Monitoring System for Gas Station Underground Fuel Storage Tank using Internet of Things

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BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

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ABSTRACT

Gasoline station nowadays are still using the manual method of monitoring the underground fuel tank and its fuel level, there are causes in using the manual process, it can affect the health of workers who are assigned in dip sticking and it is a waste of time monitoring system for gas station underground fuel storage tank using internet of things" is an Arduino base project that was designed and developed in Python Arduino code. It is a comprehensive information system intended to manage, monitor and record the status inside the fuel storage tank.

The primary objective of this work is to develop an effortless and efficient tool to automate the monitoring process of the fuel level in underground storage tank. Prototyping model was used as the software development life cycle, with this type of method; the researchers can create a sample program that will be presented to the target users.

Monitoring System for Gas Station Underground Fuel Storage Tank using Internet of Things was evaluated by IT experts and tested by the end-users and the results showed that the said application is capable of replacing the manual of monitoring the fuel level for it will simplify the process of monitoring the underground storage tank fuel level status.

The researchers recommended conducting trainings for the end-users to familiarize themselves to the features of the system and it was also recommended to conduct a further study on how to improve and maintain the Monitoring System for Gas Station Underground Fuel Storage Tank using Internet of Things.

Keywords: Prototype model, Automate, Arduino, Python code

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To our Almighty father, our Lord and Savior, for giving the wisdom, strength, support, and knowledge in exploring things, for the guidance in helping surpass all the trials that we encountered and for giving determination and pursue our study, and to make this study possible.

DEDICATION

This humble project is heartily and profoundly dedicated to the following persons who spend their time with us and show their concern from the beginning until now that inspires us a lot.

Our beloved School,J.H Cerilles States College School of Engeneering and Technology;

Our loving parents, for the moral encouragement, financial assistance as well as their spiritual support in every path the researchers take:

Nestor P. Niego

Mary J. Niego

Elsa G. Tago

Edith M. Sulatorio

Claude Mae Limbaga Cacayuran

Above all, the Almighty Father

To God be all the Glory!

Mairine

Grand Year

Jonnabelle

Louie Jay

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BACKGROUND OF THE PROBLEM

Introduction

Our society is now being reshaped by rapid advances in information technologies-computers, telecommunications network, and other digital systems-that have vastly increased our capacity to know, achieve and collaborate (Attali et al 1992). These technologies allow us to transmit information quickly and widely, linking distant places and diverse areas of endeavor in productive new ways, and to create communities that just a decade ago was unimaginable.

Human environment been through other periods of dramatic change before, driven by such innovations as the steam engine, railroad, telephone, and automobile. But never have we experienced technologies that are evolving so rapidly. The rapid evolution of digital technologies is creating not only new opportunities of our society but challenges to it as well. Computer technology evolves at such a rapid pace; many businesses try to keep up by upgrading their computer systems on a regular basis to remain competitive. The ability of technology to perform multiple functions for its advanced system is also a significant aspect in a company's decision to adopt software. It makes effective use of advanced technology and aspires to learn more.

Monitoring the underground fuel storage tank periodically is essential to gas station operators as they need to control the quantities of the fuel stock, workers at gas stations use dipstick to measure the volume of the fuel in the underground tank. This task normally takes half an hour which is inconvenient, especially under the hot weather in Malaysia. Not only that, but the workers are also at risk of inhaling hydrocarbon released by gasoline which can cause health problems. There are more than 30,000 persons affected by hydrocarbon toxicity

every year. Furthermore, this conventional method might be inaccurate due to human errors when performing the measurement. (Raja, F., et. al (2019).

Project Context

Dip sticking or using manual process in measuring the gasoline level of the underground fuel tank may cause health problem because of inhaling the gasoline fume. In addition, this conventional method might be inaccurate due to human errors when performing the measurement.

To avoid such risk, this Monitoring System for Gas Station Underground Fuel Storage Tank using Internet of Things was proposed.

Purpose and Description

The purpose of Monitoring System for Gas Station Underground Fuel Storage Tank using Internet of Things was to design a prototype to monitor fuel level in underground fuel storage tank. It accurately measures fuel level left in the storage tank. This information is then stored in systems and reported to the users using Arduino base system, data will be transferred in webpage and to android application.

Objectives of the Study

The main objective of this work is to develop an effortless and efficient tool to monitor the fuel level of underground storage tank technology using Arduino, Webpage, Webpage and Android application, and to automate the manual process of monitoring the fuel level in every gasoline station to avoid risking the health of all the gasoline station workers. Furthermore, it specifically aims to:

- Monitor the fuel level in the tank;
- Send data to the cloud database/cloud storage.
- Create a webpage where data collected from the prototype, displayed, and viewed.

- Generate report on the gas level of an underground tank.
- Create android mobile application.

Significance of the Study

Monitoring System for Gas Station Underground Fuel Storage Tank using Internet of Things was significant to the following:

Gas Station Owner. The main beneficiary of this study is no other than the Gas Station Owners. They can easily use this system to monitor their business without wasting or spending a lot of time remotely.

Station Workers. Station Workers who are assigned in dip sticking will be safe and being protected in getting such sickness cause of the gasoline fume that they can inhale in performing the manual process of measure the Fuel level in underground fuel tank.

Researcher. Allows the researchers to have opportunity of Developing an Arduino Based Gasoline Station Underground Fuel Tank Monitoring System the industry. It helps the researcher enhance their skills through developing, java programming and designing and Arduino base project.

Scope and Limitation

The study is about the monitoring system for gas station fuel level. The implementation of the system is intended for the gas station to fix their problems with regards to their manual process of monitoring which called dip sticking. The gas station workers can monitor the fuel level easily by using this system. The system contains some features such as: it automatically measured the fuel level to give information to the workers if the fuel tank is full, half full or empty. It provided reliable and a user-friendly interface for both owners and workers. The owners and the workers can monitor the fuel remotely by the several hardware

devices attached to the Arduino board. After monitoring the fuel level, the attached LCD will display if the fuel tank is needed to be refill or not.

The limitation of this system are the following: the system won't send data on cloud storage without internet connection; the system can't detect any leakage of the underground fuel storage tank; it cannot send sms; and cannot detect the fuel storage tank temperature.

Definition of Terms

This defines terminologies specific to the problem domain, explaining terms, which may be unfamiliar to the reader.

Arduino. It is an open-source electronic platform based on easy-to-use hardware and software. Arduino board can read inputs light on a sensor.

Arduino Uno. Arduino boards are able to read inputs light on a sensor, a finger on a button, or a Twitter message and turn it into an output-activating a motor, turning on an LED and publishing something online. We use Arduino Uno to access the way for software so we can enter the microcontroller of the program

Capacitive Level Sensor. It is a device which detect or measures of the fuel level inside the fuel tank also it is a physical property and records, indicates, or otherwise responds to it. It is used to measure the fuel level in our tank.

ESP8266-wifi module. A hardware device that uses to send data from the sensor of the system to our cloud storage through ISP.

Hardware. Refers to the physical elements of a computer. This is also sometime called the machinery or the equipment of the computer.

LCD_i2c Display. This chip converts the I2C data from an Arduino into the parallel data required by the LCD display. The board also comes with a small trim pot to make fine adjustments to the contrast of the display.

Program. It is a series of coded software instructions to control the operation of a computer or other machine.

Python Programming. Python is commonly used for developing websites and software, task automation, data analysis, and data visualization. this programming language

was used to develop the Monitoring System for Gas Station Underground Fuel Storage Tank using Internet of Things.

Software. It is an instruction that tell a computer what to do. Software comprises the entire set of programs, procedures, and routines associated with the operation of a computer system.

System. It is a group of interacting or inter-related elements that act according to a set of rows to form a unified whole.

Chapter 2

REVIEW OF RELATED STUDIES AND SYSTEM

Technical Background

At present, Gas station companies is still using the manual system in monitoring the fuel level of their station by using dip stick. Monitoring System for Gas Station Underground Fuel Storage Tank using Internet of Things is used to monitor the fuel level automatically. Since this Arduino based project was designed as an automated fuel monitoring system. The system can be used by the workers and owners of the said company. The Gasoline station owners shall avail this system to be advance in monitoring their underground fuel tank storage and also not being behind from other competitive gasoline station companies.

Researchers create a webpage to give all the information needed by those who want to know or try the Monitoring System for Gas Station Underground Fuel Storage Tank using Internet of Things this web is created for visitors of the system. Also researchers created an android application to make all the monitoring strategies easier user will just click and open the android application installed in their smartphones and automatically the status of the fuel level will display all the information that users need.

Hardware Specification

In development of Monitoring System for Gas Station Underground Fuel Storage Tank using Internet of Things, these are the following hardware specifications were required:

Arduino Board

The goal of Arduino is to create an accessible way for software developers to enter the world of microcontroller programming, researchers used this device to upload the Arduino IDE program to the system

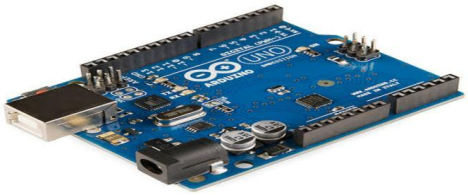

Figure 2.1 Arduino Uno

Sensor

A sensor converts the physical action to be measured into an electrical equivalent and processes it so that the electrical signals can be easily sent and further process. It is used to measure the distance of the fuel level through the movement of the floater.

Figure 2.2 Capacitive Sensor

LCD_i2c

Users can easily interface a Liquid Crystal Display (LCD) with an Arduino to provide a user interface. Here, users can monitor the fuel level in the fuel tank. This device displayed the fuel level output.

Figure 2.3 LCD_i2c Display

Jumper Wires

It used for connecting the components to the Arduino board and also to splice if there are wires that cannot reach the area of connecting to other components.

Figure 2.5 Jumper Wires

ESP8266-Wifi Module

This is a transmission layer of Internet of things is used to convert serial port or TTL in to invaded module which can conforming to Wi-Fi, researcher used this kind of device in order to send data to ThingSpeak .

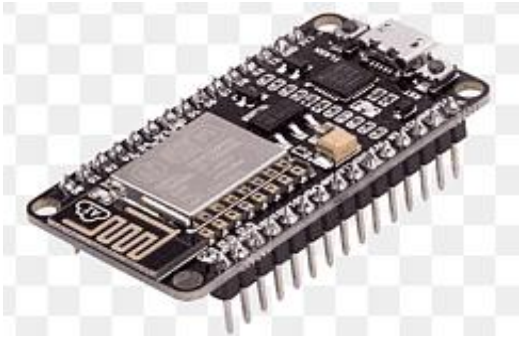

Figure 2.6 Wi-Fi module

Breadboard

It is used to build and test circuits before finalizing any circuit design in creating a system, researchers used this device in order to connect or to provide circuit in the proposed project system.

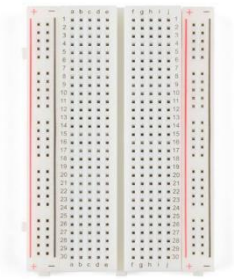

Figure 2.6 Breadboard

Software Specification

An Integrated Development Environment called Arduino IDE was being used by the proponents to write and Upload programs to Arduino compatible boards, where user manipulate the codes and upload it to the prototype to achieve its desired outputs. The proponents also created a Thing Speak account to provide instant visualization of data from the prototype.

In creating the System webpage, the proponents use the PHP a side scripting language that was embedded in HTML. The proponents uploaded the finish system to their web hosting account for the user to access it using their mobile phones or laptop wherever they are to monitor the data's in monitoring the fuel level left in the storage tank. The proponents also used the android studio to create an application for android mobile phone the researcher will used a python language to manipulate the android studio coding.

Programming Environment

Arduino technology has its own Integrated Development Environment (IDE) which the users can easily code the components to do its functions. It contains a text editor for

writing a code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It is connected to the *Arduino* hardware to upload programs and communicate with them. The proponents also used the PHP in designing the monitoring system and Thingspeak.com, also a website for displaying the data inside the prototype and fetch it to display it in the monitoring system.

Related Studies

According to International Journal of Engineering Research and Technology Konstantinos Loizou, Eftichios Kourtroulis, have proposed a sensor which is constructed using multilayer tubes. The cost of manufacturing and associated electronic circuits, which are used for data collection were low. The proposed sensor was developed using polyethylene pipes, which were used for construction of water distribution systems in buildings and industries. The working of this sensor was evaluated in a 4-meter water storage tank. The results of the experiment presented the accuracy of the sensor. However, the sensor showed some limitations when it was use for long time.

L.A. Gama-Moreno, A. Corralejo, A.Ramirez-Molina, implemented a system to monitor water tanks. The implemented system consisted of instrumentation system, an application, which managed the water levels and a mobile user interface. The system was called as Interface Monitoring Water Tanks (IRMA). Ultrasonic sensor was put into use along with Arduino Microcontroller Board, which is connected to the application service. Notifications are sent when the water level goes below the minimum threshold.

BezaNegashGetu, HussainA.Attia, have developed a system which initially tests the availability of water in the tank with the help of a level detector and then adjusts the state of the water pump according to the information collected through the level detector. This design makes use of seven segment display and a motor pump. The proposed system consists of water level sensor and a digital logic processor circuit. The proposed system eliminates

manually controlling of water requirements in home and agricultural fields. Shrenika R M, Swathi SChikmath, have designed a noncontact water level monitoring system using LabVIEW and Arduino. Ultrasonic sensor measures the depth of water in the tank. The program written will receive the data from the sensor and supplies the collected data to Arduino and based on the data received, Arduino board switches the pump ON or OFF. This design overcomes the disadvantages of most of the proposed systems which use SS sensors, which corrode when meets chemicals present in the water.

Development of an Automated System for Fuel Tank Level Checking and Machinery Location Management to Optimize Remote Accessibility and Mobile Tracking by Daniela Popescu, Adela-Ioana Borzan and Doru-Laurean Băldean

In the present paper, the approach of the subject is based on experimental testing and development. Knowing that electronic control may offer a considerable advance in improving the production process efficiency, we are defining here an applied methodology for monitoring the fuel level inside the machineries' reservoirs to assess values of consumption and energy distribution, using remote accessibility and mobile tracking. Basic materials and their connections which are applied in the present research are shown in Figure 1. It offers the implementation details, with specific connections of the Fuel Level Sensor (FLS), as well as the digital graphic interfaces. The applied research presents a practical engineering part, on the one hand, and a substantial scientific or analytical content, on the other hand. This is going to clarify what the present paper intends to show. The schematics and the figures contain some of the captures made when implementing and using the hardware with the software application for the remote control of the machinery. In the present case, the fuel level is not only monitored as a simple measurement to be displayed on board during operation. The study goes further to monitor the actual fuel flow, fuel level, consumption, and efficiency related to the work done by the specific machinery from a remote location. The

Fuel Level Sensor (FLS) (1) is the energy supplied from a battery (12–24 V) and placed in the fuel tank (2). It is supported by a volumetric method of determining the fuel level. Through the analog RS 232 interface (3), the signals are sent via electrical linkages (4) to the system's control unit (5), which transfers the location and operational data to the server (6), to be stored (8) and analyzed (9).

Synthesis

The project developed by the proponents was derived from the existing projects stated on the related studies that are the basis of the researchers in developing this system.

Those developed systems that were developed by Raja Fazliza Raja Suleiman, Fatin Qaisara Muhammad Iqmal Reza. W similar to Monitoring System for Gas Station Fuel Storage Tank because it can both automate the monitoring strategies without risking the health of a user's and also not to waste a lot of time, also they are using a level sensor to monitor the fuel level in the underground fuel storage tank and also, they have an android application same to Monitoring System for Gas Station Fuel Storage Tank. But somehow there are some capabilities of their system and to Monitoring System for Gas Station Fuel Storage Tank that is not similar, like their system can automate and detect fuel storage tank temperature but the Monitoring System for Gas Station Fuel Storage Tank cannot do that kind of process, the Monitoring System for Gas Station Fuel Storage Tank only focuses in monitoring the fuel level in the fuel storage tank.

Chapter 3

DESIGN AND METHODOLOGY

This project utilized a prototyping approach to build the Monitoring System for Gas Station Underground Fuel Storage Tank using Internet of Things. This is one of the best ways to create a new implemented device before supplying it to market. Figure 3.1 shows the flow of the methods done by the proponents in creating the study.

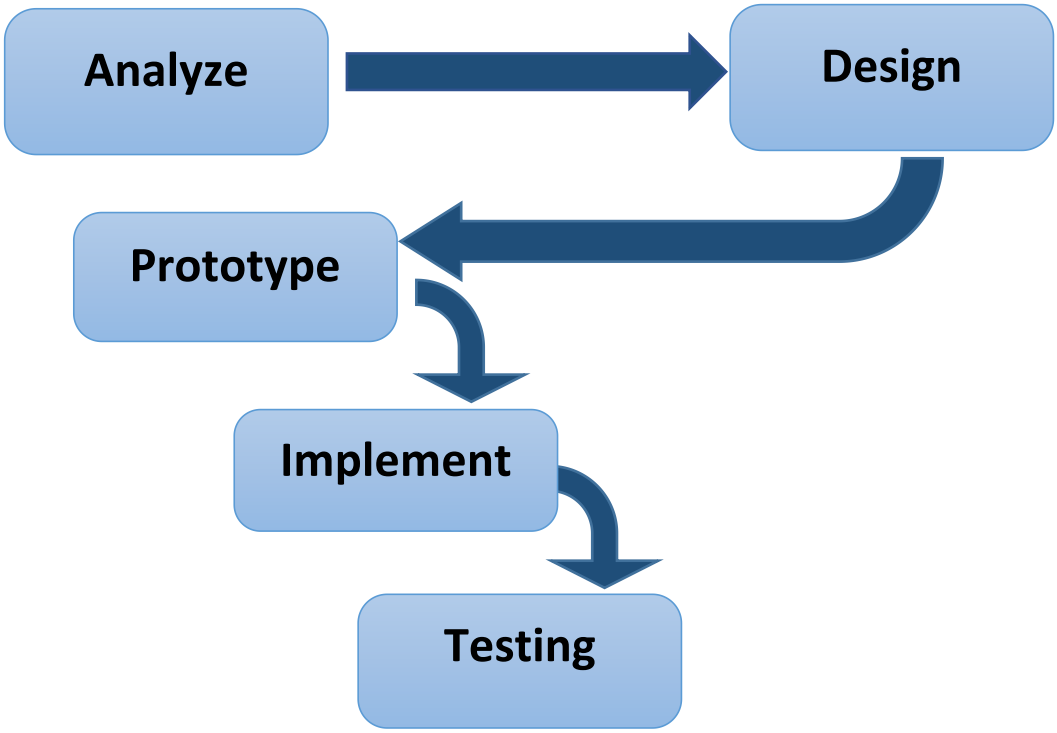

Figure 3.1 Prototype Model

Requirement Analysis

The proponents interviewed Gas Stations Owners and staff/workers to gather information required and necessary for the development of the system. The researchers asked some question about the problems that the owners and workers are facing in using manual monitoring strategy called dip sticking, and its impact of using it.

In designing the project, the researchers used the technique of analyzing how to come up with the idea of building the prototype. A month of brainstorming, planning, sharing ideas, searching for problems that needed to be solved and crafting to perfection, researchers did all to ensure that the idea is right.

Design

In designing the prototype, researchers conducted for the testing of the build project, collecting ideas all of the attached component is functional and suitable for implementation, after a month of testing the prototype the researcher's observation if more accurate than before, as what had been observed the prototype functionality is perfectly worked.

Researchers give a lot of effort to build the prototype, trying the very best to construct a miniature of a gasoline station to make the prototype more realistic and more efficient. Researchers attached all the components needed in the miniature a mini fuel storage tank, a capacitive sensor, Esp8266 Wi-Fi module, lcdi2c, Arduino Uno, and a breadboard.

Implementation of the prototype had been conducted to the gasoline station as far as the prototype is hundred percent working, it gives some benefits of the end-users. A problem has been solved, problem in using the manual process of monitoring the fuel level becomes automated. Researcher created a mobile application and a webpage connected to the Internet to gather and store data from the project.

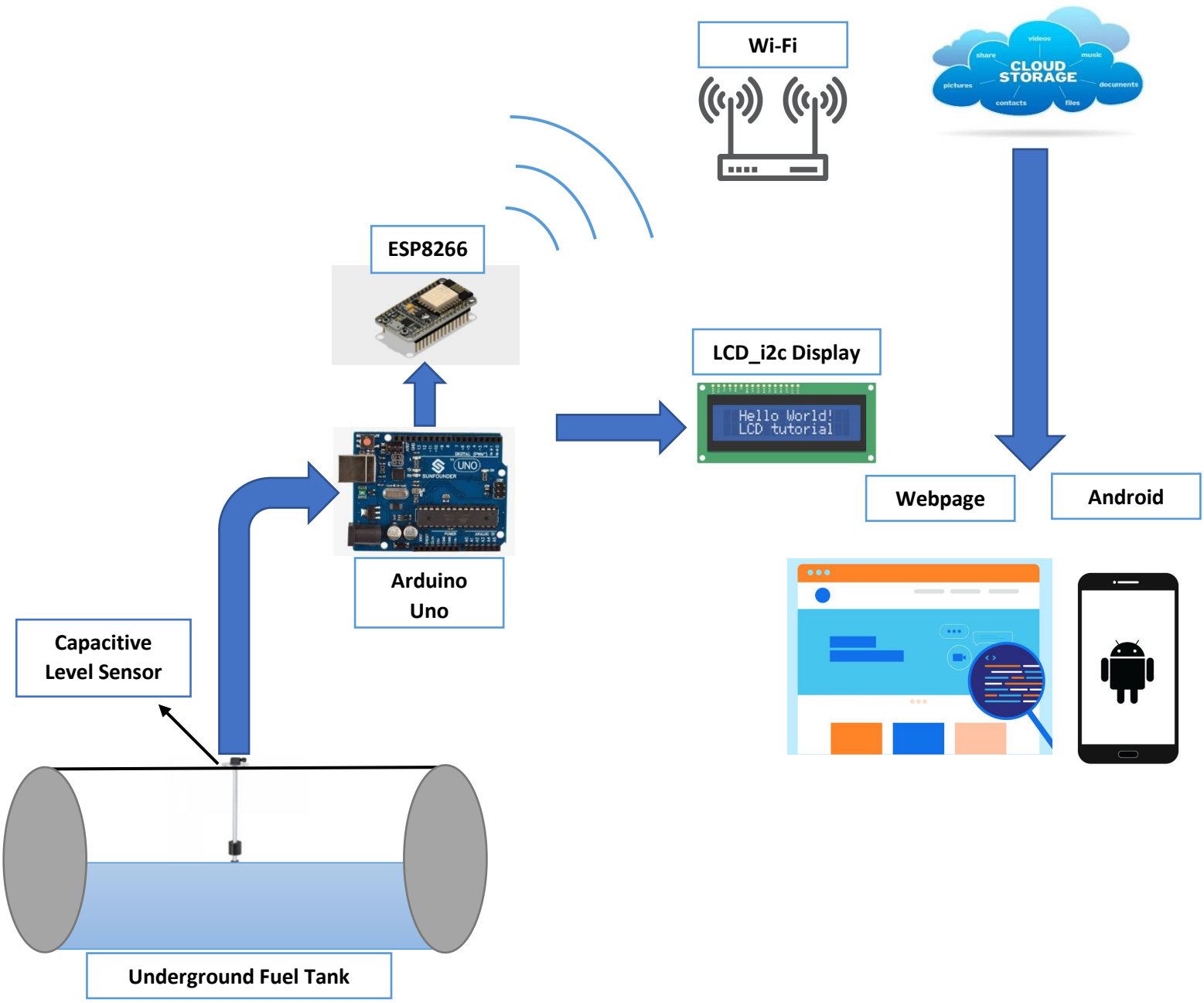

Figure 3.2 System Design

Refers in figure 3.2 the design, where the capacitive sensor is being attached inside the underground fuel storage tank and it is connected to the Arduino Uno board, the Esp8266 is being attached in order to transmit data to the cloud storage called ThingSpeak only if the internet connection is available.

The lcdi2c display the output of the collected measurement of the fuel level from the capacitive level sensor, when the data is being gathered and stored in the cloud database it will already sent and display to the end-user’s webpage and android application where the researchers developed.

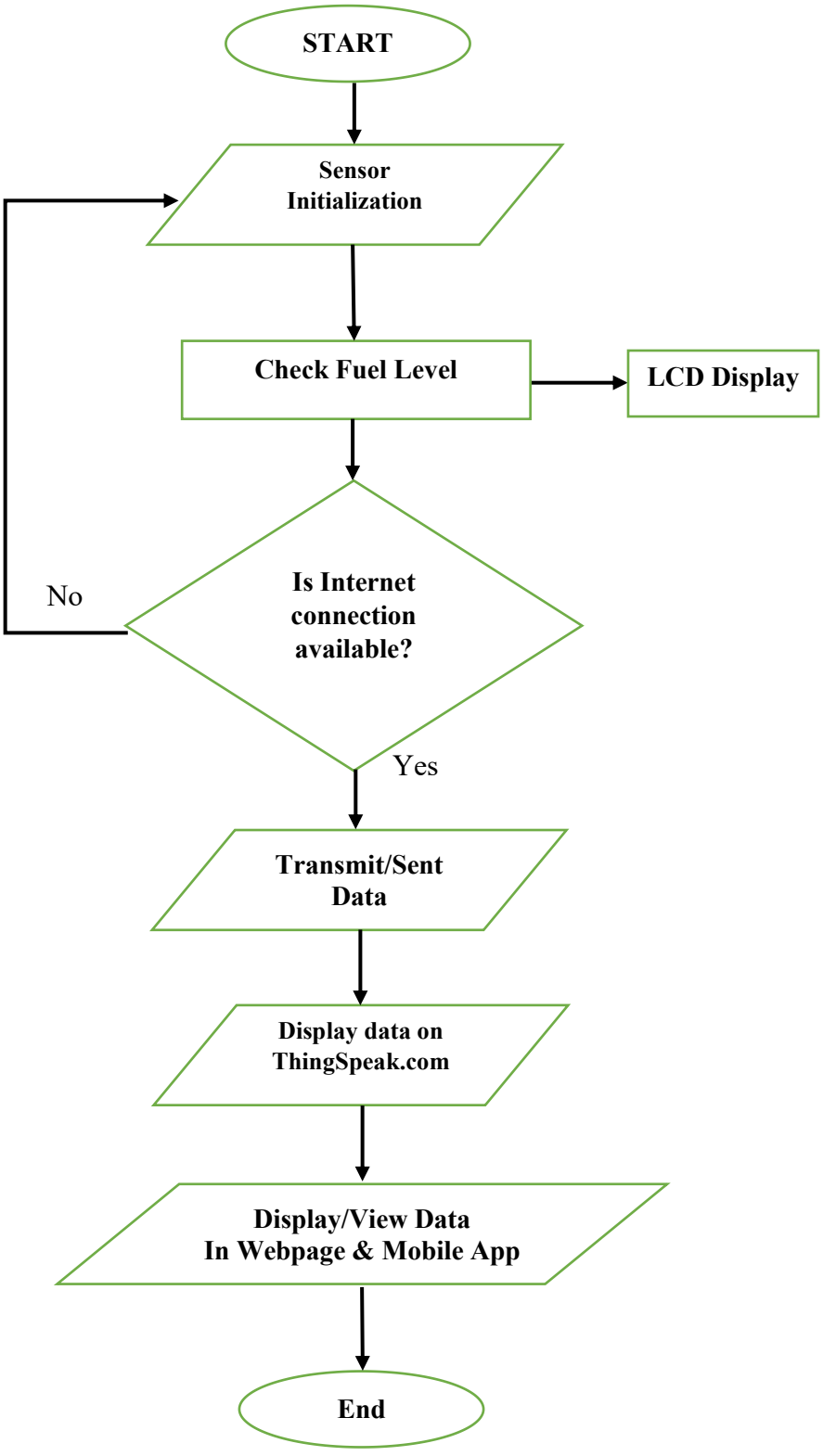

Figure 3.3 Flowchart

As what the figure 3.3 shows, it is a flowchart where to start the system users need to initiate the capacitive level sensor in order to make it functional in measuring the fuel level and display the output in the Lcdi2c, then the users need to connect the Esp8266 to the internet to transmit data from capacitive level sensor to the cloud database (ThingSpeak.com), and if Esp8266 is not connected to the internet the process will only display in the Lcdi2c and cannot transmit data to cloud database. When data is stored in ThingSpeak it automatically Display in the Webpage and Mobile app of the users.

Implementation

To make the design more realistic, the researcher constructed a miniature gasoline station to which all the components were attached. The little gasoline station is composed of plywood and glasses, with wiring for the mini fuel station's lights attached by the researcher. The station consists of one cashier office and one convenience store, as well as a fuel pump in the middle of the little gasoline station, to which the researcher added an LCD to serve as a monitoring display.

The researcher experiment was setting up by using the constructed components such as capacitive fuel-level sensor, underground fuel tank, ESP8266-wifi module, Jumper wires, Arduino Uno, Breadboard, LCD_ i2c, USB serial, power adapter. The following experimental steps were taken. The capacitive level sensor was mounted to the breadboard with a 2.2K resistor and the LCD_i2c SCL is connected to A5, SDA to A4 of the Arduino Uno and VCC to positive and GND is connected to negative of the Breadboard.

The ESP8266-wifi module is connected from RX to 7 in Arduino Uno and the TX is connected to 8 ports in Arduino. VCC is connected to positive and GND is to negative, the jumper wires are used to connect two points of the connecting wires to each other without soldering. Jumper wires are typically used with breadboards and other prototyping tools.

The researcher used Arduino Uno to program the open-source microcontroller board that can be integrated into a variety of electronic projects. Researcher also used USB serial so that the Researcher can enable the communication between devices and a host controller such as PC. Power adapter is used to provide a power supply for our electronic devices.

This is how the researcher carried out the project's plan; they invested a lot of time, effort, and optimistic thinking to complete it. Furthermore, with the assistance of professors, the researcher creation is completely functional.

Testing

During this phase researcher created an Arduino IDE source code and in the web system. The proponents then uploaded it to the prototype and to the Internet of Things ThingSpeak respectively. The prototype of the project was tested its functions to its desired outcome. The Monitoring System for Gas Station Underground Fuel Storage Tank using Internet of Things project can function first is to monitor the fuel level in the storage tank and able to send data to the webpage through internet connection, and it can also be monitor by using the android mobile application that the researcher is going to create. The prototype will send data to the ThingSpeak that can be viewed in the webpage.

Chapter 4

DEVELOPMENT, TESTING AND IMPLEMENTATION

Description of prototype

The Monitoring System for Gas Station Underground Fuel Storage Tank Using Internet of Things is a system that can keep track of the fuel level in the underground tank. It can automate and display the fuel percentage and liter inside the tank through the LCD i2c, capacitive level sensor is used to measure the fuel level, other devices like ESP8266 collect all the data from the capacitive sensor and send it to the cloud database if the internet is enabled, it is simple to monitor the fuel left in the tank trough website and mobile app if the internet is enabled.

The researcher created a miniature gasoline station with a convenience shop on the left and a cashier post on the right, with the gasoline pump machine in the middle and the lcdi2c attached. The gasoline tank is located beneath the little gasoline station. It is made of glass and has a capacity of 4 liters. It has holes in the top of the container for capacitive sensors to measure the amount of gasoline within. All the wiring and components were installed at the top of the cashier's station, where there was also an indication of a Wi-Fi signal.

Figure 3.4 Prototype

Gantt Chart

A Gantt chart is a type of bar chart that illustrates a project schedule and it A Gantt chart is a graphical representation of activity against time. A Gantt chart is a project management tool assisting in the planning and scheduling of projects of all sizes, although they are particularly useful for simplifying complex projects.

	June - July 2021	August 2021	September October 2021	November - December 2021	January 2022	February 2022	April 2022
Preparation of thesis proposal							
Presentation of thesis proposal							
Preparation & Submission of thesis application to ethics committee							
Data Gathering							
Report Writing							
Submission of thesis							
Presentation of thesis							

Figure 3.5 Gantt Chart

Development

Setting up the relevant sensor on the gasoline tank and connecting it to the control unit is the first basic step in developing an automated system for fuel tank level monitoring. The ESP8266-wifi module device is used to send data over a wireless network. Once you've received a specific type of signal from the capacitive fuel level sensor, you'll know what to do next. It can be sent and received using a cloud database, a website, and an Android app.

A float capacitive fuel level sensor is used to measure the fuel level. The sensor was activated to retrieve the fuel tank. The sensor is made up of a rod and a capacitive float capsule. As the level of fuel in the tank rises, the transmitting unit with the capacitive sensor the floater began to rise causing the capacitive sensor to rotate.

Testing

Researchers began a comprehensive testing of the system in this phase, checking all the components for functionality, connections in all circuits to avoid short circuits, and checking all codes in the Arduino IDE. The researcher also double-checked all the system's output to see if it was accurate. Researchers compared running scripts with and without ThingSpeak to see which code was more accurate in transferring data from the capacitive sensor to the ESP8266-wifi module.

Filling the fuel tank to the top was done to see if the capacitive fuel level sensor was defective and were able to determine that there would be no sparks from the sensor because gasoline is a fuel that is very sensitive to sparks. All were done is to avoid some issues and errors when running/testing the system.

Implementation of Plan

The researcher created a system that is presented to the Gasoline Station through user’s approval. If the supporters agree to use framework, the researchers will hand over the project, as well as the documents that will act as a guide for user updates and maintenance.

This system is likely to be user-friendly for all gasoline station owners and employees, as users will have no difficulty utilizing it. Researchers devised this technique to be implemented in every gas station, but only for those who are willing to participate in the study. This system was designed to prevent all employees at the gas station from being sick, as well as to save time for all users who are permitted to use it.

The researcher also built a webpage where users can learn more about the Internet of Things-based Monitoring System for Gas Station Underground Fuel Storage Tank. The

homepage covers all information about the system, including how it works, its importance and advantages to users, the sensors and devices used to develop the system, the system's features, and an overview, making it simple for users to understand how the system works.

In addition, the researcher developed an Android application to provide access to Gas Station owners on the status of the fuel level inside the fuel tank. The program provides users with information by presenting the current fuel level condition. It shows how many liters and what percentage of them are remaining in the gasoline tank now. All the users must do enable their internet connection and open the android application that the researcher created, and in a matter of seconds, the android application will provide all the information that the users require to monitor their fuel level, even if they are on vacation somewhere else.

Chapter 5

RESULT, DISCCUSSION, CONCLUSION AND RECOMMENDATION

Monitor the fuel level inside the underground fuel tank, the researchers create an idea on how to monitor the fuel level in the tank and it is fully functional by the use of the capacitive fuel level sensor that being attached inside the fuel tank. The sensors floater detects the fuel level by its movement.

Figure 3.6 Monitoring the fuel level

Sending data to cloud database is fully functional by the use of Esp8266 that is connected to the internet, data that being gathered from the capacitive sensor is sent to the cloud database.

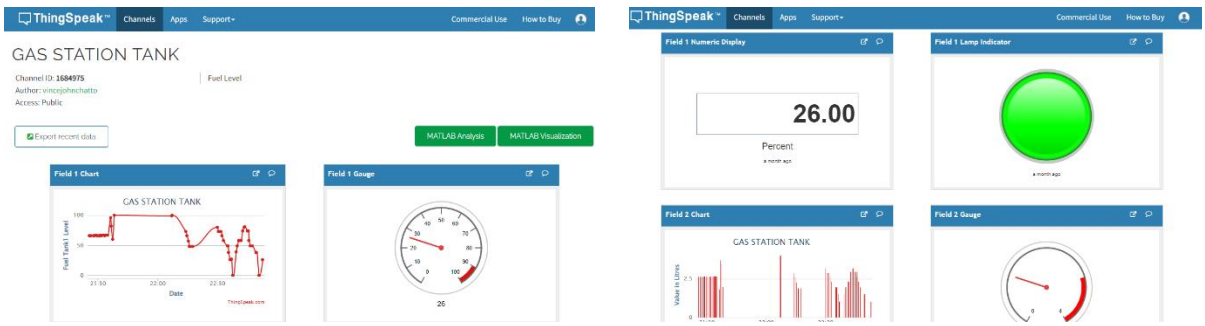

Figure 3.7 Data stored in ThingSpeak.com

The researchers create a webpage where data collected from the prototype, display, and viewed this objective is fully accomplished by the researchers by the help of HTML coding in order to create a webpage where the data is being displayed and viewed by the end-users.

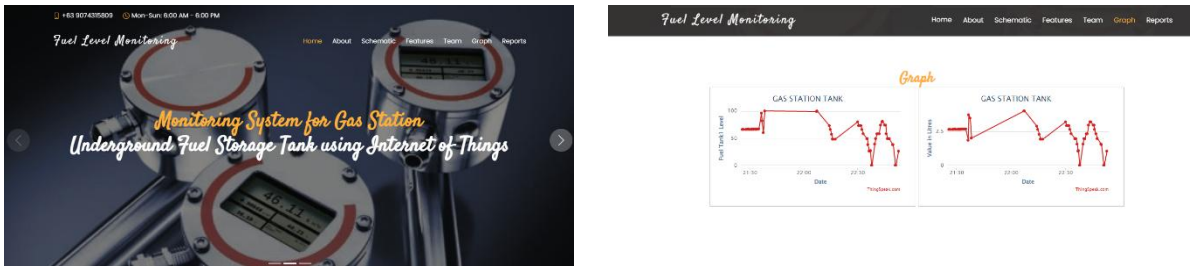

Figure 3.8 webpage of the system

Generate report on the fuel level in the underground tank, in the webpage of the system where the researchers built the reports will automatically have uploaded and enable to viewed by the users. The reports will be the guidance record of the past and current status of the fuel level inside the fuel tank.


Fuel Level Monitoring

Created At	Entry ID	Tank Level
April 20th 2022, 10:07:07 pm	659	99
April 20th 2022, 10:07:23 pm	660	100
April 20th 2022, 10:14:09 pm	661	73
April 20th 2022, 10:14:44 pm	662	66
April 20th 2022, 10:15:30 pm	663	57
April 20th 2022, 10:16:04 pm	664	48
April 20th 2022, 10:16:21 pm	665	48
April 20th 2022, 10:17:29 pm	666	48
April 20th 2022, 10:30:00 pm	667	80
April 20th 2022, 10:30:33 pm	668	73
April 20th 2022, 10:31:26 pm	669	73
April 20th 2022, 10:31:52 pm	670	73
April 20th 2022, 10:32:20 pm	671	66
April 20th 2022, 10:33:07 pm	672	58
April 20th 2022, 10:35:04 pm	673	49
April 20th 2022, 10:35:23 pm	674	49
April 20th 2022, 10:35:42 pm	675	38
April 20th 2022, 10:36:24 pm	676	26
April 20th 2022, 10:36:52 pm	677	26
April 20th 2022, 10:37:07 pm	678	27
April 20th 2022, 10:37:40 pm	679	0

Figure 3.9 Reports

The researchers created an android mobile application for users in order to give them access of monitoring in the fuel level even if they are in the vacation. This application displayed the measurement of the fuel level by its percentage and liters.

Figure 3.10 Android Application

Conclusion

The project was finally developed by the researcher. It automatically measures the fuel level inside the underground fuel tank perfectly by the use of the capacitive fuel level sensor, it also automatically collects the data and store it in the cloud database which is called ThingSpeak, and also the users can monitor the fuel level status through their mobile android and also in the webpage.

As a result, the monitoring system for gas station underground fuel storage tank using internet of things is fully functional according to its objective, from monitoring the fuel level inside the fuel tank. Then the system can send data to the cloud database or cloud storage if it is connected into the internet.

The researcher accomplished the work in creating a webpage where data collected from the prototype, displayed, and viewed by the users or for those who are interested of the system. It also generates report of the fuel level, the report is displayed in the webpage and can also be printed. Android application is being develop by the researcher to give access of display about the status of the fuel level in the fuel tank so that the users is being updated.

Recommendations

For future works other related sensors can be added to monitor the fuel storage tank condition such as ultrasonic sensor. And also future researcher can add some features to this system like detection of leakage inside the fuel tank and they can add a feature where the system can send or notify the users via sms and also future researchers can add a detection of fuel storage tank temperature.

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Appendix "A"

Actual Prototype

Sensor

Back of the Component

LCD

APPENDIX "B"

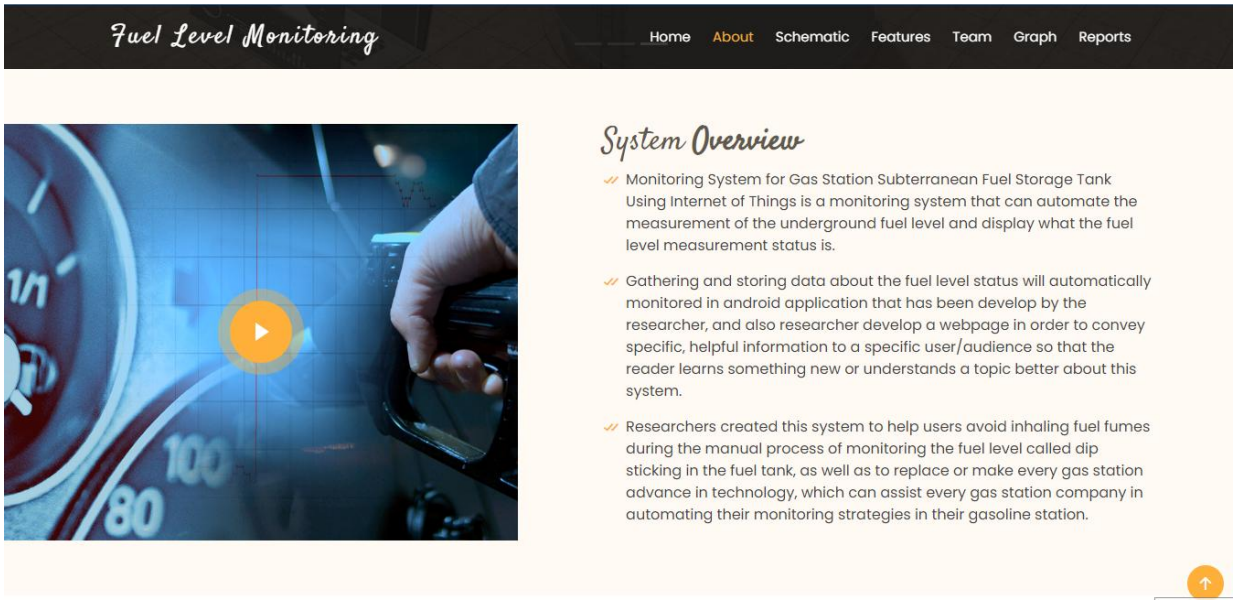
Screenshot of the Webpage

Homepage

This is the home page of the system where users can visit and view the title of the Monitoring System for Gas Station Underground Fuel Storage Tank using Internet of Things

About

In the about page, users were able to see the overview of the project.

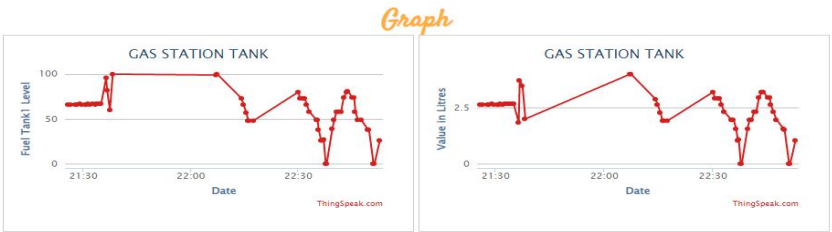


Prototype

This is the prototype page it contains schematic diagram and the components used in the system.

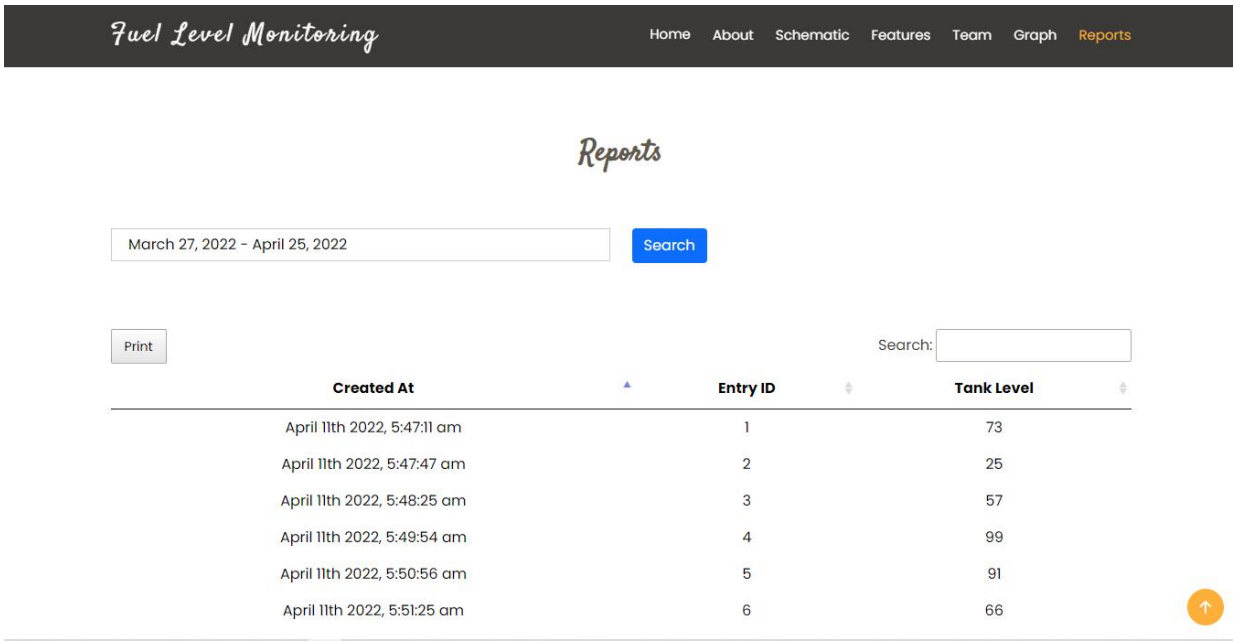
Graph

In the page, users can view the graph regarding current and the last fuel level from ThingSpeak.



Report

This is the report page where users can view reports regarding the status and level of the fuel inside the fuel tank.



APPENDIX "C"

Photo Documentation

The researcher gathering data on how to realize the prototype and interviewing the workers of a Gasoline Station.

APPENDIX "C"

Photo Documentation

The researcher upon checking and installing the components of the prototype.

“APPENDIX D”

Consultation Logs Form

Monitoring System for Gas Station

Underground Fuel Storage Tank using Internet of Things

Date	Time	Concern/Issue	Signature

"Monitoring System for Gas Station Underground Fuel Storage Tank using Internet of Things"

ABSTRACT

Monitoring System for Gas Station Underground Fuel Storage Tank using Internet of Things was evaluated by IT experts and tested by the end-users and the results showed that the said application is capable of replacing the manual of monitoring the fuel level for it will simplify the process of monitoring the underground storage tank fuel level status.

INTRODUCTION

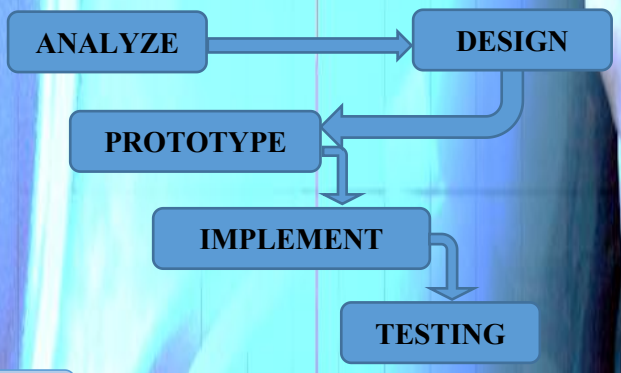
Human environment been through other periods of dramatic change before, driven by such innovations as the steam engine, railroad, telephone, and automobile. But never have we experienced technologies that are evolving so rapidly. The rapid evolution of digital technologies is creating not only new opportunities of our society but challenges to it as well.

Computer technology evolves at such a rapid pace; many businesses try to keep up by upgrading their computer systems on a regular basis to remain competitive. The ability of technology to perform multiple functions for its advanced system is also a significant aspect in a company's decision to adopt software. It makes effective use of advanced technology and aspires to learn more.

KEYWORD

Prototype model, Automate, Arduino, Python code

METHODOLOGY



CONCLUSION

The project was finally developed by the researcher. It automatically measures the fuel level inside the underground fuel tank perfectly by the use of the capacitive fuel level sensor, it also automatically collects the data and store it in the cloud database which is called ThingSpeak, and also the users can monitor the fuel level status through their mobile android and also in the webpage.

As a result, the monitoring system for gas station underground fuel storage tank using internet of things is fully functional according to its objective, from monitoring the fuel level inside the fuel tank. Then the system can send data to the cloud database or cloud storage if it is connected into the internet.

The researcher accomplished the work in creating a webpage where data collected from the prototype, displayed, and viewed by the users or for those who are interested of the system. It also generates report of the fuel level, the report is displayed in the webpage and can also be printed. Android application is being develop by the researcher to give access of display about the status of the fuel level in the fuel tank so that the users is being updated.

RESULT

Monitor the fuel level inside the underground fuel tank, the researchers create an idea on how to monitor the fuel level in the tank and it is fully functional by the use of the capacitive fuel level sensor that being attached inside the fuel tank. The sensors floater detects the fuel level by its movement.

Sending data to cloud database is fully functional by the use of Esp8266 that is connected to the internet, data that being gathered from the capacitive sensor is sent to the cloud database.

The researchers create a webpage where data collected from the prototype, display, and viewed this objective is fully accomplished by the researchers by the help of HTML coding in order to create a webpage where the data is being displayed and viewed by the end-users.

Generate report on the fuel level in the underground tank, in the webpage of the system where the researchers built the reports will automatically have uploaded and enable to viewed by the users. The reports will be the guidance record of the past and current status of the fuel level inside the fuel tank.

The researchers created an android mobile application for users in order to give them access of monitoring in the fuel level even if they are in the vacation. This application displayed the measurement of the fuel level by its percentage and liters.

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