.

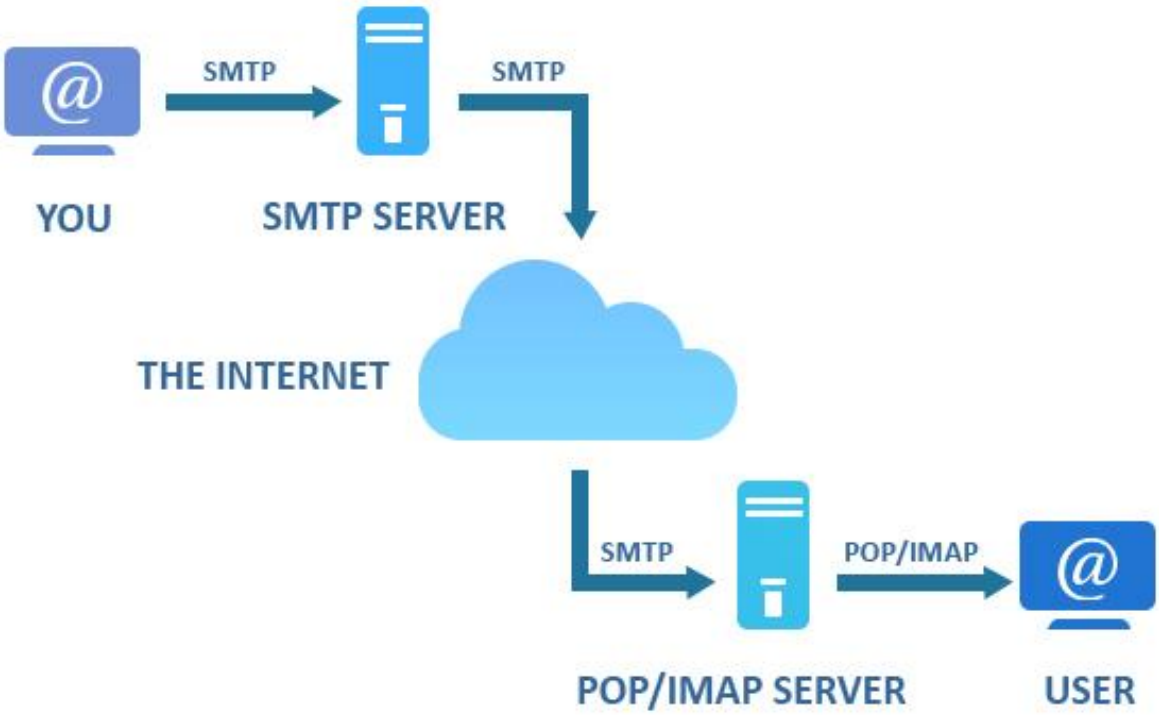

Figure 27: SMTP Mail Server Functionality

We have taken help from a third-party bulk SMS provider to send the notification to the user.

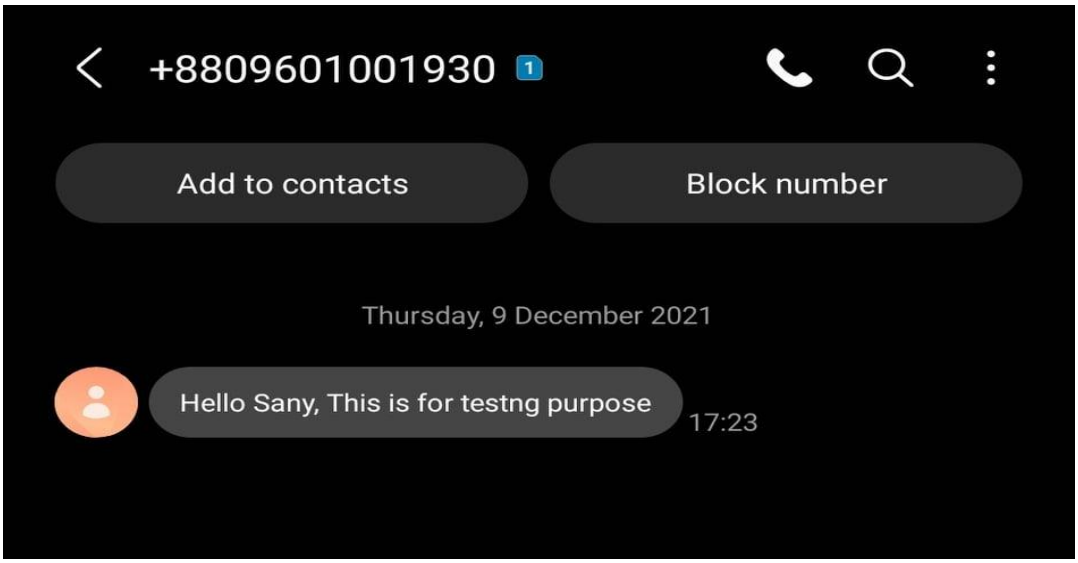

Figure 28: Test SMS Notification

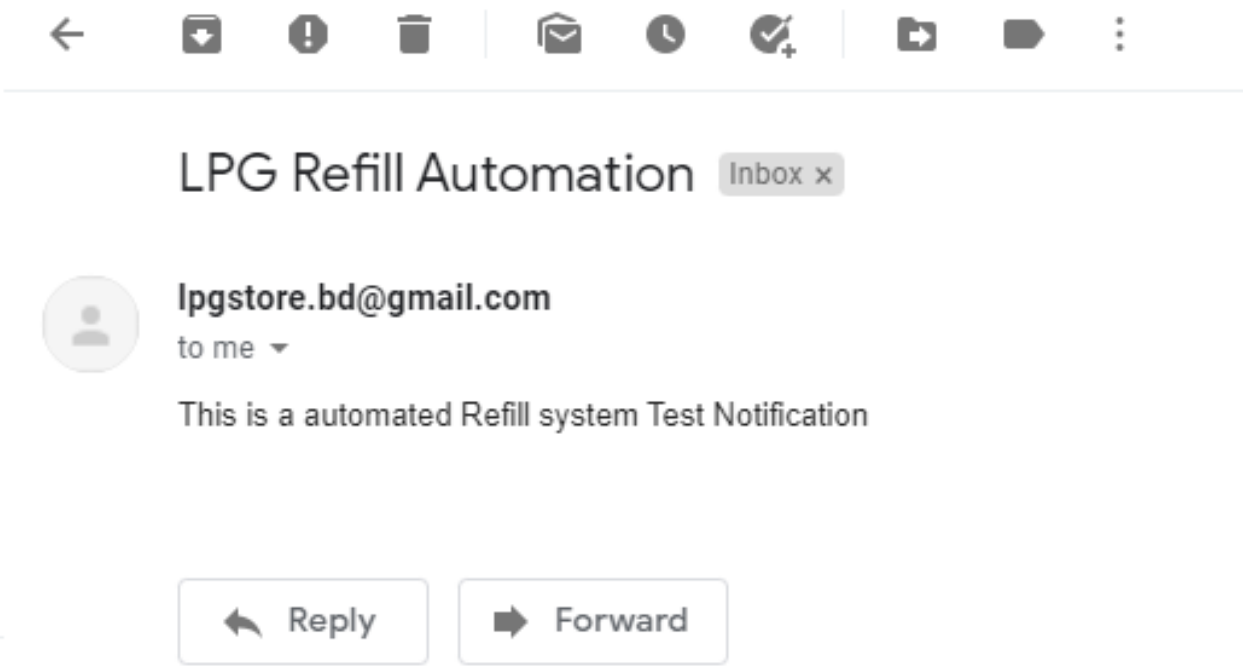

Figure 29: Email Notification

We have tested both the SMS and Email notification service and both of the functionality works fine with our system.

5.6 Summary

In this chapter, we have discussed about the core of the project, products that needs for the project, tools we used, software programs we need, simulator we used and the database we used. For the project, we have to gather plenty of things and acquire plenty of things out of our study material. We had to buy the sensors, soldering devices, wires, controllers, resistors and power supply cable. For software part, we had to learn many new things to finish the project. We used MySQL database, SMTP Mail server, third party bulk SMS service, web programing languages. We also created our own public area network and server to upload the sensor data to the database. Here we have discussed how we designed our whole system and how we achieved it with proper implementation. The process helped us to achieve more than we expected.

Chapter 6: Compliance with Standards

6.1 Introduction

In this chapter, we discuss about the consistency of our system with diverse standard. There are several international standards which a system should meet. Among them, IEEE, US and European standards are noteworthy to mention. The compliance of our developed system to all these standards is discussed in this section.

6.2 Compliance with IEEE standard

In Case of IEEE standard, there are a few distinct guidelines put forwarded by IEEE Standard affiliation. Load sensor, amplifier module and nodemcu models are used in other IEEE standard projects. Our equipment is safe and does not pose any threat to the environment. Our system is beneficial to the society. We could not find any direct guideline about the system we built. However, the wireless connection we created by nodemcu and local server met the IEEE guideline perfectly with the wireless IEEE 802.11 policy. [11]

6.3 Compliance with US standard

In case of US standards, we could not find exact standard for our hardware system. We find a system for ecommerce business. Like ISO 10008:2013, ISO 9126; user quality management and customer satisfaction, our ecommerce system meets the standard as we are selling goods with data security, privacy and with secure payment gateway. [12]

6.4 Compliance with European standard

Our developed hardware part has no conflict with European standard, The Electronic Commerce Directive (2000/31/EC) provides rules for online services in the EU. Our system met the standard requirements for running ecommerce in European standard also. [13]

6.5 Summary

The different standards of safety, regulations and laws are discussed in this section. As our hardware is not harmful or make no disturbance with the environment and our ecommerce website is already an accepted marketplace in all over the world, our system meets the relevant regulations set by IEEE, US and European Standard.

Chapter 7: Design Impact

7.1 Economic Impact

With a growing industry like LPG, if providers start to use our product, there will not be a huge economic impact from the beginning but definitely it will help them to keep track of the users, get feedback and grow more of their business. In the long run with exponentially growing users, we may see a healthy economic impact.

7.2 Environmental Impact

Our hardware system is a simple load measuring device which do not make any harm to the environment, and the wireless equipment we use is a common and have low frequency compare to other wireless equipment. Our system doesn't do any good for the environment but also it doesn't pollute it.

7.3 Social Impact

Our system is only for the LPG users. So, this brings on a good impact only one portion of the people. Our developed system brings a solution to minimize the hassle of LPG users. In this era of ours, everything has been automated so does ours. Our system automates the LPG refill system and make LPG users life easier.

7.4 Political Impact

Our project does not have any direct impact on political aspects.

7.5 Ethical Impact

Our project helps the LPG users and providers. Our system makes life easier for the user, decreases hassle of LPG refilling, anyone can order or refill LPG at any time with a few clicks. On the other hand, our project helps providers to keep track of users, payments and cylinders which helps them a lot. So, we can say, from ethical point of view, our project is on positive sides.

7.6 Health and Safety Impact

Our system doesn't have any health and safety issues.

7.7 Manufacturability

Our system is well designed and documented. Hardware parts are widely available and software parts are mostly open source. Thus, this would not be a complex system to manufacture

7.8 Durability

Durability is the ability of a physical product to remain functional. We don't have the scope for checking the durability of our system. We just build the prototype of the system using local sensors and components.

7.9 Summary

In this chapter, we discussed about the economic, social, environmental, political impact of our project. We also discussed about health and safety issue, manufacturability and durability of our project.

Chapter 8: Total Cost for Implementation

8.1 Introduction

Cost efficiency is one of the biggest parameters for an idea to become successful. For any problem, solution must be cost efficient for end user and provider. Without cost efficiency, the product or proposed solution fails most of the time. For our project, we tried to make a solution for LPG users with a minimal cost which will benefit users and providers both.

8.2 Cost Table

Table 1: Cost Table

Components	Quantity	Price
1. Load Sensor	1	200-TK
2. Amplifier Module	1	240-TK
3. NodeMCU	1	400-TK
4. Breadboard	2	110-TK
5. Wires		40-TK
6. Wooden Base	2	200-TK
7. WIFI Module	1	160-TK
8. Bulk SMS API	1	200-TK
9. Other components		250-TK
Total		1800-TK

8.3 Summary

In this chapter, we discussed about the hardware component cost of our project and software API price we used in our website to send notifications.

Chapter 9: Result & Discussions

Our goal was to make an analog distribution management system smart with the help of hardware and software components. After plenty of research, planning and worktime, we have successfully reached our goal. We have implemented and tested all the features we propped initially;

- ✓ We have implemented load sensing device and connected that to a server using WIFI module. These data go to database.
- ✓ We have developed an Ecommerce Website for user where he/she can register and purchase cylinder. User can also check the remaining gas level
- ✓ We have developed an admin panel. Store Admin can see all the user, payment, gas level and can send email automatically to user for refill and payment.
- ✓ We have successfully launched our application and tested all the possible scenario. All the features are working perfectly.

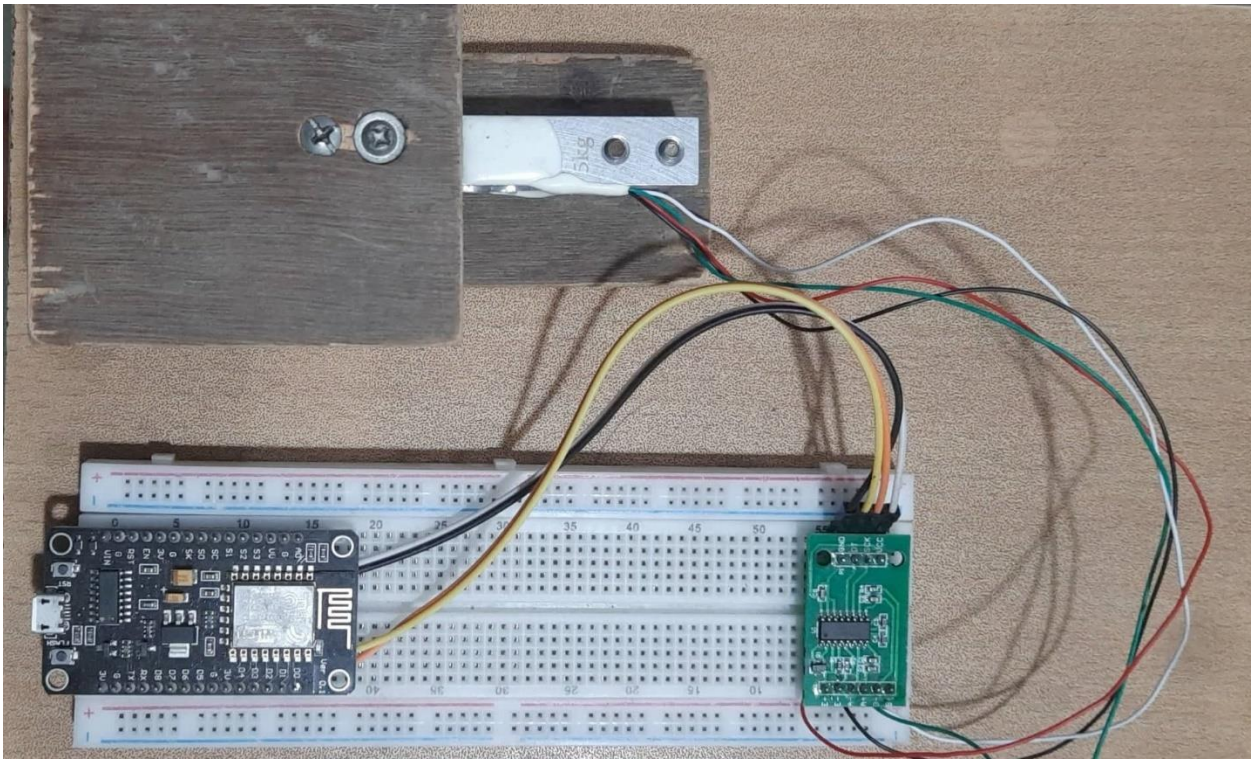

Figure 30: Hardware System

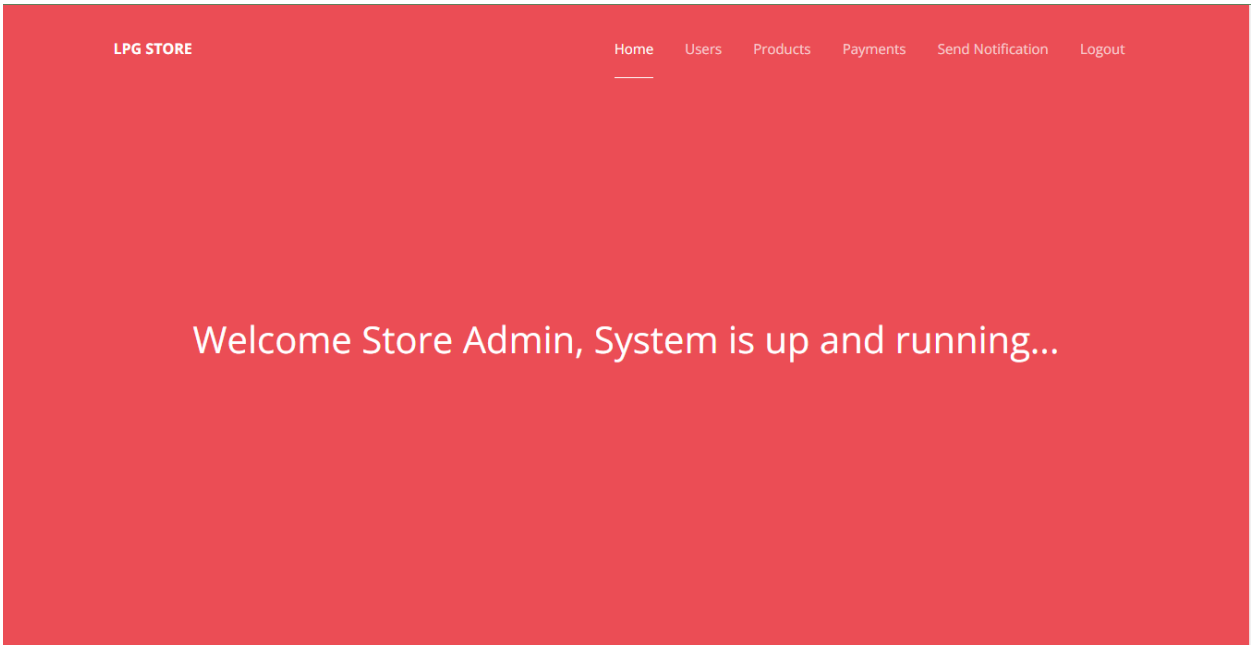

Figure 31: Admin Panel

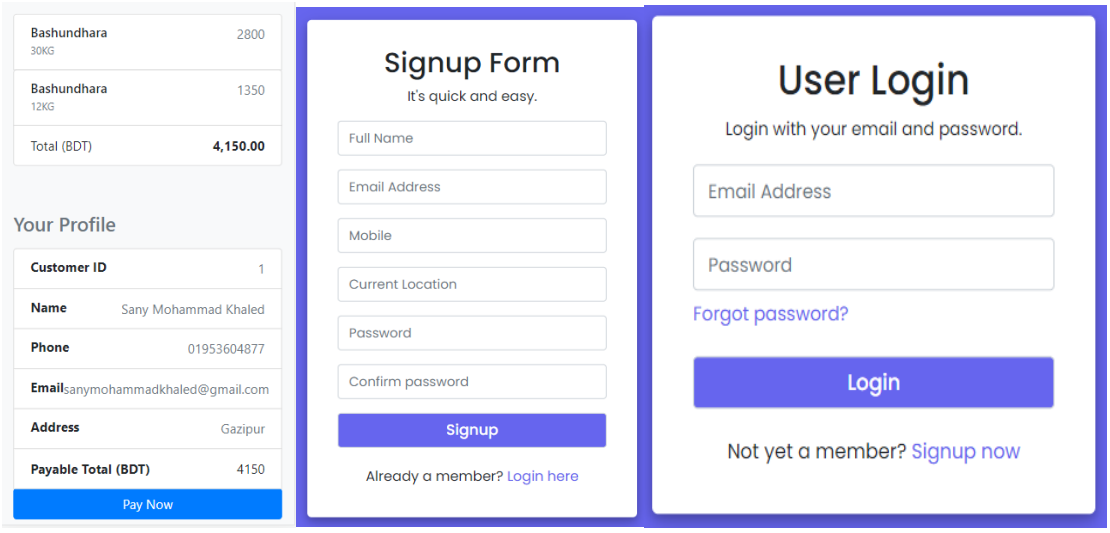

Figure 32: Payment, Signup, Login

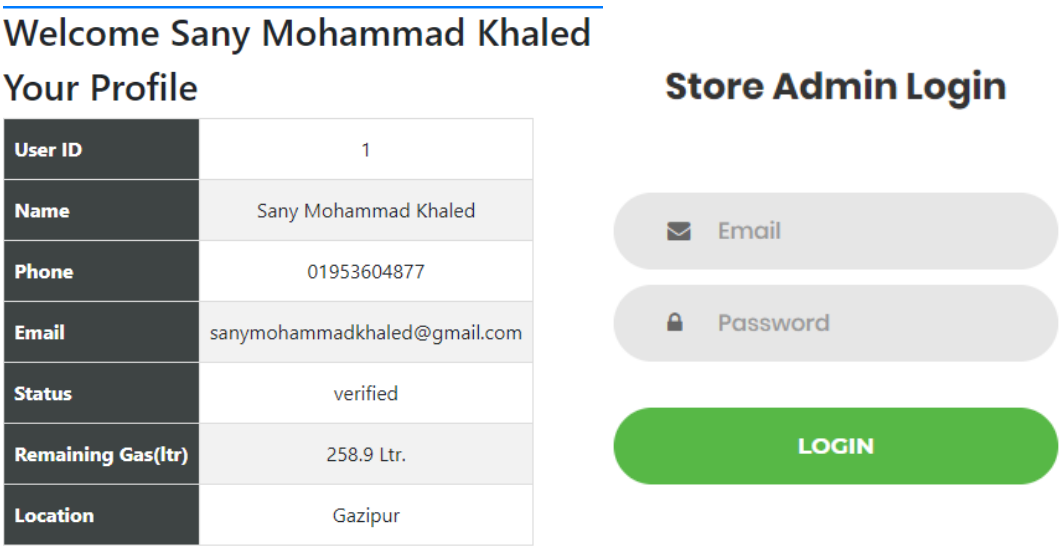

Figure 33 User Profile, Admin Login

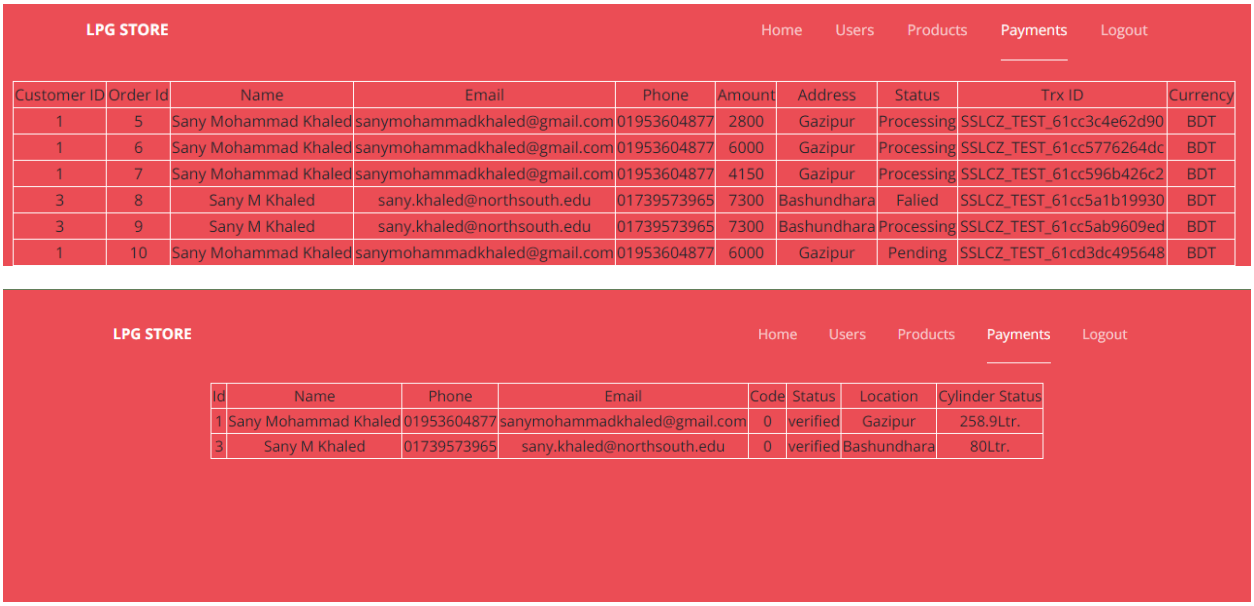

Figure 34: User data, Order Data

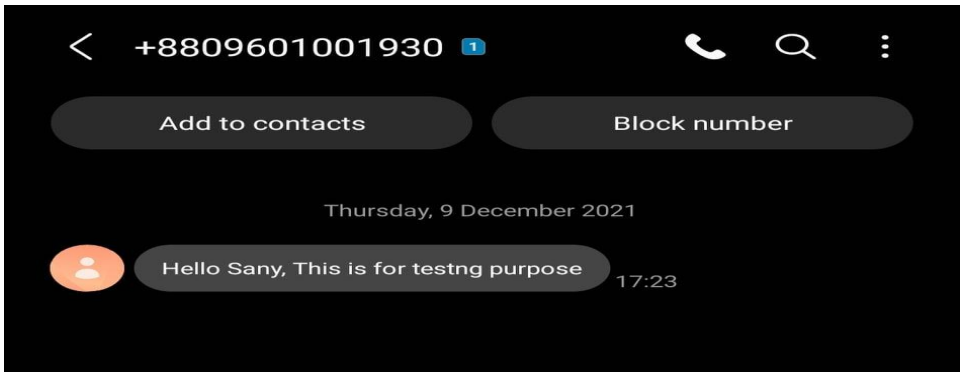

Figure 35: Test SMS Notification

Chapter 10: Conclusion and Future Work

10.1 Conclusion

LPG is the next generation of fuel. Bangladesh is one of the densely populated countries in the world. The key energy source in the country is natural gas but the supply is less than the demand. So, people are moving towards LPG in increasing rate. With so much new consumer moving into LPG, the distribution management system is still analog system and people face many difficulties about LPG cylinder refill. So, mitigate this hassle and to bring LPG under one platform, we developed a system.

Our system offers online purchases of LPG with full functioning payment gateway which includes bank payment, card payment, mobile banking payment and cash on delivery also. Currently, there is no management system for LPG distribution. Ecommerce is already in every sector of business and we also adopt the ecommerce concept with the LPG management.

With the mixture of hardware and software, we also make the refill system automated. Admin and consumer, both can have a track of remaining gas level constantly. With a simple payment confirmation from consumer, providers will refill the cylinder.

After talking with providers and consumer, we found out the best solution to mitigate the hassle of both party and successfully implemented our system. Our smart LPG distribution system is ready to replace the analog LPG Distribution system.

10.2 Future Plan

Although our developed system is fully capable of replacing old management system, there is always a place for betterment. Initially, we have implemented our system on local server, used local mail server and it only runs on browser. We have following plans to make our system more user friendly and increase availability;

- We want to focus more on user interface for better user experience.
- Beside website, we want make android and iOS version of the system.
- We want to move the system from local server to hosted server.

Chapter11: Bibliography

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Chapter11: Appendices

Appendix A: ESP program code for data to read and send to the web server

```
#include <ESP8266WiFi.h>

#include <ESP8266HTTPClient.h>

#include <WiFiClient.h>

WiFiClient WifiClient;

#include <Wire.h>

#include "HX711.h"


#define calibration_factor 400000 //This value is obtained using the
SparkFun_HX711_Calibration sketch


#define LOADCELL_DOUT_PIN  D6

#define LOADCELL_SCK_PIN  D5


HX711 scale;

const char* ssid     = "sany";

const char* password = "Sany1111";

const char* serverName = "http://192.168.1.102/499B/post-esp-data.php";

// Example: http://xxx.com/esp_hcsr04_php_post.php

String apiKeyValue ="abc";

// Example: tPmAT5Ab3j7F9

String sensorName = "1";

String sensorLocation = "Gazipur";

void setup() {

  Serial.begin(9600);

  WiFi.begin(ssid, password);
```

```
  Serial.println("Connecting");
  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }
  Serial.println("");
  Serial.print("Connected to WiFi network with IP Address: ");
  Serial.println(WiFi.localIP());

  scale.begin(LOADCELL_DOUT_PIN, LOADCELL_SCK_PIN);
  scale.set_scale(calibration_factor); //This value is obtained by using the SparkFun_HX711_Calibration sketch
  scale.tare(); //Assuming there is no weight on the scale at start up, reset the scale to 0

  Serial.println("Readings:");
}
void loop() {
    if (WiFi.status() == WL_CONNECTED) {
    HTTPClient http;
    http.begin(WifiClient,serverName);

    http.addHeader("Content-Type", "application/x-www-form-urlencoded");

    // Prepare your HTTP POST request data
    String httpRequestData = "api_key=" + apiKeyValue + "&sensor=" + sensorName + "&location=" + sensorLocation + "&weight=" + String(scale.get_units(),1) + "";
    Serial.print("httpRequestData: ");
    Serial.println(httpRequestData);
```

```
    // Send HTTP POST request
    int httpResponseCode = http.POST(httpRequestData);

    if (httpResponseCode > 0) {
      Serial.print("HTTP Response code: ");
      Serial.println(httpResponseCode);
    }
    else {
      Serial.print("Error code: ");
      Serial.println(httpResponseCode);
    }
    // Free resources
    http.end();
  }
  else {
    Serial.println("WiFi Disconnected");
  }
  delay(2000);
}
```