ARDUINO DRONE ROBOT

MUDRIK AIZAL BIN SUHAIZAL (10DTK15F1069)
MOHAMAD SYUHAIDI BIN MD SAAD (10DTK15F1142)
NUR AMIRUL AZIZ BIN ROSLI (10DTK15F1081)

DIPLOMA KEJURUTERAAN ELEKTRONIK (KOMPUTER)
JABATAN KEJURUTERAAN ELEKTRIK & ELEKTRONIK
POLITEKNIK SEBERANG PERAI

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CONFIRMATION OF THE PROJECT

The report titled "Arduino Drone Robot" has been submitted, reviewed and certified as meeting the requirements and needs of the project as specified. We declare that this thesis is the result of our own except that each excerpt we have explained the source.

VERIFIED BY:

PROJECT SUPERVISOR: ENCIK KHAIROL ADHA BIN AHMAD
DATE: 2/10/2017

ABSTRACT

The purpose of this project report to explain the progress of the project during semester 5. The theme of this December 2016 session was "Sumo Robot". This project was selected this current of technology prefer automatic product that can be controlled by machine or remote control. This system was created from software combination and hardware. In this semester, all student should make a "Mobile Robot" project for programming and connect with Arduino which show the output after the programmed was running.

APPRECIATION

We would like to express my sincere appreciation and gratitude to our project supervisor, Encik Khairol Adha bin Ahmad for their guidance and talks given during the duration of the project. Appreciation is also extended to the families, friends and lecturers who have helped and help us directly or indirectly in the production of this project.

Thank you also to our parents for their kind support and encouragement throughout the period we studied at Seberang Perai Polytechnic and in this particular projects we carry out our "Quadcopters: Drone". The carrier and kindness you all in this project much appreciated.

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CHAPTER 1: INTRODUCTION

1.1 - INTRODUCTION

A drone, in a technological context, is an unmanned aircraft. Drones are more formally known as unmanned aerial vehicles (UAVs) or unmanned aircraft systems (UASes). Essentially, a drone is a flying robot. The aircrafts may be remotely controlled or can fly autonomously through software-controlled flight plans in their embedded systems working in conjunction with on board sensors and GPS.

In the recent past, UAVs were most often associated with the military, where they were used initially for anti-aircraft target practice, intelligence gathering and then, more controversially, as weapons platforms. Drones are now also used in a wide range of civilian roles ranging from search and rescue, surveillance, traffic monitoring, weather monitoring and firefighting to personal drones and business drone-based photography, as well as videography, agriculture and even delivery services.

1.2 – PROBLEM STATEMENTS

- Difficult to fly the drone
- Difficult to control the drone balance

1.3 – OBJECTIVES OF THE PROJECT

Specifically:

- For learning purposes
- Drone are controlled by using Arduino UNO and Bluetooth module

1.4 – PROJECT SCOPE

A project that is produced must have its own scope to demonstrate his ability as compared to other projects. The scope of this project is using Arduino UNO, HC-05 Bluetooth Module and L298N Motor Driver circuit to allow the robot to move in the direction that is controlled by the user.

CHAPTER 2: LITERATURE REVIEW

2.1 – INTRODUCTION

Quadcopters or drone is an aerial vehicle operated to fly independently and is one of the representations of a UAV (Unmanned Aerial Vehicles). They are controlled by pilots on ground or simultaneously driven. They are called rotorcrafts because unlike a fixed wing aircraft, here lift is generated by a set of revolving narrow-chord aerofoils. Drones are actually very fascinating and in this project we are going to study about them, their components and about its widespread applications that determine its scope for the future. They are a mixture of streams of Electronics, Mechanical and especially Aviation.

Drones are of different types and have different configurations for example, bicopters, tricopters, quadcopters, hexacopters, octocopters, etc. They have different uses and accordingly respective configurations are used. Hexacopters and Octocopters have better stability and yaw configuration. Control of motion of vehicle is achieved by altering the rotation rate of one or motor discs, thereby changing its torque load and thrust/lift characteristics. The use of four rotors in a quadcopter allow the individual rotors to have a smaller diameter than the equivalent helicopter rotor, which allows them to possess less kinetic energy during flight. Quadcopters have different structures and designs according to the work needed to be done by it. Components like motors, batteries, electronic speed controllers (ESC"s) also vary according to the power needed and work done by the quadcopter. Also enhancements like GPS trackers or cameras or infrared cameras are used so that they could add value to missions like disaster relief, search and rescue, agriculture and 3D mapping of the geography of an area.

These widespread applications outshine the disadvantages which are rectifiable and hence this makes it a very productive technology in today"s world. It is supposed to appear into full time existence in the coming years. But every technology has merits as well as demerits. It is up to us to use technology productively to enhance the people as well as the planet instead of using them destructively. For instance, exploitation of drones by using them for spying and other lethal purposes that can harm people.

2.2 - HISTORY OF DRONE/UAV USE CASES

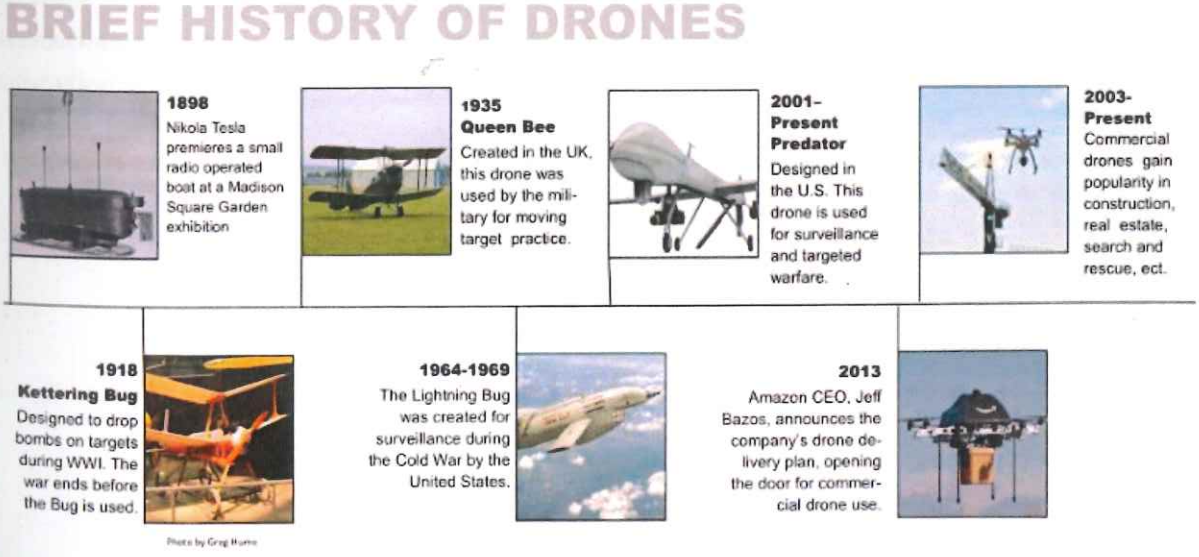
The first generally used drone was a full-size retooling of the de Havilland DH82B "Queen Bee" biplane, which was fitted out with a radio and servo-operated controls in the back seat. The plane could be conventionally piloted from the front seat, but, generally, the plane flew unmanned and was shot at by artillery gunners in training. The term drone dates to this initial use, a play on the "Queen Bee" nomenclature.

In late 2012, Chris Anderson, editor in chief of Wired magazine, retired to dedicate himself to his drones company, 3D Robotics Inc. The company, which started off specializing in hobbyist personal drones, now markets its solutions to photography and film companies, construction, utilities and telecom businesses, and public safety companies, among others.

In late 2013, Amazon was one of the first organizations to announce a plan to use commercial drones for delivery activities. Others have since followed suit; for example, in September 2016, Virginia Polytechnic Institute and State University began a test with Project Wing, a unit of Google owner Alphabet Inc., to make deliveries, starting with burritos produced at a local Chipotle restaurant.

Other common drone applications include drone surveillance and drone journalism, as unmanned aircraft systems can often access locations that would be impossible for a human to get to.

Drone education is also expanding; Embry-Riddle Aeronautical University, long a training ground for the aviation industry, now offers a Bachelor of Science in Unmanned Systems Applications, a Master of Science in Unmanned Systems and an undergraduate minor in Unmanned Aerial Systems.



2.3 - RESEARCH FOR DRONE ROBOT

2.3.1 – Understanding Drone

In general, drone is one of the advanced technology in the form of air vehicles. The shape is like an airplane or helicopter that can be operated without being driven by a crew or pilot. If an aircraft is driven by a pilot inside the cabin then this drone has a pilot who remains on the ground and only utilizes facilities such as remote controls to be able to control flying drones in the air. Therefore, many military personnel who utilize this advanced tool to be able to complete a variety of missions that have a high risk for aircraft pilot.

2.3.2 – How is Drone Work

A typical unmanned aircraft is made of light composite materials to reduce weight and increase maneuverability. This composite material strength allows military drones to cruise at extremely high altitudes. Drones are equipped with different state of the art technology such as infra-red cameras (military UAV), GPS and laser (military UAV). Drones can be controlled by remote control system or a ground cockpit.

Drones come in a wide variety of sizes, with the large drone mostly used for military purposes such as the Predator drone, other smaller drones which can be launched by hand, to other unmanned aircraft which require short runways. An unmanned aerial vehicle system has two parts, the drone itself and the control system.

The nose of the unmanned aerial vehicle is where all the sensors and navigational systems are present. The rest of the body is complete innovation since there is no loss for space to accommodate humans and also light weight. The engineering materials used to build the drone are highly complex composites which can absorb vibration which decreases the noise produced.

2.3.3 – Understanding How Your Drone Is Controlled

If you plan to fly a drone, you need to understand how it is controlled. For an object that is heavier-than-air to get airborne, you must create lift. *Lift* is a force that pushes an object upward into the air and is created by varying the air pressure above and below an aircraft.

Airplanes create lift by moving air above and below a wing. The way that air movement is created is with the horizontal movement of the aircraft. The larger the aircraft, the longer the runway they need to gain the right amount of speed to create the lift that will ultimately push the aircraft into the air.

Once airborne, the aircraft must maintain horizontal momentum in order to keep the right amount of air moving over the wings. The aircraft moves only in the direction that the nose is pointing.

With helicopters, directional control is achieved by changing the direction in which the propellers lean, by changing the pitch of the blades. This is called *changing the attack* of the propellers. Helicopters typically only have one main propeller but multi-rotors have more than one.

The most popular drones available today are multi-rotors with at least three propellers and some have in upwards of eight propellers. Multi-rotors maintain stability by varying the speeds of each propeller. Directional control in a drone is achieved by changing the attack of the propellers, the same as a helicopter, but this change in attack is accomplished by slowing some of the rotors to cause the craft angle to change enough to cause it to move

For a multi-rotor drone, there are two advanced sensors that are required to be able to achieve steady 3-dimensional flight:

- **Accelerometer:** These advanced sensors detect linear movement. That means movement in a straight line. There are three axes in a 3D space: X, Y, and Z. Accelerometers detect and measure movement along those axes but not around. This movement is called *linear movement*. Anything other than linear movement confuses an accelerometer.
- **Gyroscope:** This sensor is designed to detect rotational movement. That means movement around a line which, in a 3D space, are the X, Y, and Z axes. Whereas an accelerometer measures motion along the axis, a gyroscope will measure motion around an axis.

Radio Frequency

In order to control a drone remotely, you must be able to communicate with it wirelessly. Radio waves are an invisible wave form on the electromagnetic spectrum. Like all things on the electromagnetic spectrum, radio is measured in hertz (Hz). Extremely low frequency is anywhere from 3Hz to 30Hz and tremendously high frequency is 300 GHz – 3000GHz.

For radio to work, you must have a transmitter to send the messages and a receiver to get the messages. At a rudimentary level, this is how remotely controlling an aircraft is accomplished. More precisely, your transmitter and receiver need to be tuned to the same frequency.

To avoid situations such as your drone being controlled by someone else's remote control, devices use a unique identification code to identify a transmission on one particular radio frequency as the transmission it wants to receive. To do this, transmitters and receivers are paired using an RFID or a "radio frequency identification." All information broadcast over RFID is prefixed with an RFID so that the receiver knows that the information it is picking up is for it.

Lower frequencies tend to have a much greater range at lower power than higher frequency devices. Lower frequencies also have a greater ability to penetrate dense objects which is another reason why they are great for remote controlling a drone. However, the lower the frequency, the larger the antenna must be to receive the frequency. Most remote control drones use 900 MHz for transmission. Higher frequencies in the 2.4 GHz range are predominantly used for Wi-Fi

Wi-Fi Controls

Wi-Fi used to only be available on computers but as the technology evolved, shrunk, and grew more intelligent, it was integrated into portable devices like phones and tablets. Now there are several million products around the world that are Wi-Fi-enabled so that they can be remotely accessible.

Most drones today are Wi-Fi enabled so that they can broadcast video to a computer, tablet, or smartphone. Some drones also use Wi-Fi for remote controlling through a tablet or mobile application. The Parrot AR Drone 2.0 offers high-end interactive controls with their mobile application that runs on an iPhone or iPad.

While there are clear benefits to using Wi-Fi with your drone, Wi-Fi works on an ultra-high radio frequency which means that its range is limited to about 600 meters.

GPS

Global positioning technology has shrunk down enough that it is possible to ping satellites for location data from devices as small as a smartphone and your drone. GPS is primarily only used to communicate location back to a mobile app. GPS is also used for pre-programming routes. Once programmed, the drone can be cut loose and it will fly in sequence to each of the GPS locations identified.

2.3.4 - Unmanned Aerial Vehicles, UAVs

A true unmanned aerial vehicle, UAV, is preprogrammed prior to flight to do a specific set of tasks on a specific flight path. These are usually shaped like an airplane and are typically only used in military situations, with some exceptions of course.

Aerial drone uses and applications

There are many types of uses for aerial drones. Whether military or commercial, the applications are similar in nature. As technology progresses, the types of drones available will be endless; imagine a world in which everyone rides around in driverless cars, or a micro-drone brings you a perfectly made cup of coffee.

While these scenarios are still a ways away, the current uses for drones are as follows:

Attack drones — Used only by the military, these drones are equipped with lethal weapons and used for controlled air strikes in hostel or inaccessible areas.

Delivery drones — Originally developed for the military to deliver goods to ground troops, these drones are equipped with a claw or similar delivery system and are able to remotely drop items or gently place items in a desired target area. Some big shipping companies like DHL and Amazon are starting to implement these types of deliveries to minimize shipping times, overhead costs, and dangerous driving conditions.

Monitoring drones — Equipped with both standard and infrared cameras as well as sensitive weather instrumentation, these drones are used to monitor a variety of areas. For example, drones equipped with these cameras and instruments are used to help prevent street crimes or aid in the detection and prevention of forest fires. These drones are also used for reconnaissance missions as well as other military applications.

Photography/videography drones — These drones are becoming more popular in the art world. Prior to drone technology, aerial photos and videos had to be taken from an airplane or helicopter, and this process was very expensive. Now that commercial drones have become available, photographers and videographers of all kinds can get those stunning shots without the big budget.

2.3.5 - Applications of Quadcopters: Drone

Quadcopters have variety of applications in the field of research, military and many more. Quadcopter designs have become a cynosure as to most research fields as they are an important concept of unmanned aerial vehicle (UAV). They use an electronic control system and electronic sensors to stabilize the aircraft. Their small size and agile maneuverability prove a great strength to these quadcopters and they can be flown indoors as well as outdoors.

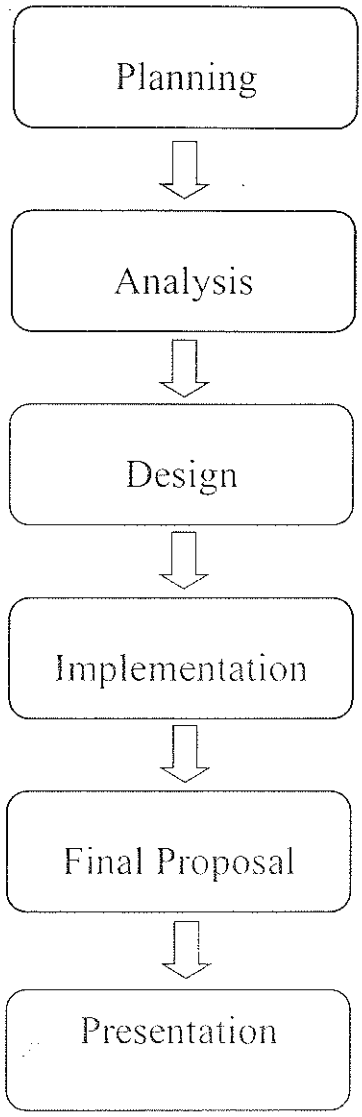
Some of their applications include:

- **3-D Mapping** - Small and lightweight drones help in surveying large landscapes with thousands of digital images that can be stitched together into a string of 3-D maps. Though military and other government satellites produce similar maps, but the stupendous outcomes of UAV technology outshines them repeatedly.

- **Search and Rescue** - Drones are a widespread application to rescue patients during injury or any calamity, manmade or natural. [4] Drones have the ability to help assist, locate and save victims, faster with more efficiency than any other option. There are campaign missions to provide a string product line of Search and Rescue (SAR) Drones. Advanced technology is used to create drones that can reach people in small spaces and supply food, water and medicine to trapped victims. Many advances like water-resistance, high definition GPS tracker and cameras in quadcopters prove a great benefactor especially in the search and rescue aim.

- **Farming** - In agriculture technology helps in great precision to monitor fields, increase yields and also save money. Moreover, drones also help precise applications of pesticides, water, or fertilizers by identifying exactly where such resources are needed and delivering them there too. [4] Cameras in drones are able to spot nitrogen levels (low or high) or watch the growth of a particular section. Infrared light cameras inform about plant health by measuring the efficiency of photosynthesis in various plants. These infrared cameras also detect which land is suitable for appropriate growth of which plant.

2.4 – STEP OF PROJECT



2.5 – RESEARCH FOR COMPONENTS

Arduino UNO:

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button.

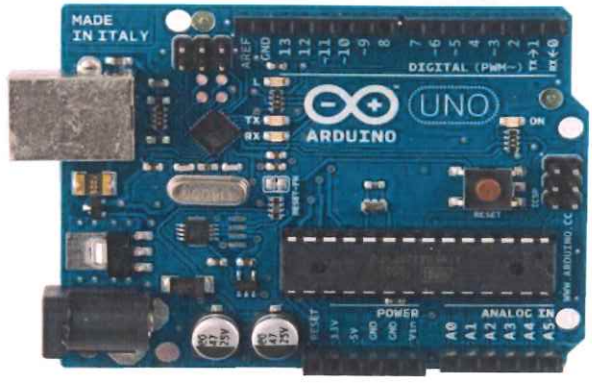


Figure 2.5.1 – Arduino UNO

L293N Motor Driver:

This dual bidirectional motor driver is based on the very popular L298 Dual H-Bridge Motor Driver IC. This module will allow you to easily and independently control two motors of up to 2A each in both directions.

It is ideal for robotic applications and well suited for connection to a microcontroller requiring just a couple of control lines per motor.

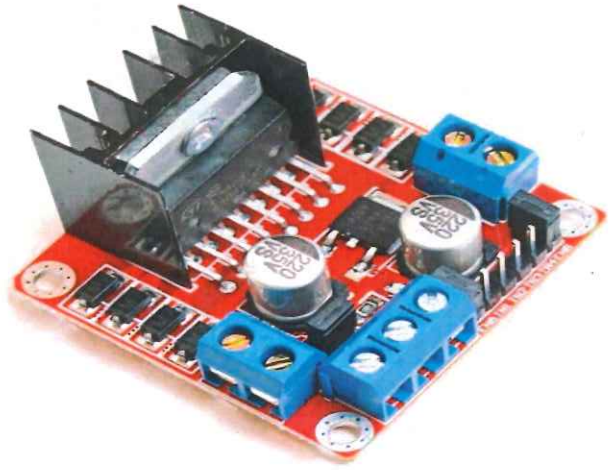


Figure 2.5.2 - L293N Motor Driver

HC-05 Bluetooth Module:

Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and mobile devices, and building personal area networks (PANs). Invented by telecom vendor Ericsson in 1994, it was originally conceived as a wireless alternative to RS-232 data cables.

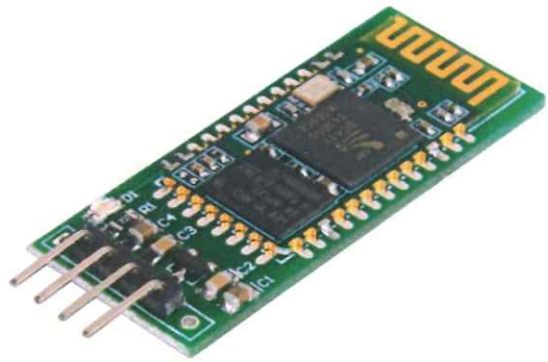


Figure 2.5.3 - Bluetooth Module

Jumper Wire:

A jump wire (also known as jumper, jumper wire, jumper cable, DuPont wire, or DuPont cable – named for one manufacturer of them) is an electrical wire or group of them in a cable with a connector or pin at each end (or sometimes without them – simply "tinned"), which is normally used to interconnect the components of a breadboard or other prototype or test circuit, internally or with other equipment or components, without soldering.

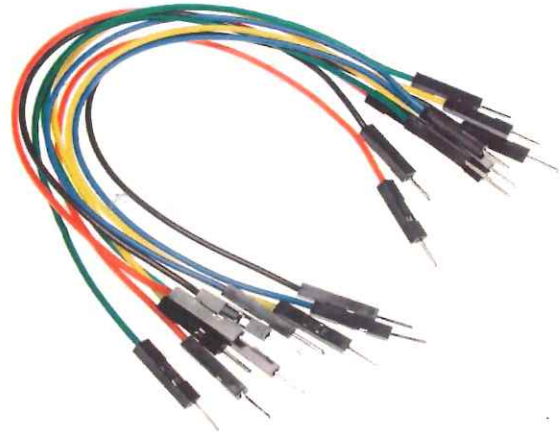


Figure 2.5.4 - Jumper Wire

Li-Po Battery 1100mAh:

Li-Po (Lithium Polymer) batteries are used because it is light. NiMH (Nickel Metal Hydride) is also possible. They are cheaper, butt heavier than Li-Po. Li-Po batteries also have a C rating and a power rating in mAh (which stands for milliamps per hour). The C rating describes the rate at which power can be drawn from the battery, and the power rating describes how much power the battery can supply. Larger batteries weight more so there is always a tradeoff between flight duration and total weight.

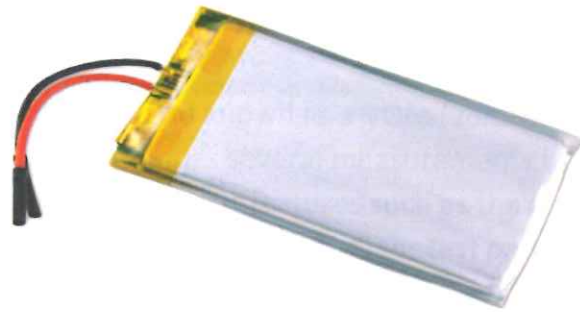


Figure 2.5.5 - Li-Po Battery 1100mAh

2.6 - HAND TOOLS AND MACHINE

In process to build this project, many hand tools and machine has been used for the making of this project. The hand tools can be found in electrical workshop or used own hand tools. For machine, those tools can be found only in electrical workshop only because the cost of machine is too high for student and the workshop already providing the machine for all students. The hand tools and machine that we used in this project is:

Multimeter:

A multimeter or a multi tester, also known as a VOM (volt-ohm-meter) is electronic measuring equipment that combines several measurements function in one unit. A typical multimeter would include basic features such as the ability to measure voltage, current and resistance. We use this tool for test path from point to point if there have any path did not connect. Besides that, we used this tool in troubleshooting case to make sure no path touching to other path.

Figure 2.6.6 - Multimeter

Solder:

Solder is the tool that used to melting a soldering iron for component pin. Solder commonly used in electronics, plumbing and assembly of metal part. This is important tools for make sure the component pin have connect with copper path at board.

Figure 2.6.2 - Solder

Soldering Iron:

This tool was actually used with solder, without this tools the component will not soldering to the board because the solder design for melting this iron to component pin for make the component connect with copper path.

Figure 2.6.3 - Soldering Iron

Soldering Remover:

This tool is used for suck the soldering iron that melting because of the user makes a wrong soldering. This tool will suck the soldering iron that melting until it's clean for the user pull the component out.

Figure 2.6.4 - Soldering Remover

Cutter:

This tool is used for cutting the wire. Besides that tis tool is used for cutting the component pin that too long after finished soldering the component onto board.

Figure 2.5.4 - Cutter

Long Nose Plier:

It is used to holding or shaping small things. Besides that, it is also used to cutted an electric cables and doing job in a small spaces.

Figure 2.5.5 - Long Nose Plier