POLITEKNIK MALAYSIA

SULTAN SALAHUDDIN ABDUL AZIZ SHAH

WELDING ANGLE DETECTOR

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JABATAN KEJURUTERAAN MEKANIKAL

JUN 2019

POLITEKNIK SULTAN SALAHUDDIN ABDUL AZIZ SHAH

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TITTLE : WELDING ANGLE DETECTOR

SESSION : JUNE 2020

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ABSTRACT

Why welding is needed because it keeps our world together. If it's make of metal-it can be welded. From car to planes and bridges to buildings, welding keeps our economy moving. It's the backbone of our world. Politeknik Sultan Abdul Aziz Shah exposes to Mechanical Engineering Department students the basic knowledge and skill which extend the principle and technique needed by a welder in the field. Furthermore, students learnt welding in subject Workshop Technology where lecturers teach students about theory in welding. As we can see, all Mechanical Students know the basic knowledge about welding like angle range between 45°- 60°, arc spacing between 2-5mm and flat position. Moreover, welding is an essential component of many industries such as the automotive industry, the construction industry, the aviation industry and more also 70 % of manufacturing products are made with the skill of welders. Welding is not hard to learn but it takes time to master that skill such as technic zigzag, circle and straight because that student of the Mechanical Department of Politeknik Shah Alam takes time to proficient and practice in welding. So with an idea of welding angle detector, it helps students to improve their skill and make it easier to practice for welding. However, current the angle detector their using welding gauge for check it in weld inspection because of that it lead student takes time to practice to master all skill in welding. Due to that issue, welding angle detectors can help students see their mistake and learn it to improvise their skill.

CHAPTER 1

INTRODUCTION

1.1 Research Background

Welding is an operation whereby two or more parts are united by means of heat or pressure or both. It is usually used on metals and thermoplastics but can also be used on wood. Some material requires the use of specific process and technique. A number are considering ‘unweldable’, a term not usually found in dictionaries but useful and descriptive in engineering.

Welding is not hard to learnt but it take time to become proficient and consistent. There are many different methods to weld many different type of metal. Numerous bridge, highways, utility, require considerable repair throughout the U.S. Many industries utilize welder: Vehicle Assembly, Aerospace, Construction, Pipelines, Oil Refineries and Drilling. As of 2016, there are about 404,800 welders working throughout the US. In 2019, the field is expected to grow at a steady rate of about 6%. This is about the average growth rates for most occupations in the US right now. That rate is anticipated to set the pace until at least 2026, which is for the foreseeable future. Welding is very high demand in industry because human use and the facility in this era also this make a chance Politeknik Malaysia introduce welding to student because it’s a right career to choose after graduation.

Furthermore, Politeknik Sultan Abdul Aziz Shah gave student Mechanical Engineering student opportunity to learnt welding theory and applies it at workshop. Student can learnt that how to use work angle when welding that maintain range for 45°-60°. Also when welding there are many technic that student can use such as zigzag, circle or straight. The range arc spacing when welding is 2-5mm if student exceed that range it could cause a defect. Moreover, student given a chance by lecturer to practice to make it prefect because of that Politeknik Shah Alam can produce a calibre student for the industry.

Therefore, this study inspires to help student Politeknik Shah Alam too enhances for their skill with using welding angle detection using programming as a new brand welder gauge. This new brand is good because welding angle detection is friendly use for a new people to use it. Plus, it's cheaper than welder gauge because welder gauge need to buy a set then it can measure the angle with manual work. So we decided to create this new brand material as a solution to get a perfect practice for welders and also to make benefit for Politeknik Sultan Abdul Aziz Shah.

1.2 Problem statement

Politeknik Sultan Abdul Aziz Shah student always consider as calibre community in welding industry because technical skill they learnt in Politeknik. There a few problem that student Politeknik Shah Alam are facing when learning welding sometimes they don't have enough time to practice because lacking facility.

Plus, commonly student were afraid when handle high temperature stuff because of that they don't really like when welding and also student underestimate of welding. Moreover, student just estimate the angle and arc spacing when welding because the spark that so bright and student need to use welding helmet for the safety for their eyes because of that student only we dim of light when welding. Sometime student can't maintain the angle range and arc spacing perfectly because rods become shorter when welding in long time.

Also, student needs welding a flat position such as Butt weld, T-joint and Lap joint along with it become difficult because each position has different angle to apply it. Furthermore, if they can't apply the range of angel when welding it shows a defect such welding not penetrates the entire thickness of the base plate, crack and undercutting. This makes students need a time to practice and enchant skill.

1.3 Research Objectives

This research embarks on the following objectives:

I. To develop a welding angle detector.

II. To help the student to enhances welding skill.

1.4 Research Question

This study will answer the following research question:

I. Is it possible to make angle detection with high accuracy?

II. Why this will help for welder to increase their skill?

1.5 Scope of Research

The scope and limits to this research are:

I. MPU-6050: Sensors in three-dimensional space and usually to help determine its position

II. Arduino Uno R3: Microcontroller board based on removable

III. Resistors: To reduce current flow, adjust signal levels and terminate transmission line

IV. LED: To illuminate objects and even places.

1.6 Significance of Research

Thus, the finding of this study will bring a lot of benefits to the student that that lacks practice and this golden opportunity to enchant skill. Plus, it wills absolutely benefits for Malaysia since we are produced a skilled community in Malaysia. Also student can use this as a step stone when apply for work in industry. Moreover, student can weld like professional in short time and it can boost student confident when welding,

1.7 Definition of Operational Terms

Welding Angle Detector: Is an electrical circuit using programming of Andriuno Uno and use MPU-6050 that use for detect of angle when welding. This project was focusing for student to maintain the range of angle and arc spacing when welding also it help for student to apply the theory when doing welding.

1.8 Chapter Summary

In this chapter, the project was explained about the inspiration of helping Mechanical student at Politeknik Shah Alam. All of the objective was for benefit of student and help us to come out the problem statement that relates the problem Mechanical student are facing. The main objective for this project was for student to enchant their skill in short time using the welding angel detector also it's a step stone for Politeknik Sultan Abdul Aziz Shah to increase a calibre student for Malaysia.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter, will be shown the gyroscope working principle, programming, and welding defects. These three topics will be the main subject for our project to working. The main objective for our project is to overcome the welding defects by using the gyroscope and making the programming for it. Welding needs a lot of practices to learn and weld perfectly, by making this project it will help the students learn fast in welding and welder can weld faster and easily. Besides, the weld products will become even better in term of quality.

Welding has been used in metallurgy for millennia with forge welding performed by blacksmiths as the only real viable technique. This all changed in the 1900's when newer method like arc-welding and oxy fuel welding were developed. Some of the most common employed day includes Gas Metal Arc Welding (GMAW), Gas Tungsten Arc Welding (GTAW), Shielded Arc Welding (SMAW), Cored Arc Welding (FCAW), Energy Beam Welding (EBW), Atomic Arc Welding (AHW) and Plasma Arc Welding. Each type of welding ha different technique also its have unique advantages and disadvantages over others.

According to the American Welder Society, welding job in the manufacturing sector has steadily increased since 2000 and several major oil

pipeline have begun construction. Numerous bridge, highways, utility, require considerable repair throughout the U.S. Many industries utilize welder: Vehicle Assembly, Aerospace, Construction, Pipelines, Oil Refineries and Drilling, and Military Support. Most welding jobs will require a high schools diploma or GED, technical and on the job training and up to date certifications acquired at a school or job site. The certification is a hands on welding test given and overseen by a certified welder that has been trained to inspect welds to determined that its performed according to the approved procedures and guidelines of the certifying organization. The hands on welding qualifications test (also known as the weld inspection test) is design to show the welder skill level and can be either a non-destructive test (NDT) or a destructive test.

2.2 Gyroscope Sensor Working Principle

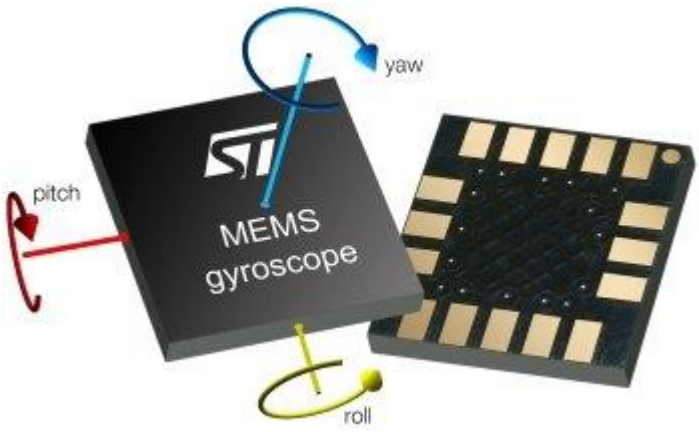

Figure 2.2.1 MEMS Gyroscope

As shown in Figure 2.1 above was the MEMS gyroscopes, it will be the main item for our group project. Gyroscope sensor is a device that can measure and maintain the orientation and angular velocity of an object. These are more advanced than accelerometers. These can measure the tilt

and lateral orientation of the object whereas accelerometer can only measure the linear motion. Gyroscope sensors are also called as Angular Rate Sensor or Angular Velocity Sensors. These sensors are installed in the applications where the orientation of the object is difficult to sense by humans. Measured in degrees per second, angular velocity is the change in the rotational angle of the object per unit of time.

Besides sensing the angular velocity, Gyroscope sensors can also measure the motion of the object. For more robust and accurate motion sensing, in consumer electronics Gyroscope sensors are combined with Accelerometer sensors. Depending on the direction there are three types of angular rate measurements. Yaw- the horizontal rotation on a flat surface when see the object from above, Pitch- Vertical rotation as seen the object from front, Roll- the horizontal rotation when seen the object from front.

The concept of Coriolis force is used in Gyroscope sensors. In this sensor to measure the angular rate, the rotation rate of the sensor is converted into an electrical signal. Working principle of Gyroscope sensor can be understood by observing the working of Vibration Gyroscope sensor. This sensor consists of an internal vibrating element made up of crystal material in the shape of a double – T- structure. This structure comprises a stationary part in the centre with ‘Sensing Arm’ attached to it and ‘Drive Arm’ on both sides.

This double-T-structure is symmetrical. When an alternating vibration electrical field is applied to the drive arms, continuous lateral vibrations are produced. As Drive arms are symmetrical, when one arm moves to left the

other moves to the right, thus cancelling out the leaking vibrations. This keeps the stationary part at the centre and sensing arm remains static.

When the external rotational force is applied to the sensor vertical vibrations are caused on Drive arms. This leads to the vibration of the Drive arms in the upward and downward directions due to which a rotational force acts on the stationary part in the centre. Rotation of the stationary part leads to the vertical vibrations in sensing arms. These vibrations caused in the sensing arm are measured as a change in electrical charge. This change is used to measure the external rotational force applied to the sensor as Angular rotation. In our project we will be using the MEMS gyroscopes to detect angle when welding by using the stability vibrations in our gyroscope.

2.3 Programming

Programming is the process of creating a set of instructions that tell a computer how to perform a task. Programming can be done using a variety of computer "languages," such as SQL, Java, Python, and C++. In our project we will select the Arduino programming and C++ to perform the gyroscopes detect the angle and give in the data.

Arduino is an open source programmable circuit board that can be integrated into a wide variety of makerspace projects both simple and complex. This board contains a microcontroller which is able to be programmed to sense and control objects in the physical world. By responding to sensors and inputs, the Arduino is able to interact with a large array of outputs such as LEDs, motors and displays. Because of its flexibility and low cost, Arduino has become a very popular choice for makers and

makerspaces looking to create interactive hardware projects. One of the most popular Arduino boards out there is the Arduino Uno. While it was not actually the first board to be released, it remains to be the most actively used and most widely documented on the market. Because of its extreme popularity, the Arduino Uno has a ton of project tutorials and forums around the web that can help us get started.

Arduino programs are written in the Arduino Integrated Development Environment (IDE). Arduino IDE is special software running on your system that allows you to write sketches (synonym for program in Arduino language) for different Arduino boards. The Arduino programming language is based on a very simple hardware programming language called processing, which is similar to the C language. After the sketch is written in the Arduino IDE, it should be uploaded on the Arduino board for execution.

Our project will need the programming to detect the angle when welding by using the gyroscope sensor. By using the Arduino uno board we will program it to detect the angle for example, the LED light will blink when the welding angle is more than 45 degree and less than 30 degree. On that, Arduino board is the best circuit board that has an easy programming language for us to program the sensor. The example for arduino programming interface is shown in figure 2.3.1.

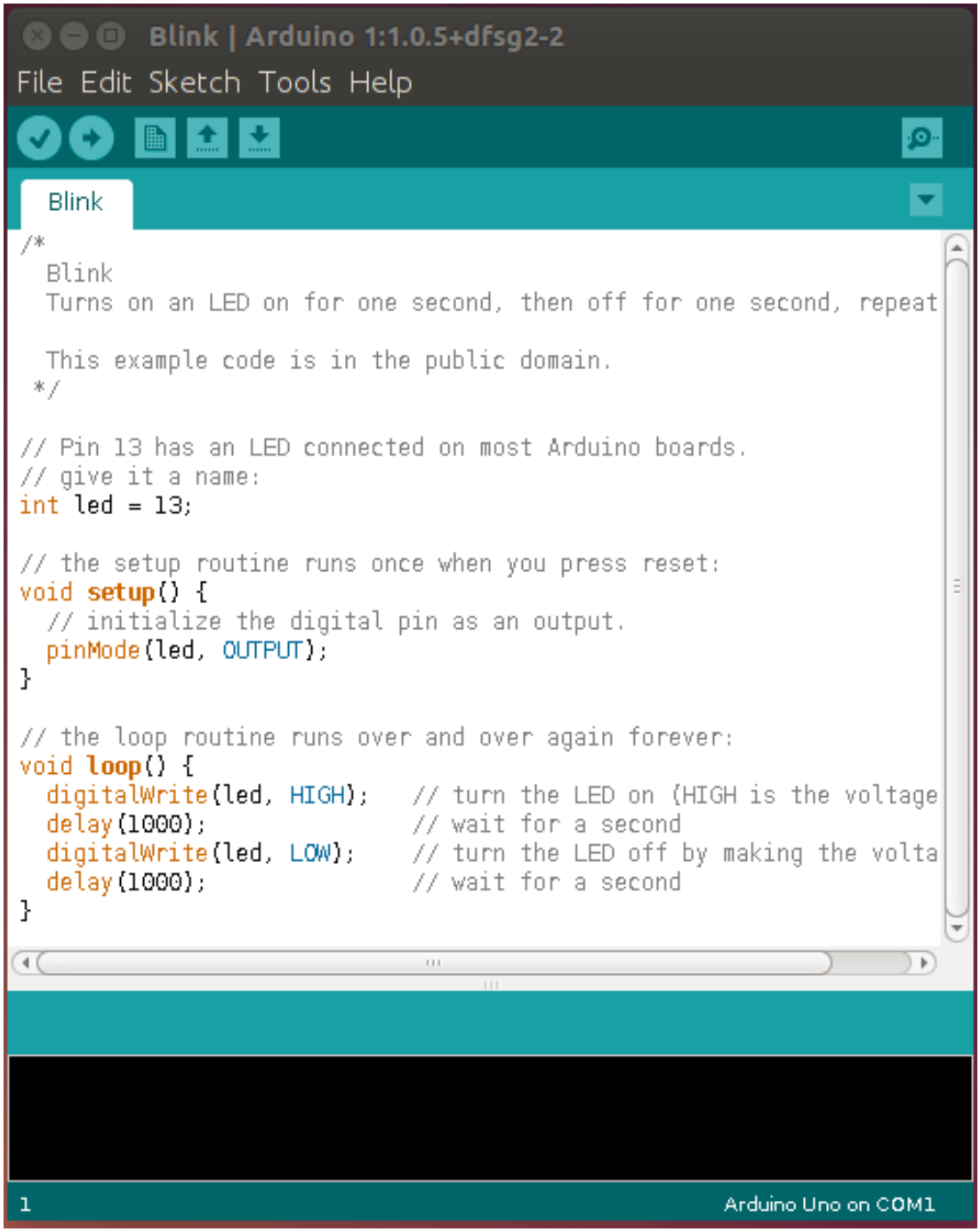

Figure 2.3.1 Arduino Uno Programming

2.4 Welding Defects

Welding Defects can be defined as the irregularities formed in the given weld metal due to wrong welding process or incorrect welding patterns, etc. The defect may differ from the desired weld bead shape, size, and intended quality. Welding defects may occur either outside or inside the weld metal. Some of the defects may be allowed if the defects are under permissible limits but other defects such as cracks are never accepted.

There are many types of welding defects as shown in Figure 2.4.1, for example such as weld crack, undercut, spatter, porosity, overlap and many more. These defects originate from various sources. In most cases, the defects occur as a result of improper weld design and unsuitable welding processes and choice of incompatible materials. In addition, a lack of knowledge of the process, poor workmanship, and inadequate training of the welder can also contribute to these defects. Furthermore, there are always certain flaws in the welding due to the inherent weakness in welding technology and the characteristics of metals.

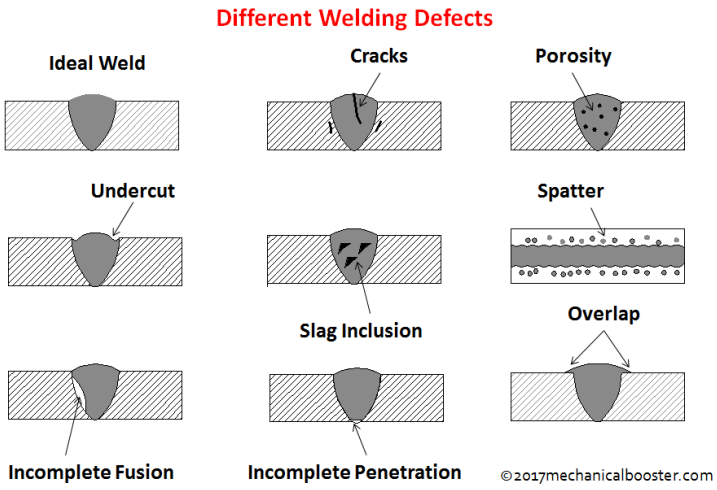

Figure 2.4.1: Type Welding Defect

The most defected when welding shown at Figure 2.3. One of the reasons that causes the welding defects are the angle of weld is not right. To prevent this project will detect the right angle of weld to reduces the welding defects from occurs. For example, we will use the gyroscope sensor to detect the angle of electrode, and then we will program it to give us a signal when the angle is doesn't right so the product will be weld properly and doesn't have undercut. Nowadays, the angle detection for welding are only used when the exam of welding certification but its efficient because it only can detect after the weld is done.

2.5 Chapter Summary

As to conclude this chapter, literature review is important to showcase all the studies of materials and methods to enhance the knowledge on this project. Every thesis and other projects that are related to this gyro sensor, programming, and welding defects are really helpful especially for us to understand it fully.

After a lot of research and discussion between group members, the welding defects can be reduced by making a sensor to detect the angle. The best sensor for our project will be the gyroscope sensor due to its compatibility to detect the angle. There is easy programming to detect the angle. Pairing sensor MPU-6050 with Arduino Uno board circuit because it has its own programming program that is similar to C++ and easy to use even for the beginner in programming and the cost for the circuit is affordable.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The design of the project was made by using Autodesk Inventor Professional 2017. The materials used in this project were highly accurate and capable of detecting 360˚ angles when welding. Furthermore, the project is using a programming gyro sensor MPU-6050, since this method is the best for this project while other sensors can't detect as good as gyro sensor MPU-6050. Figure 3.1 shows the flowchart of methodology.

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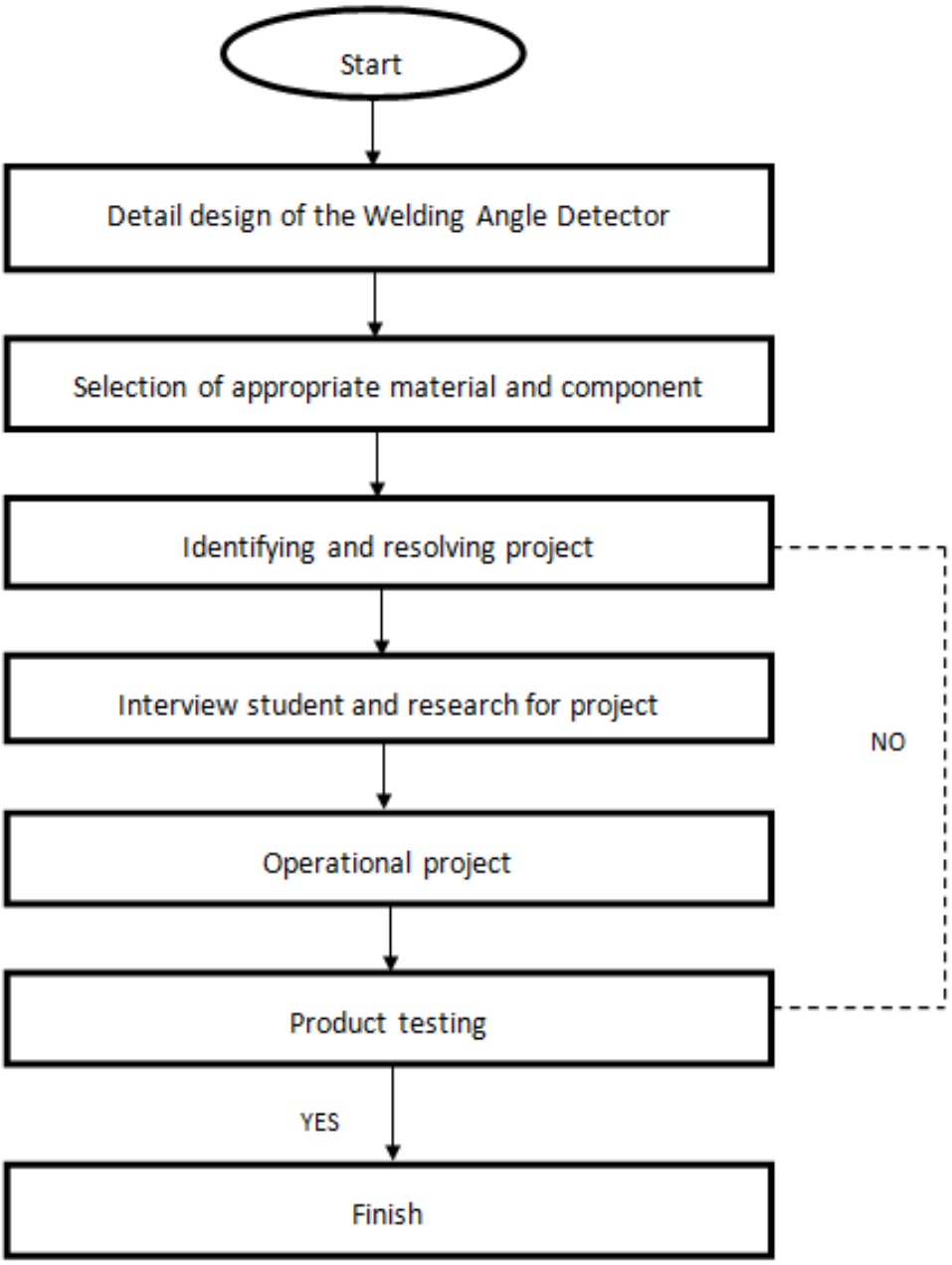


Figure 3.1.1 Flow Chart of Methodology

Flow Chart Explanation

3.2 Detail Design

. Design concept was a method which made it easier to make a selection of the best design for quality production. The idea to design this project is to make the project more functional specifications, performance and security goals. From there we can investigate the weaknesses of the welding workshop at the Politeknik Shah Alam. The design project has the durability, safety and low cost. Figure 3.2.1 presents the detailed project design and figure 3.2.2 shows the drawing of the welding angle detector.

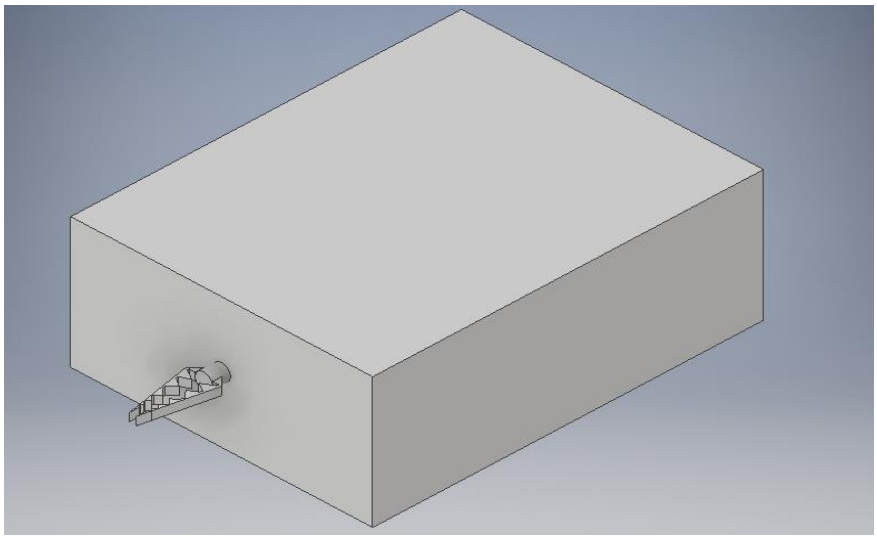


Figure 3.2.1 Isometric View Angle Detector Container

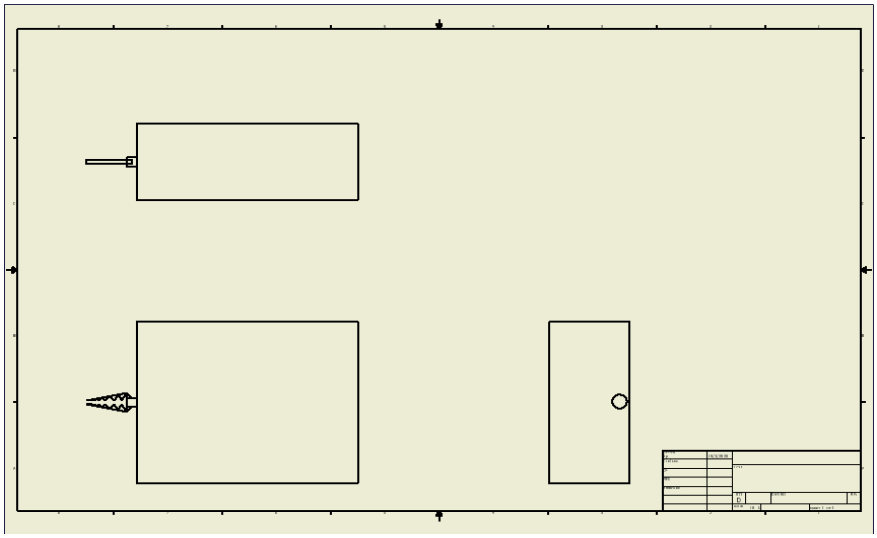


Figure 3.2.2 Drawing Angel Detector Container

3.3 Material Selection

The main material used to develop the Welding angle detector is gyro sensor MPU-6050, L.E.D (Light Emitting Diode), resistance, and Arduino Uno R3**.**

3.3.1 Gyro Sensor MPU-6050

Gyroscopes, or gyros, are devices that measure or maintain rotational motion. MEMS (microelectromechanical system) gyros are small, inexpensive sensors that measure angular velocity. The units of angular velocity are measured in degrees per second (°/s) or revolutions per second (RPS). Angular velocity is simply a measurement of speed of rotation

Gyros, similar to the one above, can be used to determine orientation and are found in most autonomous navigation systems. For example, if you want to balance robot, a gyroscope can be used to measure rotation from the

balanced position and send corrections to a motor. Figure 3.3.1 shows the gyro sensor MPU-6050

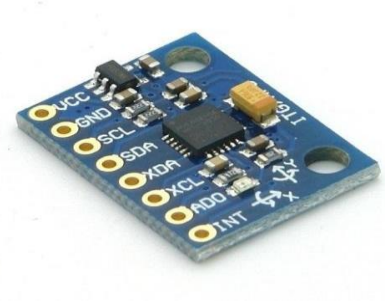


Figure 3.3.1 Gyro Sensor MPU-6050

3.3.2 L.E.D (Light Emitting Diode)

Basically, LED are just tiny bulbs that fit easily into an electrical circuit. But unlike ordinary incandescent bulbs, they don't have a filament that will burn out, and they don't get especially hot. This is why they are so cheap to run because they give of light not heat. Figure 3.3.2 show the L.E.D (Light Emitting Diode).

Figure 3.3.2 L.E.D

3.3.3 Resistor

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to divide voltages, bias active elements, and terminate transmission lines, among other uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity. Figure 3.3.3 shows the resistance.

Figure 3.3.3 Resistor

3.3.4 Arduino Uno R3

The UNO is the best board to get started with electronics and coding. If this is your first experience tinkering with the platform, the UNO is the most robust board you can start playing with. The UNO is the most used and documented board of the whole Arduino family.

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards. Figure 3.3.4 show the Arduino uno R3

Figure 3.3.4 Arduino Uno R3

3.4 Identifying and resolving project

A problem statement identifies the distance between the rods and the workpiece. Then the problem of angle at which you hold the electrode greatly affects the shape of the weld bead which is very important in fillet and deep groove welding. Furthermore, welding has more problems in terms of speed rate, angle of rod, porosity, rod cracks and other more problems we can find in welding.

With the help of a welding angle detector, it will make it easier to learn about welding and students can make a perfect arc welding with this welding angle detector.

3.5 Interview and Research

We did an interview with a student, Izzat who currently studies for Mechanical Engineering at Politeknik Shah Alam. There, Izzat explains all about the problem and issue of welding. We explain all about our project. The welding angle detector will help student Politeknik Shah Alam and Izzat agree on our project also he was very interested in it because it can help his study. Throughout the entire interview, a lot of questions about current angle detector is using a welding gauge. He also said that he is always facing the problem of range of angle when welding and he tries to perfect that skill. Other than that, he explains about a problem which his friend is also having the same problem related to welding. Figure 3.8 shows the interview we had done some research toward student mechanical.

Figure 3.5.1 Interview with Izzat

3.6 Operational Methodology

3.6.1 Electrical Circuit

The electrical circuit is carried out by preparing a L.E.D, Gyro Sensor MPU-6050, Arduino Uno and Resistance. Gyro sensor MPU-6050 uses 5 wire jumpers to connect the Arduino Uno. The wire jumper for gyro sensors connect between VCC (3v-5v), GND (Ground), SCL (Serial Clock), SDA (Serial Data) and INT (Interrupt). The first step is to use a wire jumper on the Gyro sensor at VCC and connect to Arduino Uno at 3.3v. The second step is to use a wire jumper on the gyro sensor at GND and connect to Arduino Uno at GND. SCL gyro sensor connects to A5 Arduino Uno and SDA connect to A4 Arduino Uno. Finally, the INT Gyro sensor connects to Pin 3 Arduino Uno. Furthermore, for L.E.D and resistance we need 2 wire jumpers to activate the Project. The jumper wire to connect the ground pin on the Arduino Uno to the negative rail on the LED to use the ground pin ON the Arduino Uno, now we insert the resistance into the breadboard space the resistance out wire one leg connected to the negative rail. The circuit to not work connect the negative lead of the horizontal rail on which the resistance is connected and connect the positive lead to an adjustment rail repeat this access for all 2 LED now.

The programming for the electrical circuit to use output 12 and 11 for the output signal connects the positive lead of the LED on the right to pin 12 the LED in the centre and the LED on the left to pin 11 the circuit is now complete. Figure 3.6.1 shows the electrical circuit we had done.

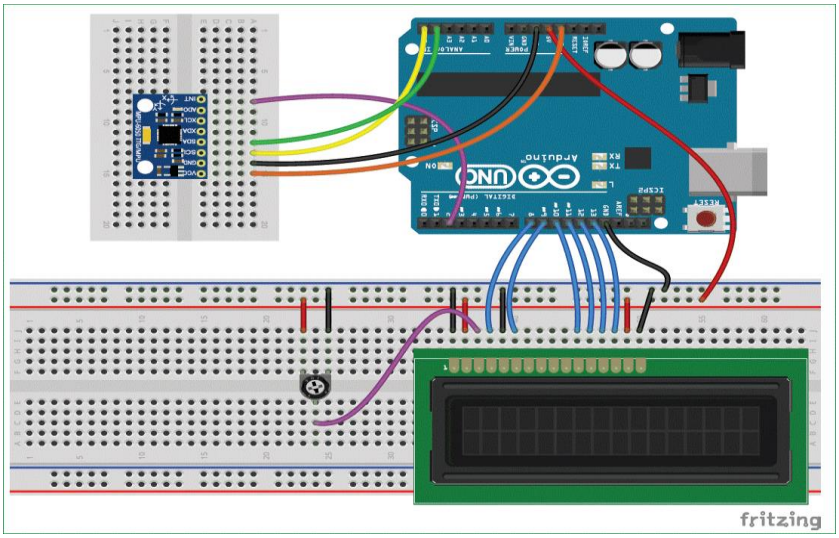


Figure 3.6.1 Electrical Circuit

3.7 Product Test

The product we have tested before we use the welding angle detector and after we use welding angle detector. We have tried this project at welding workshop Politeknik Shah Alam. From there, we have outlined the advantages and disadvantages of using welding angle detectors. The welding angle detectors we have found an advantage from the result while using the welding angle detector.

3.8 Budget Calculation

No	Material/Equipment	Amount	Price
1	Gyro sensor MPU-6050	1 unit	Rm 5
2	Arduino Uno	1 unit	Rm80
3	Resistance 220Ω	4 unit	Rm5
4	L.E.D	4 unit	Rm5
5	Breadboard	2 unit	Rm8
6	Wire Jumper	15 unit	Rm6
		Total	RM110

Table 3.8.1

3.9 Project Activity

project Activity	weeks													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Briefing and Project Planning														
Project Design														
Material Selection														
Materials Purchase														
Method Selection														
Fabrication														
Test Run														
Analysis Data														
Report Writing														
Video and Slide making														
PITEX preparations														
PITEX presentation														

Planning

Actual

Table 3.9.1

3.10 Summary

As a conclusion, the methods implemented in this project are very crucial and important to complete the project. Thus, as stated in the interview, this project is agreed and accepted by Izzat, a Mechanical Engineering at Politeknik Sultan Abdul Aziz Shah. The welding angle detector will make it easier to practice and master the skill of welding. Furthermore, the welding angle detector will make a fast weld, and it will make it more efficient.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Function of Project

Welding angle detector was designed to help students and newbie welders to practice welding technique. This project was created to solve the problem associated with the problem and defects occur while welding. Among the problems is that welder can only determine the welding angle by intuition and experience. The problem that also occurs is students did not have enough time to practice and train improving welding skills. To overcome these problems, an idea was thought and planned to create a device which has the ability to detect the angle while welding and can be used for students to learn and practice welding. The design of the product is portable and easy to install on welding device.

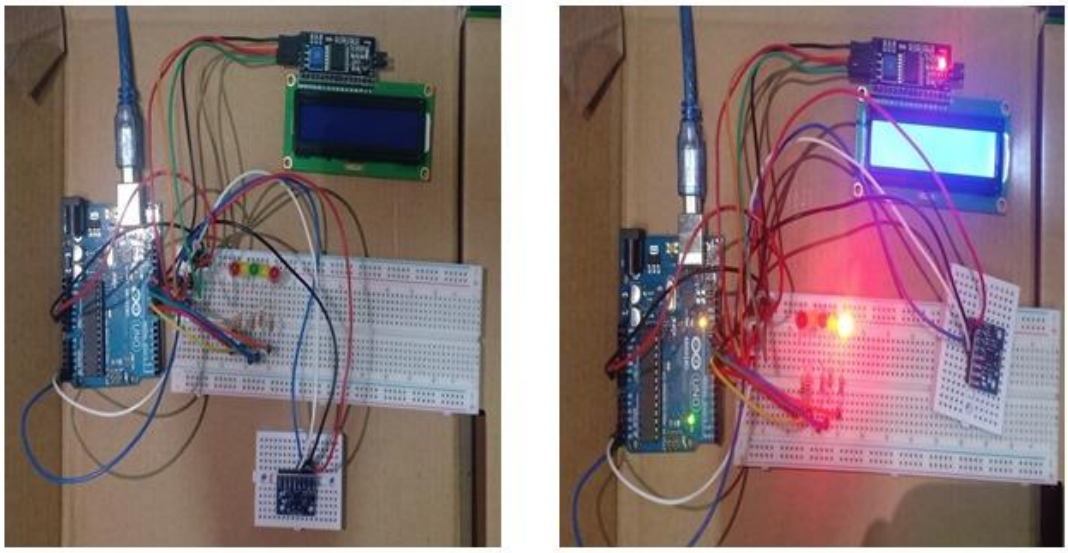


Figure 4.1.1 Welding Angle Detector

The function of welding angle detectors to students is to help detect the angle while practice welding to avoid welding defects. For detecting the angle, the gyro sensor MPU-6050 will detect the angle of weld and give alert by emitting the LED light. The design of the project also allowed reading the angle on the LCD screen. The student can save the time for training welding skill because the function ability of the project

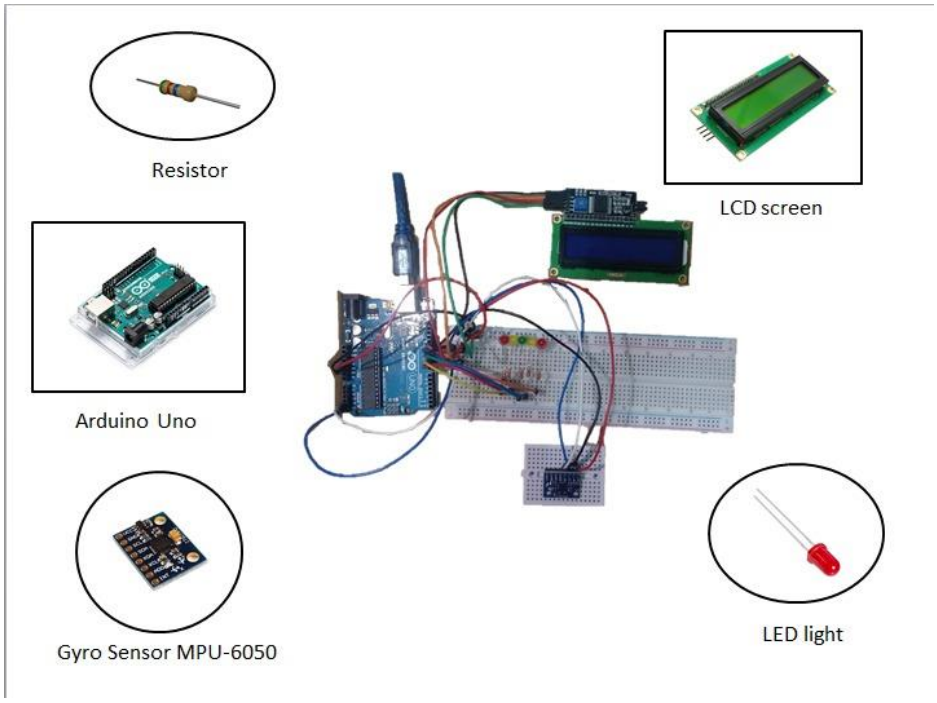


Figure 4.1.2 The component of Welding Angle Detector

4.2 The Accurate Reading of Welding Angle Detector

The project of welding angle detector was designed to help students to learn welding. This project aims to enhance their skill in short term session in welding with the help of gyro sensor MPU-6050 that provide accurate data when welding. The innovation of this project focuses on the advantages of Arduino Uno as a primary programming for this product with ability that can

use a lot of code and very good for beginners when learning programming. Project Electrical Circuit Design was successfully proposed and fabricated according to design material and fabrication method as exhibited in Figure 4.2.1.

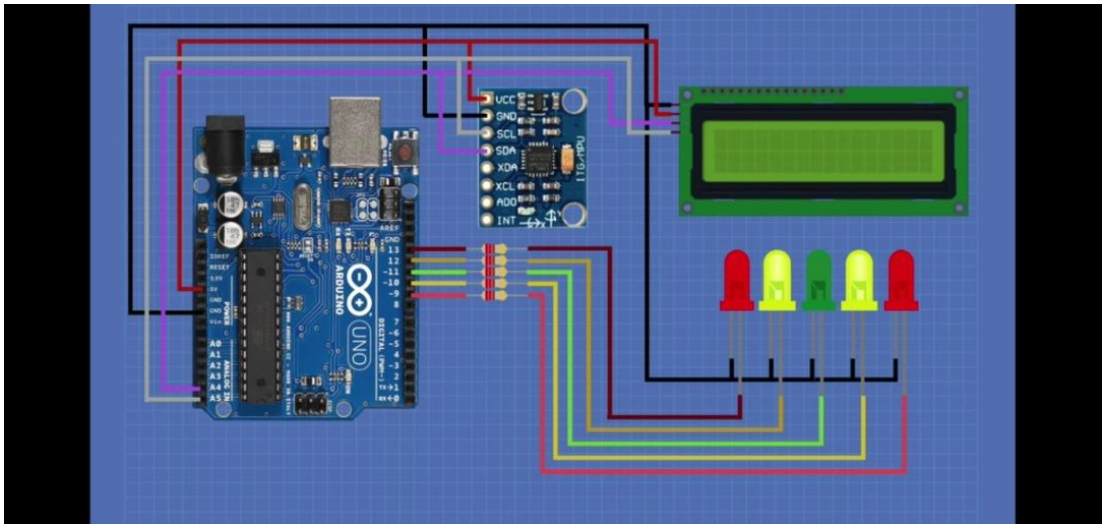


Figure 4.2.1 Projects Electrical Circuit Design

The MPU-6050 is a serious little piece of motion processing tech! By combining a MEMS 3-axis gyroscope and a 3-axis accelerometer on the same silicon die together with an on-board Digital Motion Processor™ (DMP™) capable of processing complex 9-axis MotionFusion algorithms, the MPU-6050 does away with the cross-axis alignment problems that can creep up on discrete parts, allowing the devices to gather a full set of sensor data without intervention from the system processor.

For precision tracking of both fast and slow motions, the MPU-6050 features a user-programmable gyro full-scale range of ±250, ±500, ±1000, and ±2000°/sec (dps).

4.3 Project Impact

The innovation of Welding Angle Detector (WAD) also has a long-term impact on student Politeknik Sultan Salahuddin Abdul Aziz Shah (PSA), where the use of welding angle detector has been expanded during the student class workshop. The welding angle detector has been assisted to all student mechanical engineering while doing the welding class, with this welding angle detector can make it easier for all students to learn about welding type angle. The angle for welding is 45˚ and can be detected while students make the mistake more or less than 45˚ angle. The usage of this project can reduce the learning process and save learning time. This project is a tool that can use the USB portable example using the power bank.

4.4 Comparison between Welding Angle Detector and Welding Gauge

The comparison between Welding angle detector and the welding gauge are tabulated in 4.4.1. It was designed to use full power using the USB ports. This can be achieved with a welding angle detector since it uses the power of electricity to connect the project. Since we use the USB port, we can use the power bank to activate the project.

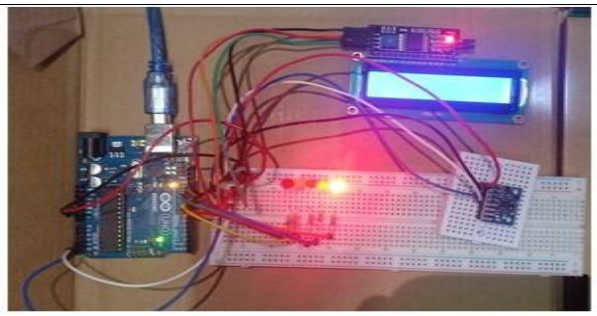
Welding Angle Detector	Welding Gauge
	
• Using electric energy	• Using kinetic energy
• Easy to detect mistake	• Hard to detect mistake
• Using power bank as power source	• Don’t have power source
• Reduce learning time	• Increase learning time
• save time	• Increase time

Table 4.4.1

CHAPTER 5

CONCLUSION

The project of welding angle detector was designed to help students to enhance their skill in welding. This project will help to reduce the time for learning in welding and also increase the chance to avoid the welding defect. The Gyro Sensor MPU-6050 is small also that gyro is an inexpensive sensor that measures angular velocity also that Gyro Sensor MPU-6050 is able to collect data accurately while welding. Besides, the innovativeness of this project is using Arduino Uno as the primary component for the function of the product and using the concept basic coding. Another feature that is found in this project is it has a portable port such as a USB adapter that can be used anytime without depending on a high voltage power source. Moreover, this product offers an affordable price while it has cheap maintenance, as a result it can save the cost.

Through this project, it can develop creativity in creating projects to be more attractive and useful. Furthermore, the project was designed with the help of Autodesk Inventor 2017. Other than that, the welding angle detector also is easy to use so it is capable of student use for themselves. The project uses Arduino Uno which is programming for basic coding but has many benefits. Also with help with this programming student is able to change welding angles freely because it is easy to understand this programming. The main feature for this project is Gyro Sensor MPU-6050 because it is capable of collecting data accurately with short time and also

this product is very cheap. Finally it can conclude that the stated objective was achieved and implemented effectively.

The effectiveness of the project used during welding, it indicates that the project has the potential to be expanded to marketing to expand its usage. It is recommended that the promotion be carried out for the commercialization purpose.

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