Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF A VISUAL INFORMATION SYSTEM BASED ON LIQUEFIED PETROLEUM GAS (LPG) BOTTLING CONVEYOR SYSTEM USING VB.NET

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Bachelor of Electronics Engineering Technology with Honours

2022

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A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology with Honours

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

DECLARATION

I declare that this project report entitled "**DEVELOPMENT OF A VISUAL INFORMATION SYSTEM BASED ON LIQUEFIED PETROLEUM GAS (LPG) BOTTLING CONVEYOR SYSTEM USING VB.NET**" is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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Date : 13/01/2023

APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology with Honours.

Signature : SHAHRUDIN BIN ZAKARIA
Pensyarah

Supervisor Name : SHAHRUDIN ZAKARIA

Date : 02/02/2023

DEDICATION

I dedicate this project to God Almighty my creator, my strong pillar, my source of inspiration, wisdom, knowledge and understanding. He has been the source of my strength throughout this project and on His wings only have I soared. I am dedicating this thesis to my beloved grandparents who have meant and continue to mean so much to me. Although they are no longer of this world, their memories continue to regulate my life. Their love for me knew no bounds and, who taught me the value of hard work. Thank you so much , I will never forget them.I also dedicate this work to my beloved parents ; Mr Mrs Murali Seetha who has encouraged me all the way and whose encouragement has made sure that I give it all it takes to finish that which I have started. To my family members, classmates and friends who have been affected in every way possible by this quest.

Thank you. My love for you all can never be quantified. God bless you.

ABSTRACT

The Internet of Things (IoT) is a network of 'things' that allows physical objects to interact with each other via sensors, electronics, software, and connections. There is no need for humans to interface with these systems. The Internet of Things aims to make life easier by automating every tiny action that we encounter. In addition to assisting in the automation of jobs, the advantages of IoT may also be used to improve current safety standards. In today's society, safety is very important, and strong safety procedures must beintroduced in places employment. This project updates the current industrial safety paradigm. Traditional Gas Leakage Detector Systems, despite their high accuracy, overlook a few issues in the area of notifying industrial personal to a leak. As a result, we employed IoT technology to create a visual information system in an LPG bottling conveyor system to monitor the process of LPG bottle transporting in conveyor s using VB.NET.

ABSTRAK

Internet of Things (IoT) ialah rangkaian 'benda' yang membolehkan objek fizikal berinteraksi antara satu sama lain melalui penderia, elektronik, perisian dan sambungan. Tidak ada keperluan untuk manusia untuk berinteraksi dengan sistem ini. Internet Perkara bertujuan untuk menjadikan hidup lebih mudah dengan mengautomasikan setiap tindakan kecil yang kita hadapi. Selain membantu dalam automasi pekerjaan, kelebihan IoT juga boleh digunakan untuk meningkatkan standard keselamatan semasa. Dalam masyarakat hari ini, keselamatan adalah sangat penting, dan prosedur keselamatan yang kukuh mesti diperkenalkan di tempat pekerjaan. Projek ini mengemas kini paradigma keselamatan industri semasa. Sistem Pengesan Kebocoran Gas Tradisional, walaupun ketepatannya tinggi, mengabaikan beberapa isu dalam bidang memberitahu peribadi industri tentang kebocoran. Hasilnya, kami menggunakan teknologi IoT untuk mencipta sistem maklumat visual dalam sistem penghantar pembotolan LPG untuk memantau proses pengangkutan botol LPG dalam penghantar menggunakan VB.NET.

ACKNOWLEDGEMENTS

First and foremost I am extremely grateful to my supervisors, Prof. TS. SHAHRUDIN BIN ZAKARIA for his invaluable advice, continuous support, and patience during my FYP study. His immense knowledge and plentiful experience have encouraged me in all the time of my academic research and daily life. I would like to thank all the members in BEEA 2019/2020. It is their kind help and support that have made my study and life in University Teknikal Malaysia Melaka a wonderful time. Finally, I would like to express my gratitude to my parents, my family members, friends and all UTeM staffs. Without their tremendous understanding and encouragement in the past few years, it would be impossible for me to complete my study.

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IoT	-	Internet of Things

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CHAPTER 1

INTRODUCTION

This chapter offers the reader with an overview of the project. Included are the study's background, objective, problem statement, and scope. It explores the origins of this research and the factors that led to its creation.

1.1 Synopsis

Malaysia generated roughly 2.7 million metric tonnes of liquefied petroleum gas (LPG) in 2021. Since 2013, when 2.53 million metric tonnes were produced, LPG production in Malaysia has been on the rise. Cases of LPG gas cylinders leaking and exploding are rising in frequency as the number of consumers of this fuel grows. According to Wan, who works for OSHDynamics Sdn Bhd, an occupational safety and health consulting firm, as LPG is denser than air, it tends to remain near to the floor rather than float away when there is a leak. When combined with air, the mixture becomes very explosive. Several prior research have previously created gas detecting sensors for use in detecting LPG leaks. This technique is flawed in recognising the precise LPG leakage and is influenced by the presence of adjacent gases. Gas sensors detect certain gases simultaneously and have a shorter lifespan, necessitating more monitoring. In this project, in order to monitor the product of LPG in the LPG bottling plant, a camera is installed on the LPG bottle conveyer as a monitoring the quality of LPG bottle; DHT 11 and MQ2 sensor as leak detector and temperature monitor; Infrared sensor as counting the final qualified product. The Internet of Things (IoT) is used to detect and signal when LPG gas is leaking from an

LPGbottle and temperature changes. It also had the ability to save data and blinking LEDs to signal a leak. Internet of Things is the most advanced technology now used by enterprises since it is more convenient and efficient. This project will detail our IoT-based LPG bottling monitoring system built using VB.NET.

1.2 Problem Statement

In today's industry sector, monitoring and data collection have contributed to a lack of labour force, sluggish production lines, and diminished output. In order to save expenses, industries are automating their processes and employing fewer people. The bottling of liquefied petroleum gas (LPG) grows as the human population increases. Both humans and machines make mistakes in the workplace, but automation is more efficient, quicker, and error-free. At larger production levels, it takes longer forhumans to identify product defects and gather data generated by a programmedautomation system. The output of automated industries will continue "24/7," which implies twenty-four hours a day and seven days a week. Therefore, the firm or industry owner must pay a higher wage in order to have sufficient staff to work effectively in accordance with their output. To address this problem, a project using a VB.Net system to monitor LPG bottle conveyor and monitor the surrounding temperature is being developed. This device may be set with information about LPG's ideal temperature and leakage. This project is low-risk and more secure due to its reliance on IoT and reliable data collection. Consequently, the manufacturing line willbe operating efficiently.

1.3 Project Objective

The objectives of the project are shown as following:

- To create a real-time LPG bottle conveyor monitoring system.
- To detect exact defects on LPG bottle product transporting on conveyor.
- To enable faster recovery and restoration of operations.

1.4 Scope of Project

The scopes of the research areas are:

- Using an IoT platform with the support of VB.Net to monitor LPG bottle transmissiont conveyor.
- Create coding using VB.NET together with arduino UNO to monitor LPG leakage and temperature.
- Ensure the product is in good condition by image detection method before approving it for consumers.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Liquefied petroleum gas (LPG) is a hydrocarbon gas fuel that is derived from crude oil or natural gas. LPG occurs as gases at room temperature, but when moderate pressure is applied, it becomes liquefied, thus the name liquefied petroleum gas. LPG is a combination of mostly butane and propane, two petroleum gases. LPG-possessing nations with varying mixing ratios (Prima Gas, 2011). (Malaysian Standard (MS) 830, 2003) In Malaysia, commercial LPG may comprise a combination of propane, propylene, butane (normal-butane or iso-butane), and butylenes (including isomers).

2.2 Properties of LPG

LPG is a petroleum product composed mostly of propane, propylene, butanes, and butalenes, as well as various mixtures (National Institute of Standards and Technology, 2010). The proportion of LPG blends vary each country dependent on LPG production. Some nations may refer to LPG as 6 propane in commercial contexts. Commercial LPG is a combination of LPG products, with propane accounting for 70% and butane accounting for the remaining 30%. (according to Petronasspecification in Malaysia at 2011). In order to detect odourless LPG in the case of a leak, the odorant ethyl mercaptan is added. LPG is a commonly available, non-toxic, odourless, and clean-burning gas fuel. LPG is now used as a fuel for burners in restaurants, heaters and cooking equipment in homes, and transportation. Under pressure, LPG is a liquid, but at room temperature, it is a gas. The customer received commercial liquid LPG. The liquid-to-gaseous LPG ratio is 270:1. LPG is liquefied at reasonable temperatures and stored in LPG storage tanks for the safety and convenience of the handler. LPG is kept in liquid form and consumed in gaseous form.Installing a vaporizer is required to convert liquid LPG to gaseous LPG. LPG is a readily liquefied substance (National Institute of Standards and Technology, 2010).

Table 1 :Typical LPG data characteristics

Typical Liquefied Petroleum Gas (LPG) Data Characteristics		
Description	Unit	Specification
Density @ 15ºC	Kg/l	Minimum 0.547
Composition (Propane + Butane)	% vol	Minimum 97
Copper Corrosion, (1hr @ 37.8ºC)	A	Maximum 1
Vapour Pressure @ 37.8ºC	kPa	380 ~ 830
Free Water	% vol	Nil
Total Sulphur (Stenched)	mg/kg	Maximum 100
Volatility @ 95% evaporation	ºC	Maximum 2.2

2.3 LPG cylinder

According to Prima Gas (1998-2009), distributors provide four different kinds of LPG cylinders based on their sizes and functions, as shown below.

i. C10 (10 kilogramme LPG cylinder) (10 kg LPG cylinder)

ii. C14 (14 kg LPG cylinder)

iii. C50 (50 kg LPG cylinder)

iv. F14 (14 kg LPG cylinder for forklift)

The selection of LPG cylinders is determined by the types of appliances. C14 is the most popular gas cylinder used in residences. The LPG cylinder is constructed of steel that can withstand the internal pressure of LPG. F14 differs from other kinds in that it is used to fuel forklifts and in the fuel withdrawal mechanism. F14 has been modified by adding tubes to the valve to maximise the use of LPG in liquid form.

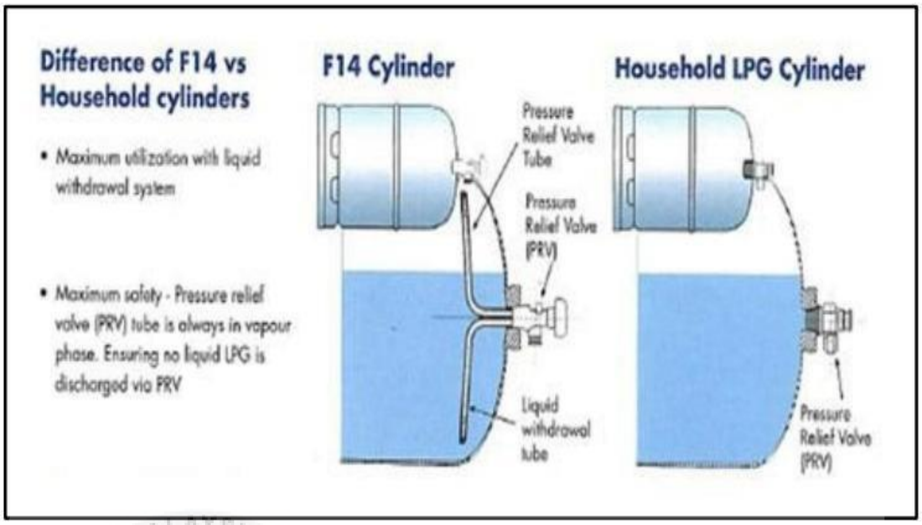

Figure 1: Difference of F14 LPG cylinder and household cylinder

2.4 Usage of Visual Basics.NET

Visual Basic.NET is a commonly used application development tool that has recently been enhanced. Visual Basic.NET is difficult to refer to as the next edition of Visual Basic since both the development environment and the programming language have undergone a practically full redesign, requiring millions of programmers to adapt to a new programming paradigm. Visual Basic.NET is a considerable improvement on an ageing programming language. This programming language has grown over over three decades to become one of the most widely used languages in the world. Visual Basic.NET has enhanced a number of Visual Basic's features and added intriguing new capabilities to the language.

Visual Basic.NET is settling into its new position as a top five programming language on the TIOBE index, which assesses popularity based on search engine data, according to David Ramel (2019). After reaching an index high, VB.NET is prominent in the February 2019 edition. In fact, among the top 20 languages monitored by TIOBE, VB.NET saw the most gain from the previous year's ranking, a 3.02 percent increase. VB.NET is a GUI-based development tool that provides Rapid Application Development (RAD) that is quicker than the majority of other programming languages. Additionally, VB has a simpler syntax than other programming languages, an intuitive visual interface, and excellent database connection. Table 2 compares the VB.NET and C# programming languages.

Table 2 : Difference between VB.NET and C# programming language

Basis	VB.NET	C#
Pronunciation	It is pronounced as Visual Basic .NET.	It is pronounced as C-Sharp.
Belonging	It is an updated version of Classic Visual Basic 6.0.	It belongs to the C family and it is evolved from C.
Variable Declaration	Variables are declared using keywords such as Private, Protected, Friend and Static, etc.	Variables are declared using declarations.

Basis	VB.NET	C#
Object Creation	The object is created using New and Create Object().	The object can be created using New.
Object Initialization	In this, Sub New() is used to initialize, uses a newly created object.	In this, constructors are used to initialize the object.
Class Declaration	In VB.NET declare a class by using Class <implementation> keyword.	In C# declare a class by using the Class keyword.
Default Property	It is defined by using Default.	It is defined by using Indexer.
Overloading Function	In VB.NET for Overload a function or method Overloads keyword is used.	In C# for Overload afunction or method no language keyword isrequired for this purpose.
Exponential Operator	It uses the 'this' operator.	It does not use the 'this' operator.
Base Class	In VB.NET refer to a base class by using the MyBase keyword.	In C# refer to a base class by using the base keyword.

2.5 Usage of Infrared camera

Every thing emits infrared radiation, often known as a heat signature. A camera that detects and measures the infrared radiation emitted by objects. The camera turns the infrared data into an electronic picture depicting the apparent surfacetemperature of the being monitored item.

The optical system of an infrared camera focuses infrared radiation onto a specific detector chip with thousands of detection pixels arranged in a grid. Each pixel in the sensor array creates an electrical signal in response to the infrared radiation concentrated on it. The camera processor performs a mathematical computation to the data from each pixel to generate a colour map of the object's perceived temperature. Each temperature degree is represented with a unique hue. The generated colour matrix is transferred to the camera's memory and shown as a thermal picture of the item.

Zuzana Stankovičová, Vladimír Dekýš, Pavol Novák, Bohumír Strnadel, 2017, Using an infrared camera to detect natural frequencies. The study is about estimating natural frequencies using an infrared camera. Using an infrared camera, the object's radiation was captured after it was disturbed with random noise. When the lock-in frequency in the examined frequency area was altered, lock-in thermography was used to analyse the measured data. The results of the lock-in technique were examined.On the basis of differences in the actual parts and amplitudes of output infragrams, natural frequencies have been identified. Pattern recognition within infragrams is an essential symptom.

Bianca Spieß, Elke Metzsch-Zilligen, Rudolf Pfaendner, 2021, IR-camera-based mechanical examination of flame retardants during UL94 standard testing.During the UL94 standard flammability test, an infrared camera is used to explore the mechanism of action of flame retardants. Using an IR-camera to capture temperature profiles enhances the results of regularly used UL94 tests, which offer qualitative data on burning behaviour. The examination of these properties offers fresh knowledge about the underlying mechanism of the flame retardant. Lower peak temperatures and faster cooling imply a cooling mechanism. Important for dilution is a reduced time range to reach the peak temperature. Each flame retardant method of action has a distinct impact on the temperature profile. Therefore, the approach presented here may offer a more precise conclusion on the flame retardant properties of flameretardants.

2.6 LPG leakage detection

In their research on gas leak detection and localization approaches, Pal-Stefan Murvaya and Ioan Sileaa (2008) outline a number of methods for detecting gas leaks. They use an old or novel method to detect the gas. The strategies presented in this research are nontechnical and hardware-based. Volume 2 Issue 3 of the Journal of VLSI Design and Signal Processing, pages 1-10 2016 MAT Journals All Rights Reserved, which includes acoustic, visual, and active techniques. In their study, they indicated that gas pipelines are equipped with a range of leak detection methods. As a consequence of developments in sensor fabrication and processing power, certain approaches have been enhanced since their inception, while others have been created. However, each detection technique has its own benefits and drawbacks. Each type of leak detection methods has benefits and limitations. For instance, all external procedures involving detection from outside the pipeline by eye inspection or portable detectors may detect extremely tiny breaches and pinpoint their position, but the detection time is quite lengthy. At high flow rates, methods based on the mathematical model of the pipe are effective, however at low flow rates, a mass balance-based detection system would be more appropriate. This disadvantage is likely to vanish for some of these procedures as a result of future technical advances. In the suggested research, the authors classify leak detection systems. The majority of detection methods depend on the measurement of a particular physical quantity or the occurrence of a certain physical phenomena. As there are various commonly utilised physical factors and phenomena, such as acoustics, flow rate, pressure, gas sampling, and optics, this may be used as a categorization criteria. Optical detection techniques are shown by the following example. Due to the vast range of these detection options, leak detection technologies are often categorised as optical or non-optical. Figure 2 depicts the classification's block diagram.

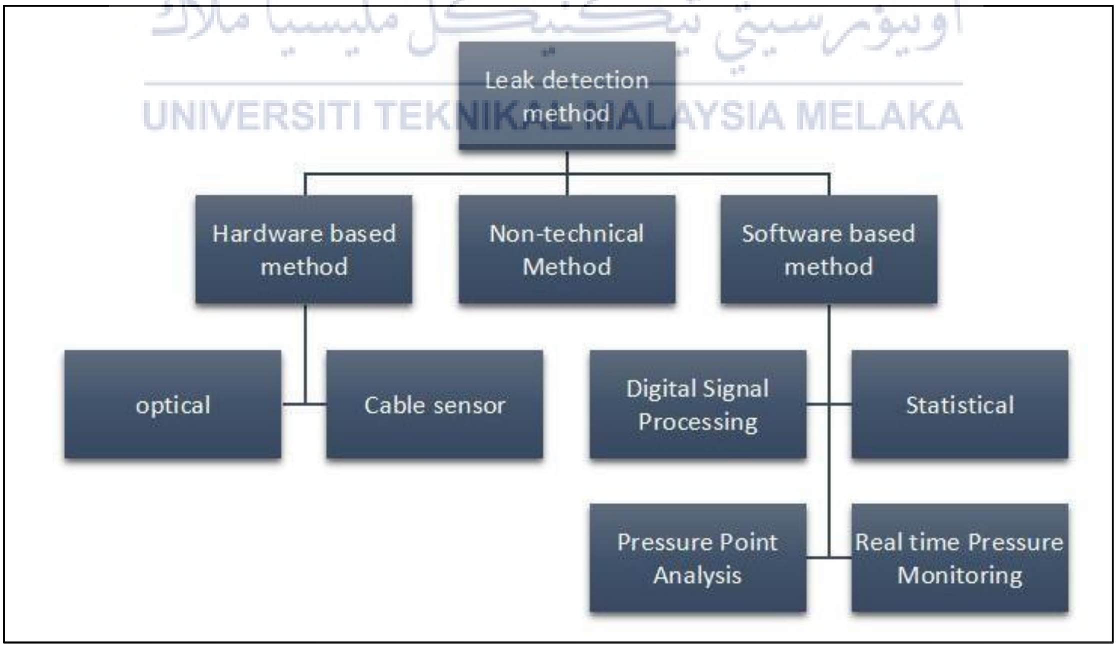

Figure 2: Classification block diagram

In this publication, Zhao Yang, Mingliang Liu, Min Shao, and Yingjie Ji (2011) described their study on gas pipeline system leak detection and leak site analysis. In this study, the authors presented many SCADA I/F Models: Every 30 seconds, the SCADA system transfers the obtained data from a pipeline system to the Transient Simulation Model. This module exchanges information with SCADA. Every thirty seconds, dynamic metrics such as pressure, flow, and temperature are captured. Transient Simulation Model: On the basis of real data, precise numerical techniques are used to model transient flow. Pressure and temperature are supplied as independent variables in order to calculate pressure and temperature averages. Then it is possible to collect all gas pipeline system parameters. Leakage Detection: The leakage detection is accomplished by comparing the SCADA system data with the Transient Simulation Model data. Based on transient simulation and volume balance, this model may offer leakage point assessment and quick warning. On the basis of continuity equation, momentum equation, energy equation, state equation, and volume-mass balance, a model for leakage detection is constructed. THE leakage detection model is comprised of the following five modules: SCADA I/F, Dada Bass, Transient Simulation, Leakage Detection, and Output. Leaks as little as 0.3% of the nominal gas flow may be identified with ease. When the leaking point is closer to the entrance, the pressure is even greater, therefore the pressure difference between the gas and the atmosphere is even greater, and leakage is much greater. The relationship between pipeline output pressure and leakage location is almost linear. The findings indicate that outlet pressure and leakage are more significant factors than coefficient of frictional resistance and pipeline diameter. An on-line computer algorithm has beencreated to determine leakage site, and it operates effectively when the leakage percentage spans from 0.3% to 93% of the nominal gas flow. Therefore, the created software proves to be a highly valuable tool for automated pipeline monitoring and rapid leak identification.

Falohun A.S., Oke A.O., and Abolaji B.M., 2016. They propose a technique for the detection of dangerous gases that makes use of an integrated circuit and MQ-9 in this piece of research. In essence, they made use of an embedded design, which is comprised of switches, relays, solenoids, LEDs, miniature or customised LCD panels, radio frequency devices, and sensors for data such as temperature, humidity, light intensity, and other such things. Embedded systems often do not have a humaninterface device, a keyboard, a monitor, discs, or printers in addition to other recognised input/output (I/O) devices that are typical of personal computers. The amount and kind of detectors as well as the fire alarm system that is used to safeguard a property will be determined by the goals of the owner about the protection of the property, the value of the property, and the requirements of the insurance company. Heat detection will be used in any areas that are not considered to be of particularly high value. Again, providing just partial protection for a building while expecting tremendous performance from the fire alarm devices that are already installed is one of the most common mistakes that may be made during the installation of fire alarm systems. The concept of operation that is provided in this work suggests that the gas detector alarm system is designed to ensure that gas occurrences are recognisedintelligently, instantly reported, and regulated interactively. This is what is meant by "immediately reported." It is built around a timer that takes input from the MQ-9 gas sensor and, in the event that gas is present, turns on a buzzer and a series of LEDs. According to the datasheet for its product, the MQ9 sensor is designed to be used in gas detection equipment for carbon monoxide and CH4 as well as the LPG family and any other similar industrial or automotive assembly.

2.7 Summary

In the 21st century, LPG consumption has expanded significantly. As a consequence, the damages caused by the gas leak continue to increase daily. We are implementing a very sophisticated technology called as Internet of Things (IOT); visual information system in order to eliminate these issues. It is employed in a broad variety of applications in contemporary society, and its future prospects are expansive. Our suggested system is more efficient and environmentally beneficial since it detects LPG bottle defects through camera and monitors leakage and temperature before out for market. LPG cyclinders of the highest quality are thus primarily intended to ensure the safety of industrial personal and boost output. This system enables workers at an LPG bottling company to use their time more efficiently.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter will provide a comprehensive overview of the project's evolution. The implementation of VB.NET software is the most crucial aspect of this project's development, which is divided into numerous distinct phases. The camera and sensors are linked to VB.NET in order to monitor LPG bottle transmission line. Consequently, the objective of this project is to investigate the usage of a VB.NET-programmed camera and sensors to monitor LPG bottle transmission line and monitor the temperature and leakage of an LPG cylinder, as well as to verify the model.

3.2 Flow Chart

VB.NET is the programming language utilised for this project. VB.NET is a programming language developed for developing applications compatible with the new Microsoft.NET Framework. In turn, the. NET platform solves many of theshortcomings of "traditional" COM, Microsoft's Component Object Model, which offered one method to application and component compatibility. The flowchart shownin Figure 3 starts with project research and concludes with the effective production of hardware.

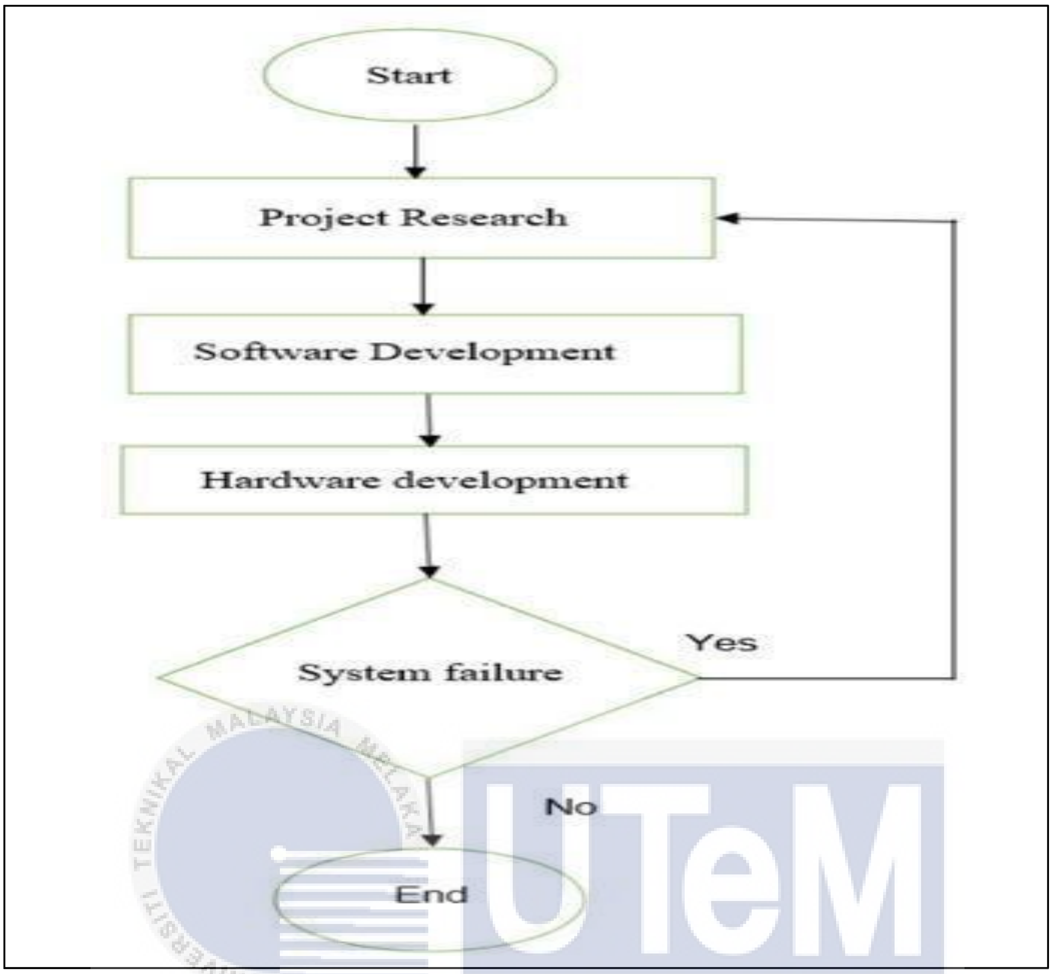

Figure 3: Workflow of the project

3.3 Material and methods

3.3.1 VB.NET

3.3.1.1 VB .Net Visual Setup

As suggested by the project's name, the simulation of the conveyor system used to transport the workpiece down a manufacturing line would be simulated using the VB.Net programming tools Visual Studio. The project is created using the most recent version of Visual Studio 2022. Multiple items from the Toolbox in the Design tab, such as Picture Box, Button, Timer, and Label, might be used to create a visual layout for the manufacturing line.

Below is an example of a simple conveyor line to transport a workpiece with a sensor that detects it's presence:

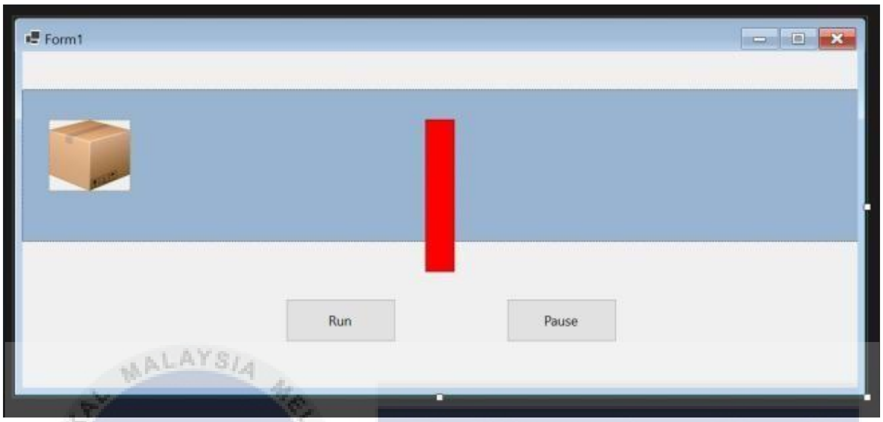

Figure 4: Example of a visualized simple conveyor line design with Visual Studio.

In the layout for the figure above, the design comprised of Picture Boxes and Button where the button will start the command to move the Picture Box that represents the workpiece to move from left to right and it will pass under the sensorfor detection.

3.3.1.2 VB .Net Animation

Animation is used to replicate the workflow of a conveyor line in an automotive production by depicting the movement of a workpiece from one station to another. To imitate an animation, 'Timer' would be used, since the location of the simulated workpiece, depicted using an image object box, would be shifted from one direction to another every second.

VB.Net provides many options for simulating an animation. The first is to linearly move an item, such as a Picture Box. This may be accomplished by programming the object's movement direction and the number of pixels it will travel each millisecond of the interval period. This procedure may also be performed manually, with each button push controlling a pixel movement to a predetermined value.

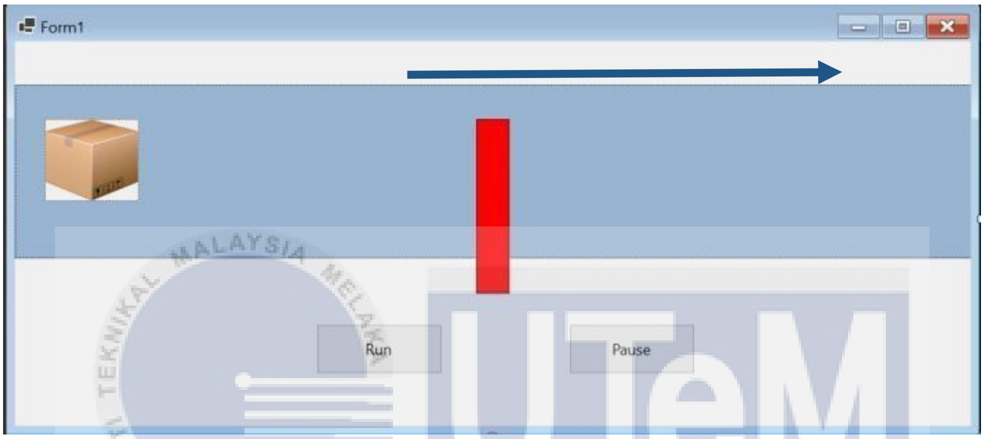

Figure 5: Movement direction of the automated animation when Run button is pressed.

Figure 6: Example of the movement direction of the manual animation when multiple direction movement command is given.

The second method is to arrange multiple object of the same image linearly in it's travel path. The animation occurs by having each object appear in order and then the loop repeats to give the illusion of a moving object.

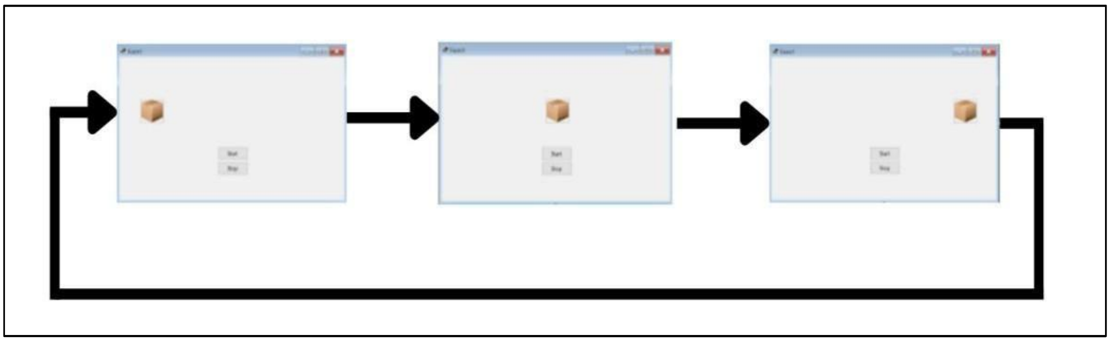

Figure 7: Display window loop (from left to right) for every 1 second interval after start button is pressed.

Since the animation would be more seamless when using the first method, the project would be done using the first method, albeit the difficulty to change the direction as the sub-program for the animation sequence is written in an 'If' loop, which is hard to get out from.

Animation sequence for both method would utilize the use of 'Timer' function as an animation is moving an object to a different position at every interval of a unit of time.

```
0 references
Private Sub Timer1_Tick(sender As Object, e As EventArgs) Handles Timer1.Tick

    Dim Collided As Boolean = False

    If Collision(PictureBox1, Sensor1) = True Then

        Sensor1.BackColor = Color.FromArgb(57, 255, 50)
    Else

        Sensor1.BackColor = Color.FromArgb(139, 0, 0)

    End If
```

Figure 8: Function of timer for animation.

The figure shows an example of a section of the code to utilize the ‘Timer’ function. In the Timer sub-section, the code is written to move the Image Boxfrom left to right repetitively. The first ‘If’ loop in the sub-section provides command to move the Picture Box for 10 pixels by utilizing ‘Me’ keyword to move itself to the left if the Picture Box’s width is less than the area, where the condition remain constant.

In the meantime, the simulation of the sensor’s function is also written in the sub-section as the process occurs simultaneously. The simulated sensor comprised of a set of ‘If’ loop that utilizes a collision-detection code written in another line.

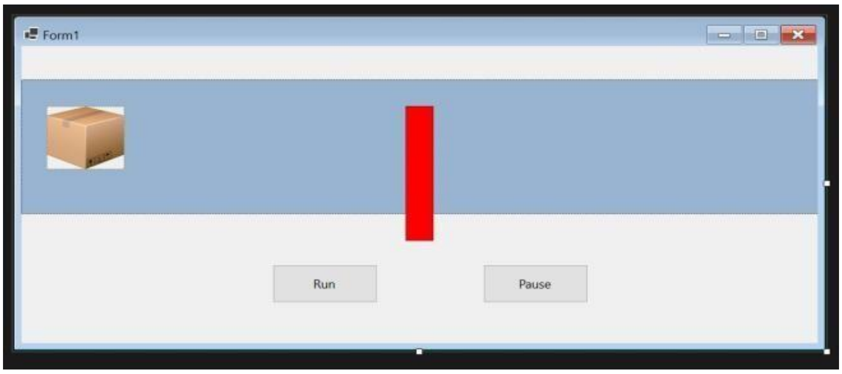

Figure 9: Function of Picture box.

The way it functions is that, as the Picture Box collided with the sensor, which is visualized as another Picture Box in the example from Figure 9, the sensor unit changed color from dark red to green. This is to simulate a sensor detecting an object passing under the sensor.

3.3.2 Camera for Image Detection

3.3.2.1 Connecting camera with VB.Net

In this project , camera is used to monitor LPG bottle transmission line. The camera converts that infrared data into an electronic image that shows the apparent surface temperature of the object being measured. The camera is placed on top of the inspection chamber, as the object pass through the inspection chamber the thermal image of the object can be inspected.

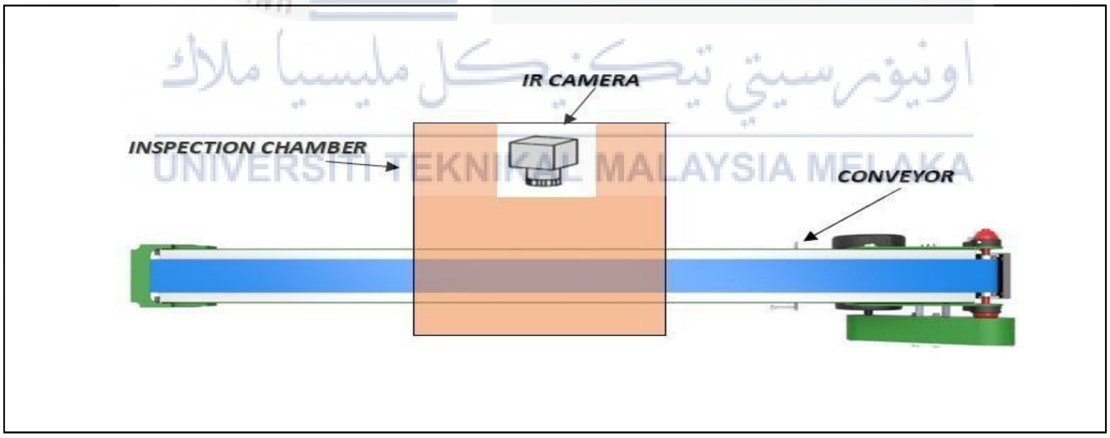

Figure 10: Position of camera in inspection chamber

```vb
Imports AForge
Imports AForge.Video
Imports AForge.Video.DirectShow
Imports System.IO

1 reference
Public Class Form1

    Dim CAMERA As VideoCaptureDevice
    Dim bmp As Bitmap

    0 references
    Private Sub Button1_Click(sender As Object, e As EventArgs) Handles Button1.Click
        Dim cameras As VideoCaptureDeviceForm = New VideoCaptureDeviceForm
        If cameras.ShowDialog() = Windows.Forms.DialogResult.OK Then
            CAMERA = cameras.VideoDevice
            AddHandler CAMERA.NewFrame, New NewFrameEventHandler(AddressOf Captured)
            CAMERA.Start()
        End If
    End Sub
```

Figure 11: Sub- section of coding camera connected to VB.NET

3.3.2.2 Detecting diameter of product

```python
# Install scipy di CMD
from scipy.spatial import distance as distcond
from imutils import perspective
from imutils import contours

# Import Numpy
# Install Numpy di CMD
import numpy as np

# Install Imutills di CMD
import imutils
import math
# Import OpenCV
import cv2

# Inisialisasi variabel midpoint

# Menentukan titik tengah dari objek yang akan diukur
def midpoint(ptA, ptB):
    return ((ptA[0] + ptB[0]) * 0.5, (ptA[1] + ptB[1]) * 0.5)


# Mengaktifkan Kamera untuk Menampilkan Video Secara Realtime
cap = cv2.VideoCapture(0)
```


Figure 12: Sub- section of coding camera Image Detection

3.3.3 DHT 11 sensor

A digital sensor for detecting humidity and temperature is the DHT11. To instantly detect humidity and temperature, this sensor may be simply interfaced with any micro-controller, including Arduino, Raspberry Pi, etc. Both a sensor and amodule are available for the DHT11 humidity and temperature sensor. The pull-up resistor and a power-on LED distinguish this sensor from the module. A relative humidity sensor is the DHT11. This sensor employs a capacitive humidity sensor anda thermistor to measure the ambient air.

3.3.3.1 Working principle

The DHT11 sensor comprises of a thermistor for measuring temperature and a capacitive humidity sensing device. The humidity detecting capacitor consists of two electrodes separated by a substrate that can hold moisture as a dielectric. The capacitance value changes as the humidity levels fluctuate. The IC calculates, interprets, and converts the modified resistance values into digital form.

This sensor uses a negative temperature coefficient thermistor to measure temperature, which results in a drop in resistance value as temperature rises. This sensor is typically built of semiconductor ceramics or polymers in order to obtain higher resistance values even for the smallest change in temperature.

The DHT11 has a temperature range of 0 to 50 degrees Celsius with a 2- degree precision. This sensor has a 20 to 80% humidity range with a 5% accuracy. This sensor's sampling rate is 1Hz. In other words, it provides one reading per second.

The DHT11 is a tiny device with a 3 to 5 volt operational range. 2.5mA is the maximum current that can be used for measuring.

3.3.3.2 Coding in Arduino Uno

```
#include "LiquidCrystal.h"
#include <dht.h>
 dht DHT;

 int DHT11_PIN= 7;

 void setup()
 {
  Serial.begin(9600);

 }
 void loop()

  {
    state = true;
    delay(100);
  }
  {
  int chk = DHT.read11(DHT11_PIN);
  Serial.print("Temperature = ");
  Serial.println(DHT.temperature);
  Serial.print("Humidity = ");
  Serial.println(DHT.humidity);
  delay(1000);
  }
 }
```


Figure 13: Sub- section of coding for DHT 11 sensor Arduino Uno

3.3.4 MQ 2 sensor

An electronic sensor called the MQ2 gas sensor measures the amount of gases in the air, including LPG, propane, methane, hydrogen, alcohol, smoke, and carbon monoxide.Chemiresistor is another name for the MQ2 gas sensor. When the sensing component comes into touch with the gas, the resistance of the component changes. The detection of gas uses this variation in resistance value. A gas sensor of the type MQ2 is a metal oxide semiconductor. A voltage divider network included within the sensor is used to determine the gas concentrations in the gas. The sensor requires 5V DC power to operate. It is capable of detecting gases with concentrations between 200 and 10,000 ppm.

3.3.4.1 Working principle

This sensor has a detecting component made primarily of ceramic with an aluminium oxide base that is coated in tin dioxide and surrounded in a stainless steel mesh. Sensing element is supported by six interconnecting legs. The sensing element is heated by two leads, while the other four are employed to generate output signals.

When a sensing material is heated to a high temperature in air, oxygen becomes adsorbed on the substance's surface. Then, donor electrons in tin oxide are drawn to this oxygen, blocking the flow of current. These oxygen atoms interact with the reducing gases when they are present, lowering the surface density of the adsorbedoxygen. Now that current is flowing through the sensor, analogue voltage readings were produced. These voltage readings are taken in order to determine the gas concentration. When there is a high concentration of gas, voltage levels are higher.

3.3.4.2 Coding in Arduino Uno

```
#define Threshold 400

#define MQ2pin 0

float sensorValue;  //variable to store sensor value

void setup() {
  Serial.begin(9600); // sets the serial port to 9600
  Serial.println("MQ2 warming up!");
  delay(20000); // allow the MQ2 to warm up
}

void loop() {
  sensorValue = analogRead(MQ2pin); // read analog input pin 0

  Serial.print("Sensor Value: ");
  Serial.print(sensorValue);

  if(sensorValue > Threshold)
  {
    Serial.print(" | LPG LEAKAGE DETECTED!");
  }

  Serial.println("");
  delay(2000); // wait 2s for next reading
}
```

Figure 14: Sub- section of coding for MQ2 sensor Arduino Uno

3.3.5 IR sensor count object

An electronic gadget that produces infrared light to sense certain features of its environment is called a sensor. An IR sensor can monitor an object's heat while also spotting movement. These kinds of sensors are referred to as passive IR sensors since they do not emit infrared radiation; instead, they merely measure it. Typically, all items emit some kind of thermal radiation in the infrared range.

An infrared sensor may pick up on these radiations, which are invisible to human vision. An IR LED (Light Emitting Diode) serves as the emitter, and an IR photodiode, which is sensitive to IR light of the same wavelength as that emitted by the IR LED, serves as the detector. The resistances and output voltages when IR light strikes the photodiode will vary proportionally to the intensity of the IR light received.

3.3.5.1 Working principle

An infrared sensor operates on a similar concept as an object detection sensor. The IR LED and IR Photodiode in this sensor can be combined to create a photo-coupler rather than an optocoupler. The physics principles utilised in this sensor include weins displacement, Stephan Boltzmann, and planks radiation.

One type of transmitter that generates IR radiations is the IR LED. This LED resembles a typical LED in appearance, and the radiation it produces is invisible to the human eye. An infrared transmitter is primarily used by infrared receivers to detect the radiation. Photodiodes are a kind of these infrared receivers. Because they only detect IR radiation, IR Photodiodes are different from regular Photodiodes.

When utilised as an IR transmitter and receiver pair, the wavelength of the receiver must match that of the transmitter. Here, an IR photodiode serves as the receiver and an IR LED as the transmitter. The infrared light produced by an infrared LED can be detected by an infrared photodiode. The amount of acquired infrared light is proportional to the photodiode's resistance and the change in output voltage. This is the basic idea behind how an IR sensor works.

A portion of the infrared emission will reflect back toward the infrared receiver once the infrared transmitter produces it, after it reaches the object. Depending on the strength of the answer, the IR receiver can choose the sensor output.

3.3.5.2 Coding with Arduino Uno

```
int IRSensor = 9; // connect IR sensor module to Arduino pin D9
int LED = 13; // connect LED to Arduino pin 13

void setup(){
  Serial.begin(19200); // Init Serial at 4800 Baud Rate.
  Serial.println("Serial Working"); // Test to check if serial is working or not
  pinMode(IRSensor, INPUT); // IR Sensor pin INPUT
  pinMode(LED, OUTPUT); // LED Pin Output
}
void loop(){
  int sensorStatus = digitalRead(IRSensor); // Set the GPIO as Input
  if (sensorStatus == 1) // Check if the pin high or not
  {
    // if the pin is high turn off the onboard Led
    digitalWrite(LED, LOW); // LED LOW
    Serial.println("HIGH!"); // print Motion Detected! on the serial monitor window
  }
  else {
    //else turn on the onboard LED
    digitalWrite(LED, HIGH); // LED High
    Serial.println("LOW!"); // print Motion Ended! on the serial monitor window
  }
}
```


Figure 15: Sub- section of coding for IR sensor Arduino Uno

3.3.6 Arduino Uno

The Arduino Uno is a microcontroller board that is built on the ATmega328P. (datasheet). It contains a USB connector, a power connection, an ICSP header, a reset button, and a ceramic resonator working at 16 MHz (CSTCE16M0V53- R0). It also has 14 digital input/output pins, 6 of which can be used as PWM outputs. It also features a USB port and a power connector. The only things needed to get started area USB cable to connect it to a computer and either an AC-to-DC converter or a battery to supply power. It comes with everything needed to support the microcontroller. When experimenting with your Uno, you shouldn't be very concerned about making a mistake because, in the worst case, you can just buy a new chip for a few dollars and start over.

It was decided to use the Italian word "uno," which means "one," to symbolise the first release of the Arduino Software (IDE). Future iterations of the Arduino platform were built on top of the Arduino Uno board and version 1.0 of the Arduino Software (IDE). The Arduino platform's standard board is called the Uno. It was the first of several boards that used a USB connection for power. For a complete list of all the board models that have previously existed, including those that are currently in production, visit the index of boards page on the Arduino website.

3.3.6.1 Structure ofvArduino Uno

Microcontroller: Microcontroller is the central processing unit of Arduino Uno.

Digital Pins: There are 14 digital pins on Arduino Uno which can be connected to components like LED, LCD, etc.

Analog Pins: There are 6 analog pins on the Uno. These pins are generally used to connect sensors because all the sensors generally have analog values. Most of the input components are connected here.

Power Supply: The power supply pins are IOREF, GND, 3.3V, 5V, Vin are used to connecting sensors because all the sensors generally have analog values. Most of the input components are connected here.

Power Jack: Uno board can be powered both by external supply and via USB cable.

USB Port: This port function is to program the board or to upload the program. The program can be uploaded to the board with the help of Arduino IDE and USB cable.

Reset Button: This is used to restart the uploaded program.

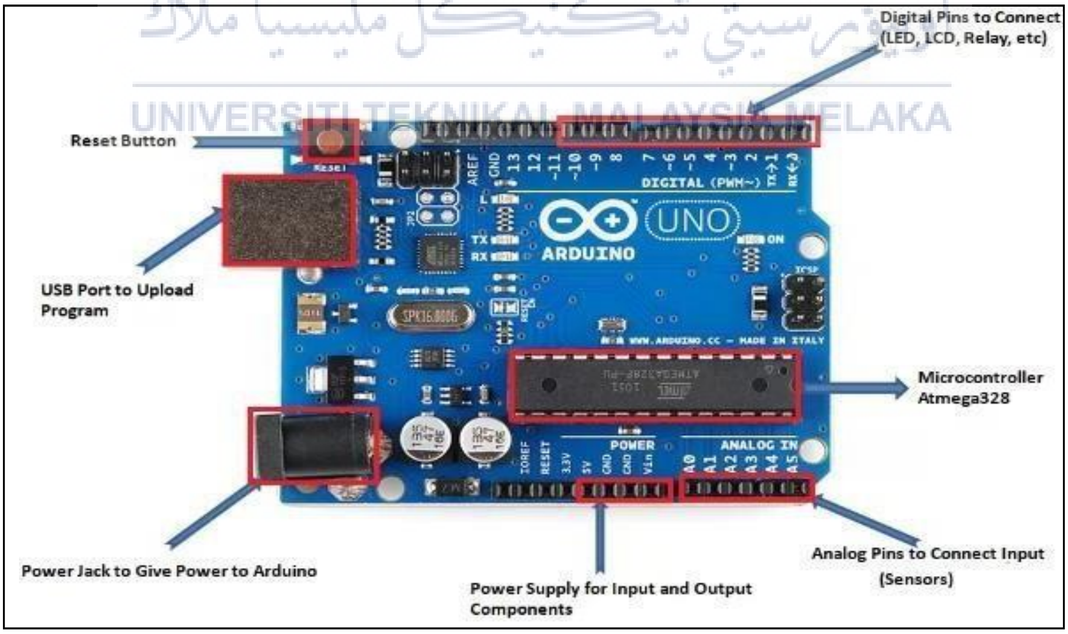

Figure 16: Arduino Uno hardware structure

3.4 Summary

In this chapter, we outline the suggested approach that will be used to provide a revolutionary, integrated approach to visual information systems. The primary objective of the suggested methodology is to develop a straightforward, quicker, and more effective plan for lowering labour requirements and the typical amount of time spent on the assembly line. The methods utilised to accomplish the objectives, as well as the hardware and software employed, are described in depth.

CHAPTER 4

RESULTS

4.1 Introduction

In this project, the creation of an industrial product monitoring system is based on a real-time monitoring system that makes use of the hardware and software that were previously discussed in the chapter. The foundation of this monitoring system is VB.Net Animation. The system's monitoring capabilities include measuring product diameter, optimal temperature, and quantity of product utilising camera and sensors. After the system's hardware and software have been installed, the system has to be examined. This will guarantee that the system can operate correctly and that all coding and programming are accurate. The data and the coding must be adjusted if any errors are found during testing. Keep in mind that this is a crucial point.

4.2 Results

4.2.1 Image Detection result

This is where the camera's output is displayed; the camera picks up physical attributes of things like diameter. The object is regarded as acceptable in the industry if it has the programmed value. Additionally, an object is considered to be defective if its shape or diameter doesn't fulfil the standards.

Figure 17: Camera Set Up for detecting diameter of object

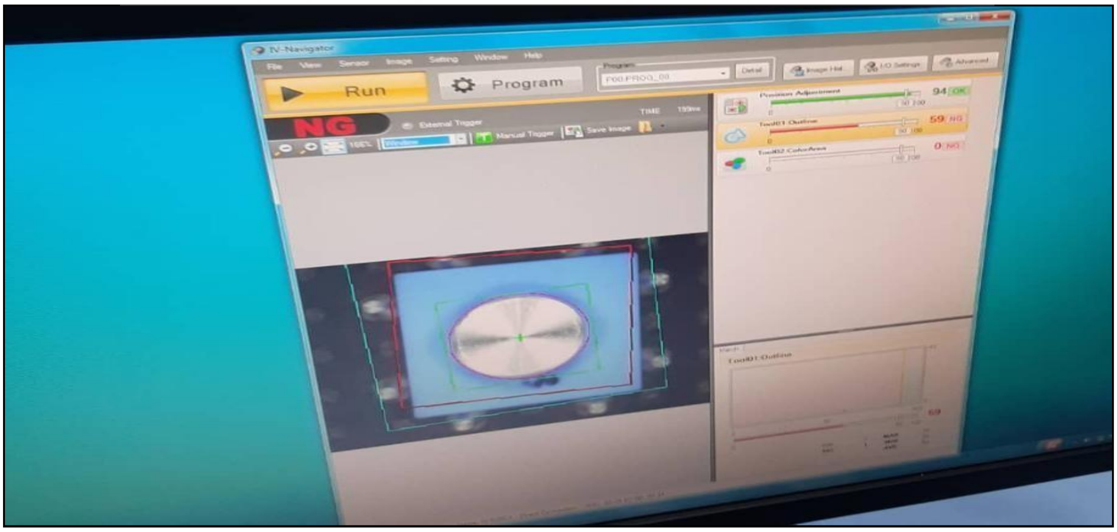

Figure 18: Output Image detected diameter of object

4.2.2 DHT 11 Sensor results

The optimal temperature of the object in the production line is detected by this sensor. If the desired optimum temperature is found, the product is accepted, and any item that doesn't fit the specifications is deemed to be defective.

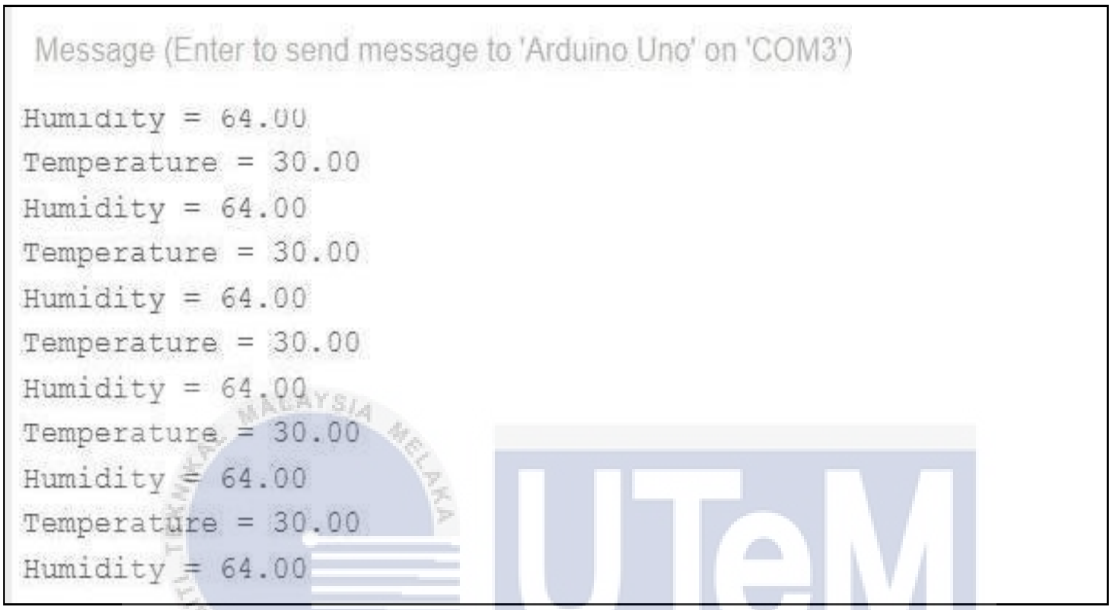

Figure 19: Output detected from DHT11 sensor

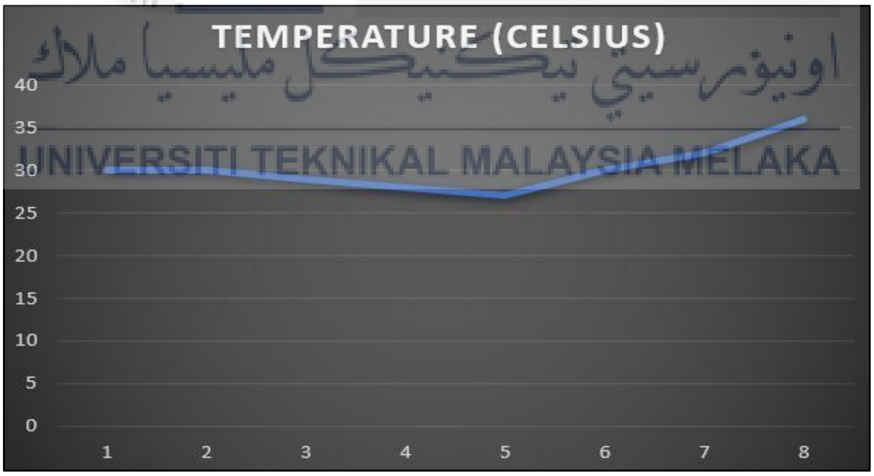

Figure 20: Output graph of temperature detected by DHT 11 sensor

4.2.3 MQ2 Sensor results

The leakage of LPG is detected in the production line by this sensor. If desired optimum treeshold value is found, the product is accepted, and any item that doesn't fi\t the specifications is deemed to be defective.

```
Sensor Value: 402.00 | LPG LEAKAGE DETECTED!
Sensor Value: 431.00 | LPG LEAKAGE DETECTED!
Sensor Value: 437.00 | LPG LEAKAGE DETECTED!
Sensor Value: 432.00 | LPG LEAKAGE DETECTED!
Sensor Value: 463.00 | LPG LEAKAGE DETECTED!
Sensor Value: 463.00 | LPG LEAKAGE DETECTED!
Sensor Value: 453.00 | LPG LEAKAGE DETECTED!
Sensor Value: 444.00 | LPG LEAKAGE DETECTED!
Sensor Value: 437.00 | LPG LEAKAGE DETECTED!
Sensor Value: 431.00 | LPG LEAKAGE DETECTED!
Sensor Value: 423.00 | LPG LEAKAGE DETECTED!
Sensor Value: 416.00 | LPG LEAKAGE DETECTED!
Sensor Value: 407.00 | LPG LEAKAGE DETECTED!
Sensor Value: 398.00
Sensor Value: 391.00
Sensor Value: 379.00
Sensor Value: 370.00
Sensor Value: 361.00
Sensor Value: 353.00
```

Figure 21: Output detected from MQ2 sensor

4.2.4 IR Sensor results

The sensor detects number of object pass through to count the ideal condition product at the end of transmission line after removing defect products from transmission line.


```
Output    Serial Monitor ×
Message (Enter to send message to 'Arduino Uno' on 'COM3')
□Count: 1
Count: 2
Count: 3
Count: 4
Count: 5
Count: 6
Count: 7
Count: 8
Count: 9
Count: 10
Count: 11
Count: 12
```

Figure 22: Output detected from IR sensor

IR COUNT	OBJECT
1	DETECTED
2	DETECTED
3	DETECTED
4	DETECTED
5	DETECTED
6	DETECTED

Figure 23: Output detected and counted from IR sensor

4.3 Discussion

Based on the project's overall findings, the camera will be set to a fixed diameter measurement. If the object's diameter is less than or greater than the required measurement, it will be rejected since the object's shape is not in proper condition. The object in the production line should be kept at a temperature of 28 degrees Celsius. If an object's temperature is higher above the optimal range, it may spoil and be rejected by the market. Additionally, the MQ2 sensor is calibrated with a threeshold value of 400 as normal; anything beyond that will detect LPG leakage and be rejected as well. Therefore, the industrial process fulfils the needs of the particular product activity.

CHAPTER 5

CONCLUSION

5.1 Conclusion

As a conclsion, the Development of Visual System thesis must be composed entirely before writing the final chapter. A brief description of the Develop Visual System summary is provided in this chapter, along with a number of suggestions and ideas for potential future works. When this project is finished, it will be possible to assess whether or not the objectives were met. In terms of generating the intended results, the methodology that has been suggested is reliable and both effective. This is achieved by using the fewest number of Development of Visual System information sources possible and just information that is mainly accurate.Overall, the study presented in this project has been successful in contributing to a deeper understanding of the significance of the effective operation of the intended system for a Visual Monitoring System. This has been achieved by giving people a greater knowledge of the importance of the effective operation of the system that was created for a Visual Monitoring System.

5.2 Recomendation

The suggestions include that a solenoid arm be fitted to a station to kick the defective object in the conveyor system when the monitoring system identifies the malfunction. Additionally, a method for storing object data should be included, making it simple to spot any production-related issues afterwards. Moreover, this project should be upgraded with high technology camera which can detect temperature, texture of object, colour of object and many other featurestics, so this system can be more effective.

5.3 Project Potential

This project can be used by any small business industries or start up industries which would like to use conveyor transmission line to sort their products efficiently at low cost. This is because the setup and program of this project is made to understand the conveyor transmission line easily amd obtain the result more conveniently. Additionally, as this project is fully programmed automatically it doesn't required more man power and less supervision. This project is more recommended to industry once the suggested upgradation is done as more automatic programs is added which will be more eefective to use in industry.

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APPENDICES

A GRANTT CHART

NO.	PROJECT ACTIVITIES	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
M1	PROBLEM FORMULATION & PROJECT PLANNING /CHAPTER 1														
M2	LITERATURE REVIEW /CHAPTER 2														
M3	DATA GATHERING /CHAPTER 3														
M4	PRELIMINARY TESTING/INVESTIGATION														
M5	REPORT WRITING & PRESENTATION														