

PETROL MONITORING SYSTEM IN STORAGE TANK

MUHAMMAD TAUFIQ BIN MOHD SAFWAN CHIN

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ABSTRACT

Petrol Monitoring System in Storage Tank (PMSST) is developed to facilitate manager and staff of Trident Bliss Sdn. Bhd. This system can help and easily the manager, supervisor and staff to monitor the petrol level remain in the storage tank at petrol station. In the existing system, process of collecting volume of petrol level in storage tank is conducted manually by using fuel tank dipstick. The processes call dipping. Therefore, the proposed system is to change the current process to computerized system that connected to ultrasonic sensor. The methodology that has been applied in the project development is the Prototype model. The advantage of prototype model is it can be early act or representation of the final product and this method can reduce risk and limit expenses and costs. In the development of PMSST, Visual Studio 2010 and Microsoft access 2010 has been used as programming tools while Arduino Uno R3 with Ultrasonic Module HC-SR04 Distance Measuring as hardware tools. Visual Studio has become one of the world's most widely used programming languages while Microsoft access 2010 is an open source relational database management system. Arduino Uno R3 is an open-source physical computing platform based on a simple i/o board and development that implements the processing/wiring language Ultrasonic Module HC-SR04 Distance Measuring provide non-contact measurement function includes ultrasonic transmitters, receiver and control circuit. As a result, form system is developed and this system helps to simplify and efficiently used of monitoring remaining petrol activity.

ABSTRAK

Petrol Monitoring System in Storage Tank (PMSST) dibangunkan untuk memudahkan pengurus dan kakitangan pekerja di Trident Bliss Sdn. Bhd. System ini membantu pengurus dan kakitangan dalam memantau baki paras kekosongan petrol yang ada di dalam tangki simpanan di stesen minyak. Sebelum sistem ini dibangunkan, kakitangan pekerja syarikat ini menggunakan kayu pengukur atau dipanggil juga sebagai “dipstick” untuk mengukur baki paras kekosongan minyak di dalam tangki simpanan stesen. Proses ini dipanggil proses mencelup atau “dipping process”. Sistem ini diinovasikan untuk menggantikan proses manual kepada sistem computer yang menggunakan sensor ultrasonik. Metodologi yang akan diguna dalam membangunkan sistem ini adalah model Prototype. Kelebihan model Prototype adalah tindakan awal boleh boleh diambil dalam menangani atau mengurangkan risiko yang boleh mengurangkan kos perbelanjaan dalam membangunkan sistem. Sistem ini dibangunkan menggunakan Microsoft Visual Studio 2010 bersama Microsoft Access 2010 sebagai medium pengaturcaraan manakala Arduino Uno R3 bersama Ultrasonic Module HC-SR04 Distance Measuring sebagai alat perkakasan. Microsoft Visual Studio merupakan salah satu bahasa pengaturcaraan dan banyak digunakan dalam membangunkan sistem manakala Microsoft Access adalah pangkalan data yang menghubungkan dengan sistem. Arduino Uno R3 adalah platform i/o litar yang berfungsi sebagai operasi sistem bersama Ultrasonic Module HC-SR04 Distance Measuring yang memberikan fungsi sebagai medium mengukur jarak yang memancarkan dan penerima pancaran ultrasonik. Rekabentuk sistem yang dibangunkan memudahkan kakitangan pekerja untuk memantau baki paras kekosongan petrol dalam tangki simpanan petrol.

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LIST OF ACRONYMS / ABBREVIATION / GLOSARY

ABBREVIATION	TITLE
PMSST	Petrol Monitoring System in Storage Tank
SRS	Software Requirement Specification
SDD	Software Design Document
STR	Software Test Result
Admin	Manager and Supervisor
OS	Operating System
User	Staff and Admin

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Petrol Monitoring System in Storage Tank (PMSST) is a standalone system that uses to monitor the level of petrol store in storage tank at the petrol station by using hardware (sensor) and software tools (system). The hardware device is installing on the storage tank connected to the laptop/PC and user can monitor from the office. In Malaysia, most of the owners of the petrol station using a dipstick to measure the distance of empty petrol level in the tank. By using this system, the monitoring activities can be doing continuously raining or sunny day.

The levels of measurement are in Centimeters. This project used continuous level of sensor produced by Arduino Uno R3 with Arduino Ultrasonic Module HC-SR04 Distance Measuring installed to the tank (refer Appendix E). The sensor continuously measure the exact distance from the sensor to top level of petrol. Arduino Ultrasonic sensor enables detected maximum distance at 4.0meters. It takes over the task of indicating the distance between censor to the top level of petrol in the vessels tank.

This petrol level can be monitoring by the LCD display that connected to PC or laptop that have PMSST system that use to generate information and monitor the petrol level. The main goals of this project were to determine the best way to monitor petrol level. This project addresses the need for petrol level sensor that are relatively simple to use and accurate over a board range of hydraulic conditions.

1.1.1 Problem Statements

Nowadays, vehicle is the main medium that is often used by humans to get to their destination. Petrol is the primary fuel resources that use as internal combustion engine with spark-ignition. Petrol Station is a franchise to PETRONAS, SHELL, and ESSO who supply fuel to the user. They get the fuel sources from the main supplier or franchisor which is the company who exploring, development and extract the crude oil and natural gas such as Petroliaam Nasional Berhad (PETRONAS) which is main office located in Malaysia.

In Malaysia, petrol station does not have monitoring system for fuel level storage in their tank. They measure manually by calling their employees to measure the level of petrol in storage tanks using a dipstick. As we know, when we open the tank cover, petrol evaporates into the air. This behavior are dangerous to their worker because there inhale the evaporate petrol beside touch the petrol at the dipstick direct to their skin if no protection apply on their body. Inhaling evaporate petrol in the air can damaged human body system beside it can addicted to who always inhale evaporate petrol.

Petrol monitoring system is a best way to monitor petrol levels as it does not require to open tank cover and reaching in to make measurements that evaporate the petrol, beside the petrol can exposed to rainwater during raining days. All it involves is monitor the petrol level on the LCD screen display, displaying the level of the petrol.

1.1.2 Objectives

This project was conducted to meet three (3) objectives. The objectives of this research are:

- i. Investigate the best technique to monitor petrol level in the storage tank.
- ii. To computerize the monitoring activities from manual measurement of petrol store in tank to computer system in monitoring room.
- iii. To manage the record distance of empty petrol level from diary keeps tracking to database system.

1.1.3 Scopes

Due to the time and resources constraints and issues, this dissertation is limited in the following clauses:

- i. Design and developed the tank petrol level sensor using ultrasonic sensor module install to the tank and monitoring system.
- ii. The users of Petrol Monitoring System are the Manager, Supervisor and Staff of the petrol station as users of this system.
- iii. The system can generate information in the system to report about the distance of empty petrol level in their storage tank.
- iv. The study area is at petrol station.
- v. The system can support Windows 7 64-Bits operating system platform only.
- vi. The system use Visual Basic 2010 server as programming tools and Microsoft Access 2010 for database tools.
- vii. This system can be connected to Arduino Uno R3 with Arduino Ultrasonic Module HC-SR04 Distance Measuring.
- viii. System use Acer Intel[®] Core[™] with CPU i5-2410M 2.3 GHz

1.2 REVIEW PREVIOUS WORK

1.2.1 Labkotec (LabkoMonitor 8)

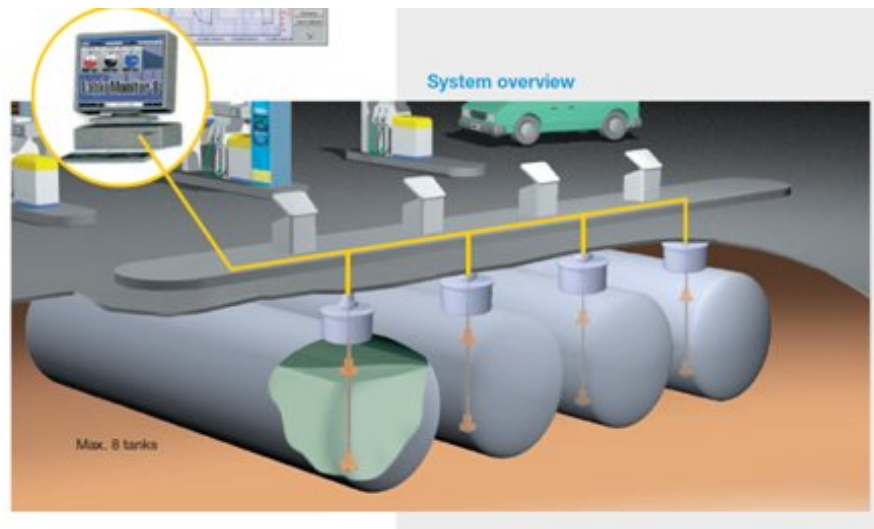


Figure 1.1 LabkoMonitor 8 monitoring system

LabkoMonitor 8 is a local monitoring system for up to eight liquid fuel tanks, which are equipped with Labko ILS (Labko 3000 sensor) or LabkoMax/Flex tank monitoring systems. LabkoMonitor 8 is ideal for stand-alone back office use at petrol refilling facilities or other storage tank farms.

The strength of this system is it allows user to monitor from monitoring room. User can update the level of petrol in the tank continuously beside the user does not need to install cloud connection because the system is connected through cable from the control unit. The weakness of this system is the user cannot monitor the level of fuel outside the monitoring room.

Based on the strength and weakness of LabkoMonitor 8, if they provide online monitoring or SMS alert to user, their system is more convenient to use [2].

1.2.2 Guard Magic

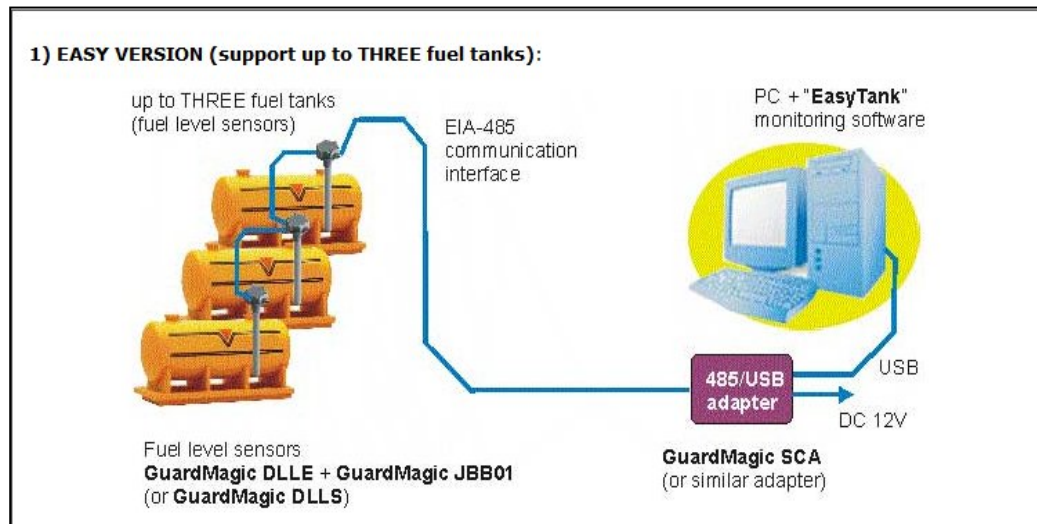


Figure 1.2 Guard Magic easy version fuel level sensor

The simple way to monitor fuel level in fuel tanks that located near office (monitoring room). In general system allows real time monitor fuel level (fuel volume) in fuel tanks, store fuel history for each fuel tank, visualization fuel level in fuel tank, generate fuel graphs, reports for fuel tanks. Fuel level sensors send to PC by connection cable information about fuel level in fuel tank. Monitoring software receives this information and stores it in database.

The strength of this system is it allows user to monitor from monitoring room. User can update the level of petrol in the tank continuously beside the user does not need to install cloud connection because the system in personal computer (pc) is connected through USB adapter from the control unit. The weakness of this system is the user cannot monitor the level of fuel outside the monitoring room.

Based on the strength and weakness of Guard Magic, if they provide online monitoring, increase support to more than 3 tank monitoring tanks and SMS alert to user, their system is more convenient to use [3].

1.2.3 Ivetel technologies Private Limited (Fuel Monitoring System)

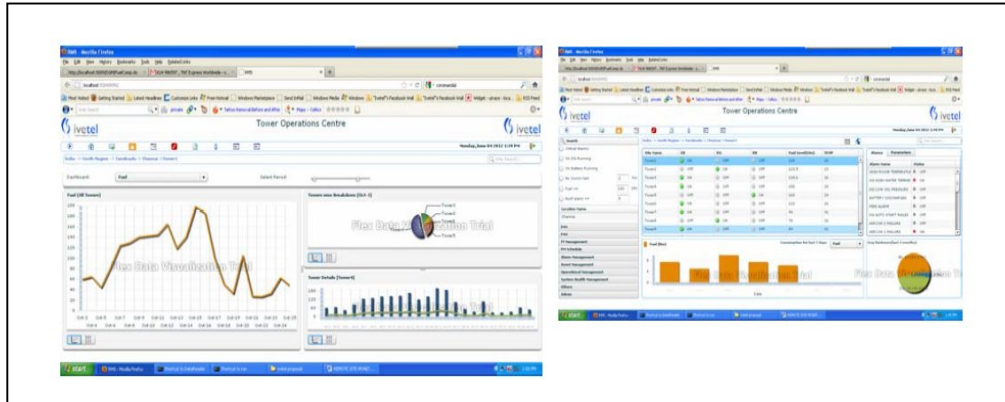


Figure 1.3 ivetel fuel monitoring system

Ivetel provides wireless m2m (machine to machine) application to monitor and control any fixed asset or any mobile asset. Monitor the location and status of diesel storage tank level, vehicle and more. Fuel monitoring system fueling control gives user to monitor where, when and how much fuel was filled into the tank. It avoids the manipulation of fuel and, consequently, reduces the operating costs of sites. FMS is continuously monitoring your tanks and delivering the information user need to manage and control your operation. FMS automatically sends SMS/GPRS Data Alert when tank conditions reach user-define threshold (Low or High Level) user always know status and can plan when tanks need to fill the diesel based on your conditions user choose.

The strength of this system is it allows user to monitor from everywhere so, they cannot cheat their company on money for fuel. User can update the level of petrol in the tank continuously beside the user can provide SMS/GPRS data alert when tank is going empty or full and where the nearest station. The weakness of this system is the user cannot monitor the level of fuel if there is no connective on some area.

Based on the strength and weakness of ivetel Fuel Monitoring System, if they also provide non-online monitoring or trough cable connection, their system is more convenient to use [4].

1.2.4 Hastel Internet Portal (HIP)

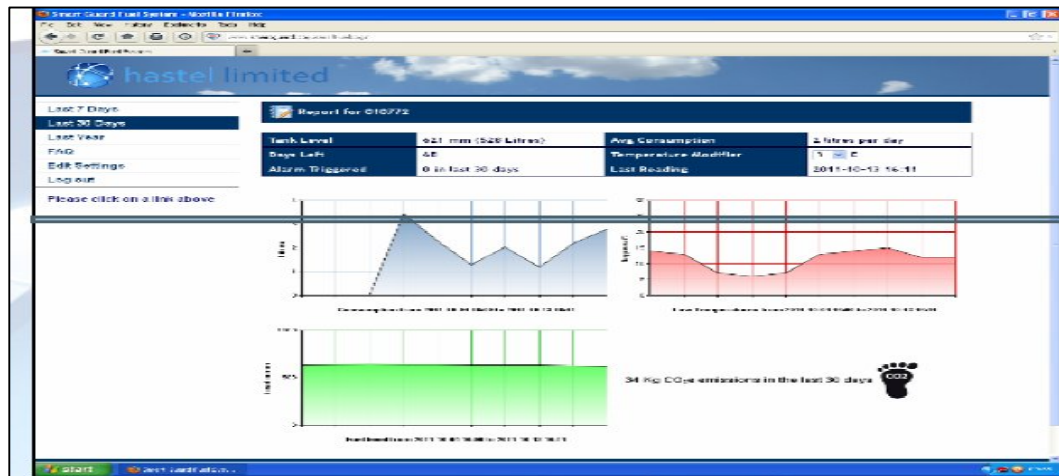


Figure 1.4: Hastel Internet Portal report

The SmartGuard is an accurate probe that measures the level of oil in user tank and continuously checks for theft or leaks. When a fuel tank level drops faster than normal, an alarm text message is sent to the user's mobile phone and optionally may be sent to several email addresses too. The daily levels are stored on the internet so others can monitor user level. Graphs of oil used each day, the tank level and the anticipated run out date can all be seen and we have tools to allow user to see the effect of changing how you set the thermostat. The system can remind user when get low so that user can arrange a delivery so they need never run out again.

The strength of this system is it allows user to monitor from everywhere. User can update the level of petrol in the tank continuously beside the user can provide SMS about fuel condition in their tank when fuel in their tank is going empty. The weakness of this system is the user cannot monitor the level of fuel if there is no connective on some area or there are no gadgets to online.

Based on the strength and weakness of Hastel Internet Portal (HIP), if they also provide non-online monitoring or trough cable connection, their system is more convenient to use [5].

1.2.5 Advantages and disadvantages of previous work

All the previous work has their advantages and disadvantages. Table 1.1 shows the pros and cons between the previous works. The features that have been compared are Operating System (OS), controller, database, online monitoring and message alert. All of the previous work has controller and database. While operating system (OS) only Labkotec (LabkoMonitor 8) and Guard Magic beside online monitoring and message alert only **Ivetel** (Fuel Monitoring System) and Hastel Internet Portal(HIP).

Table 1.1: Pros and cons between the previous works

Precious work Features	Labkotec (LabkoMonit or 8)	Guard Magic	Ivetel (Fuel Monitoring System)	Hastel Internet Portal (HIP)
Distinctive System	YES	YES	NO	NO
Sensor	YES	YES	YES	YES
Database	YES	YES	YES	YES
Online Monitoring	NO	NO	YES	YES
Message Alert	NO	NO	YES	YES

1.3 CURRENT SYSTEM AND LIMITATIONS

Current, there are no system install or being used by the staff to measure petrol remain in the storage tank. The staff need go to the tank and used dip stick to measure the level manually. Then the levels of the petrol need to update to the system that provided from main branch/franchise for monitoring and supplying petrol.

Staff or the management of the petrol station can check petrol balance in the tank by review at the system provided that contains the level of petrol after measure from the tank. If the data measured is wrong or not remembered by the staff that responsible to take the measurement, they need to measure it again.

There are limitations and problems that arise by using this method. Staff is waste their time and get burden because they need to go outside to the tank to measure the balance of petrol in the tank. If PMSST is used by the staff, they can check through this system in the office. Then, they also can monitor many times a day because the system is continuously checking the balance of petrol.

Staff collected the reading and send pass to the supervisor that replace the manager or to the manager to supervise petrol station and update petrol remaining to the main branch system, sometimes the data is difficult to understand the handwriting and maybe the data measured not accurate. So, with this system, all the record is recorded with more efficient and problem such as problem on record previous data can be overcome.

1.4 METHODOLOGY

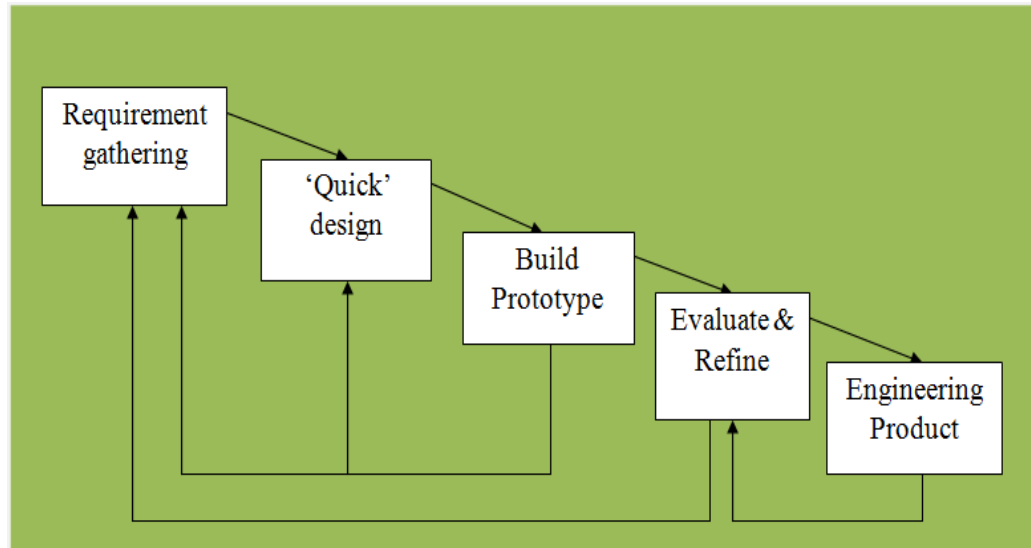


Figure 1.5 Prototyping model

The methodology that has been implied in the project development is the prototyping model. Figure 1.2 shows the Prototyping model. Prototyping is a software development process which allows programmers or developers to create part of the solution to demonstrate technical feasibility and functionality to the client and make needed refinements before developing the final product. This method can reduce risk and limit expenses and costs.

1.4.1 Requirement Gathering

Requirements are gathering by having the developer and client meet. All requirements, data are collected in the meeting. The entire important element, the input and output information desired are also identified. The client of the project is the staff of petrol station. All the information had been gathered to make sure the system is based on the requirement from client. Information that needs to be gathered is shown in Table 1.3.

Software Requirement Specification (SRS) has been produced in this phased. In the SRS, the behavior of PMSST has been described such as product description, interfaces requirements, software product features and requirement traceability.

Table 1.2: Information that need to be gathering

Source	Information Gathering
Client	Flows of the system (How the system should work?) Storage tank type and details (For choosing type of sensor) Data information of the system (How data should be included in the system)
System	Users of the system (How many privileges in the database?)
Environment	System Environment (Which environment is compatible with the system?)

1.4.2 Quick Design

After gathering the requirements, developer can precede to the next phased which is a quick design. In this phased, developer is design initial prototype which include user interfaces. They focus on a representation of those aspects of the system that are visible to the client such as input approaches and the output formats of the system. In this phased, Software Design Document (SDD) has been produced. The PMSST design description and details about design has been described and explain in the SDD.

1.4.3 Build Prototype

The quick design phased leads to the build of a prototype phase. In this phase, developer starts to construct and develop the prototype. Developer start codes the prototype in this phase. The prototype of PMSST has been build based on the design in the previous phase and the requirements gathered in the earlier phased.

1.4.4 Evaluate and Refine

Evaluate and refine phase are take place after the prototype has been developed. The prototype was evaluated and examined by the client. Their feedback can be used to refine the requirements for the system to be developed. PMSST has been evaluated by the client who is staff of the petrol station and the feedback has been gathered from them. The requirements of PMSST has been refined and repaired based on the feedback. In this phase, Software Test Result (STR) has produced.

1.4.5 Engineer Product

In this model, iteration occurs as the prototype is tuned to satisfy the requirements of the client. At the same time, developer can more understand what requirements and needs to be done. By using the feedback, the prototype and specification can be improved. After done all the phased and maybe there are iteration in several times, the system become the end product. If the client agree to the end product, user manual for the system are produced.

1.5 REPORT ORGANIZATION

This report consists of four parts as below:

Chapter 1 – Introduction

- In this part contain introduction, problem statement, objective, scope, previous work review, current system, methodology, and report organization.

Chapter 2 - Software Requirements Specification (SRS)

- In this part contain product description, interfaces requirements, software product features, requirement traceability.

Chapter 3 - Software Design Document (SDD)

- In this part contain system overview, system states and modes, system design description, and database design.

Chapters 4 – Implementation and Testing

- In this **is the Implementation and Testing phase**. This phase test case data collected base on the each use case of the system.

Chapters 5 – Conclusion

- Concludes all the chapters and the recommendations for future researchers.

CHAPTER 2

SOFTWARE REQUIREMENT SPECIFICATION (SRS)

2.1 PRODUCT DESCRIPTION

This part explains the function and requirements for the PMSST. In this part, it describes the base of the development to acknowledge what are expected from the system and described how the components cooperate with each other in the environment. The original requirements for the PMSST can be review in Appendix C. All the requirements from the client are present in SRS. This part is referred from the SRS documents.

2.1.1 Product Perspective

The PMSST is a standalone system which is an application that only can be accessed at the personal computer (pc) or laptops that contain the system and connected to the censor in the monitoring room trough cable. PMSST is real-time information about petrol level in the admin petrol storage tank. Pc or laptops that install this application should be connected to the hardware devices that use to measure the level of the petrol in the tank. The data measure can be shown trough the monitor in monitoring room. Not only for manager or supervisor to monitor but staff also can review the database on the previous level of petrol.