DEVELOPMENT OF AUTONOMOUS. ALL-TERRAIN VEHICLE (A2TV). STEERING AND BRACKING MODULE.

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ABSTRAK

Tesis ini berkaitan dengan peningkatan sistem stereng dan sistem brek ATV autonomi. Steering adalah salah satu bahagian penting yang terdapat pada Kenderaan Seluruh Medan yang digunakan untuk mengawal pergerakan kiri dan kanan. Bahagian kedua yang penting adalah bahagian brek. Brek penting untuk menyokong sistem apabila ATV bergerak dalam kedudukan yang berbeza. Fungsi brek adalah untuk menghentikan ATV bergerak atau menghentikan ATV daripada memukul Obstacle di hadapan ATV. ATV penting dalam beberapa sektor di dunia.Sektor pertanian adalah salah satunya. Ramai pekerja menghadapi sakit belakang di sektor ini. Sebabnya ialah sektor ini menggunakan alat ladang berat yang akan merosakkan kesihatan pekerja. Selanjutnya, proses keracunan tanaman adalah salah satu tugas yang paling berbahaya. Pekerja akan mendedahkan kepada gas toksik yang boleh mempengaruhi kesihatan pekerja. Perkembangan ATV Autonomi adalah untuk membantu pekerja mengurangkan sakit belakang atau cakera tergelincir. ATV autonomi dapat membantu pekerja membawa berat dan juga dapat membantu bentuk pekerja mencegah gas toksik yang menyebabkan keracunan kilang. Sistem yang dapat mengawal autonomi untuk membawa alat berat dan meracuni tanaman tanpa manusia terlibat di kawasan tersebut. Sistem akan mengeluarkan bahagian mekanikal manual dari ATV dan akan diganti dengan sistem autonomi untuk produk dan prestasi produk yang lebih baik

ABSTRACT

This thesis deals with enhancement of the steering system and the autonomous ATV braking system. Steering is one of the important part that have in the All-terrain Vehicle that was use to control the movement left and right. The second part that are important is the brake part. The brake are important to support the system when the ATV a moving in different position. The function of brake are to stop the ATV from moving or to stop the ATV from hit the Obstacle at front of the ATV. ATV are important in few sector in the world. One of the sector that are important is the agriculture sector. Many worker are facing back pain in this sector. The reason is the sector are using heavy farm tool that will damage the health of the worker. Furthermore, the process of poisoning the plant one of the most danger task. The worker will expose to the toxic gas that can effect the worker health. The development of Autonomous ATV is to help the worker to reduce back pain or slip disk. The autonomous ATV can help worker to bring heavy to and also can help worker form prevent the toxic gas that cause from poisoning the plant. The system that can control the autonomous to bring heavy tool and for poisoning the plant without human are involve in the area. The system will remove the manual mechanical part from the ATV and will replace with autonomous system for better product and performance of the product

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PS2	PlayStation 2
DC	Direct Current

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Autonomous Vehicles are lighter than other-four wheel vehicles, making it popular topic among automotive industries. This autonomous travel on low pressure tires. Autonomous system is system that improve the steering, throttle and brake design from manual control to wireless control. The connection going to controls the system's incoming and outgoing signals by using the wireless controller and wireless receiver. There a lot good things Autonomous system compared to a manual mechanical system connected to steering, throttle and braking system. The system will significantly improve overall vehicle safety, driving convenience and functionality by allowing software to customize the connection between the steering wheel, steering mechanism, braking mechanism and throttle mechanism.

1.2 Problem Statement

In this project we need to think how to develop an autonomous system to apply it at existing ATV. Also, we need to think what subsystem of autonomous system such throttle, braking, steering system and what crucial system to make sure this autonomous can be operate within in environment. To apply the Autonomous system, we need some platform to test the system. In this project we use manual ATV to apply Autonomous system that remove the old mechanical system in steering and brake that need to operate also make some modifying to apply the Autonomous system.

1.3 Objective

This project is carried out to achieve these objectives:

- To design, simulate and fabricate a steering and braking module of ATV
- To test and analyse proposed system to existing Electric ATV

1.4 Project Scope

The scope of the project is limited:

i. development of a module steering and braking module

ii. This project involves only the steering and brake part

1.5 Project Outline

Five chapters summarize this thesis.

Chapter 1: This chapter consists of an overview of the entire project including introduction, background of the project, goals of the project.

Chapter 2: In chapter two discussed the review for literature consisting of past Autonomous system research.

Chapter 3: Includes all methods used to create a Autonomous System in braking and steering module. The chapter begin with Requirement And Specification of Autonomous ATV

Chapter 4: This chapter shows the project's results and analysis.

Chapter 5: This chapter concludes the overall project results and recommends any future steps that may enhance this project's quality and outcomes.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The literature review is a reference source to be reviewed and referenced, such as articles, books, journals and the internet. The topic of the project is addressed in this section and the way they carry out their projects is summarised. This literature review, however, helps to create new ideas that can reinforce this project and make the final project a success and accomplish the project objective.

2.2 All-Terrain Vehicle History

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In the 1960s, ATV was first introduced and listed 6-wheel amphibious cars such as the Jiger of 1961. In 1970, the company released the film Diamonds Are Forever, and TV shows Magnum, P.I., its US90 or ATC90 (All Terrain Cycle). The Tri-Moto, Yamaha's first three-wheeled ATV sold in US, was started in 1980. Yamaha introduced the YFM200 in the United States in 1984, the first four-wheel ATV. The Buckmaster Edition Big Bear 400 4x4, the first ATV with camouflage bodywork, was sold in 2000. Return to your first all-Terrain vehicle interview with CNN iReporters. 71,535 dirt bikes were sold in 2012 compared to 225,244 ATVs. ATVs have a larger share of the market in comparison to dirt bikes. In2013 it is provisionally projected that the sales of UTV and side-by-side vehicles will surpass ATV. ATVs offer another choice for on the lane, whether it's for sport, fun or work. The popularity of the ATV continues only to increase, and the available functions and options are worth checking out this section of the riding community.

2.3 Related Work

The ATV is now operated by an RC control unit for braking, steering and throttling operation using Vijay Subramanian's machine vision concept and laser auto steering systems.. The work consisted of redesigning the brake control mechanism and the grip. The ATV is able to embrace new hardware to really make it independent. The redesign was required to replace outdated or broken parts, cut down additional wiring on the ATV and create a stable potential expansion infrastructure. In signals from a remote control receiver, the master controller node reads and interprets these in commands for other CAN nodes.. (Vijay , 2005)

The main objective of the research is to build the latest Acceleration Pedal, brake pedals and steering system through mechanical designs and mechatronic technology in the field "Mechatronics and Remote Driving Control for a Go Kart." This article was edited by Chien-Hsun Wu, Wei-Chen Lin and Kun-Sheng Wang. The go kart is operated wirelessly in the WiFi frequency bands by means of a visual machine. The steering-by-wire system is designed to allow the conversion to Go Kart from human to autonomous driving in the future. In the near future, a feasibility analysis and performance assessment of the Go Karts in Taiwan will be carried out to expand this study. The studies have been published in the magazine of Mechatronic Research Association. (Chien-Hsun Wu: Kun-Sheng Wang and Wei-Chen Lin)

From Anderson Pereira Correia, Carlos Humberto Llanos; "A Control Design Approach for Controlling an Autonomous Vehicle with FPGAs" Rodrigo Willians de Carvalho and Sadec A.Alfaro, this paper explains the implementation of a framework based on a reset architecture and virtual instrumentation principles. The car control system has been built in a Field Programmable Gate Array (FPGA), a microcontroller that integrates many peripherals. Contact between the FPGA and the car is done through an electronic module. A keyboard with PS2 interface allows the user to forward command to the control system. This method provides numerous options for validating and simulating solutions for various problems in robotics and mechatronic fields, according to the paper. In the simulator setting the tests and initial device validation were performed. The results of the simulation were then comparable with the actual car movement variables obtained in real time

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter explains the methods and techniques that had been used throughout this semester to accomplish the objectives stated in chapter 1. In addition, the chapter discuss process of the designing steering module in mechanical and electrical design and Throttle drive in mechanical and electrical for movement and braking system. Also fabrication process of the development steering and braking module for the Autonomous system. The project sequence show the work flow of work progress in order to complete the product system..

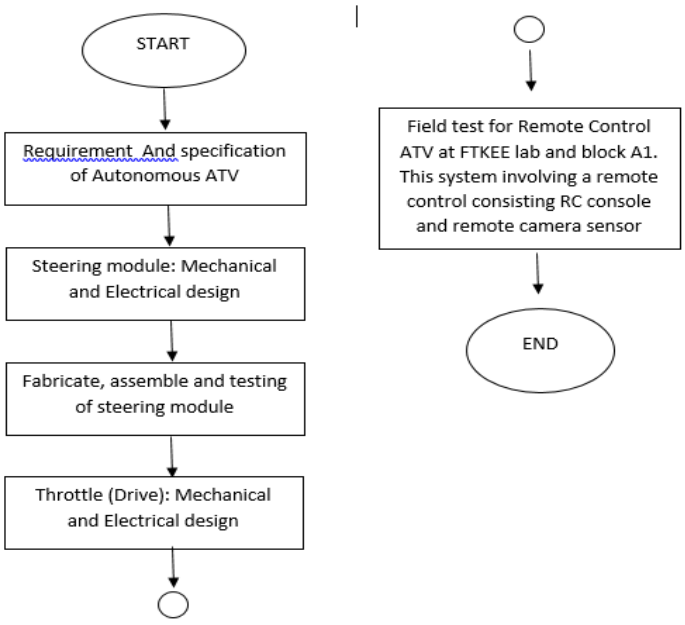


Figure 3-1 Progress Flowchart

3.2 Planning For Senior Design Project

The materials and components of each part are decided during last semester and the purchasing had been done. Early of this semester, received the components and the design of the steering and braking module was done. After that, the Mechanical part for attach the steering motor and braking module were carried out. At the same time, the designation of controller and electrical parts are installed. Electrical parts such as Arduino Mega 2560, SKPS PS2 Controller Kit, MDD10A Motor Driver were installed. After mechanical design steering part done design, the assembly of the Linear Actuator or steering motor and braking module for the project carried out. After the assembly, the steering module and braking module ready to test after all the components were installed. Finally, proceed with the report writing.

3.3 Designing the Setup of Project

Every product must have a complete design with correct measurement before it can be produced. The architecture plays a key role in this project. Before the project classification begins, the information is obtained by holding some discussion between supervisors and group members. First, the information on the components used in the Steering and Braking modules is determined so that the design can be made to ensure that all components can be assembled without error. The process proceeded with the design of the steering and braking module sketches and the installation of electrical components. The engineering design process was a methodological sequence of steps used by engineers to create practical products and processes.

3.3.1 Design Of Steering Module

The main Part of this project is the steering part. The ATV are using the manual control of the steering so the human can use same as riding are motorcycle. For this project the design are by attaching the Linear actuator with the steering shaft are use because of the position to control the steering of the ATV.

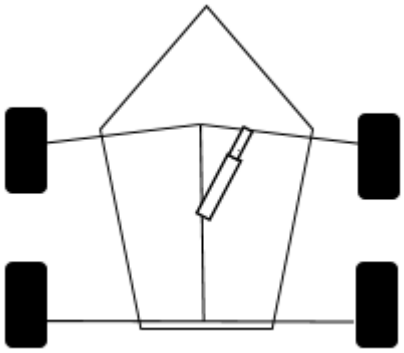


Figure 3-2. Linear Actuator Position

3.3.2 Design Of Braking Module

In this project, the second part that involve are the braking module. For the braking system that use in previous existing ATV are the wired brake. The wired brake system are use same as the bicycle system. For this project, the manual wired brake were replace by the brake by using the Brushed motor. The step are by pass the brushed motor of the ATV so the Motor will trigger the brake system which is the Brushed motor Automatic stop when the system of braking trigger. The braking system are combined with the throttle system so when ATV are moving forward it can trigger the brake by press the back button so the brake module will trigger to stop the motor

3.3.3 Design Of Electrical Part

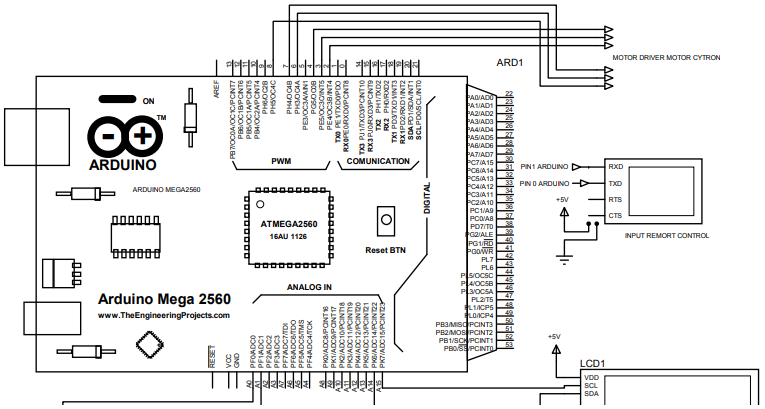


Figure 3-3 Drawing Electrical

For the figure above, it show the arrangement and the equipment component that was use in the system. The component that we choose are meet the requirement of the project objective. This design are important for easy to troubleshoot when it have problem in the wiring.

3.4 Material And Component

For the material and component, this project are choosing the component that only meet the requirement of the project objective scope. The equipment that were choose are the Linear Motor act as the Steering motor that attach to the ATV shaft, Arduino Mega 2560, SKPS PS2 Controller kit and MDD10A Motor Driver. From the observe that been made this component are suitable for apply in the Autonomous System for the ATV.

3.4.1 Arduino Mega 2560

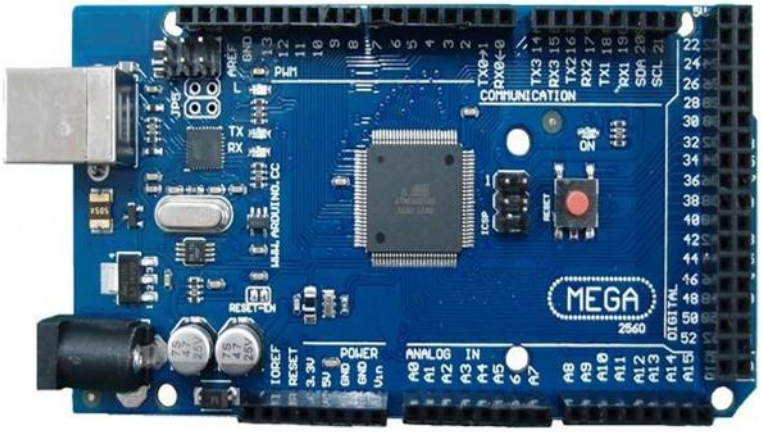


Figure 3-4 Arduino Mega 2560

For this project, the main source of the microcontroller are the arduino mega 2560. Using this Arduino because it has more port than other arduino so it will easy to operate. For the transmitter and receiver for this project, port Tx1 and Rx 1 are use for connection of the PS2 controller and receiver. For pin of PWM, this project using 2 pin which is pin 10 and 11 for controlling steering motor and Brake motor. This arduino will be connect to the laptop so it will control the motor movement according to instruction that was given

3.4.2 SKPS PS2 Controller Starter Kit

Figure 3-5 SKPS PS2 Controller Kit

For this project, the SKPS PS2 controller kit are been used. The reason using this controller kit are because the SKPS PS2 is a receiver and the controller that use are the wireless PS2 controller. The SKPS controller kit will be attach with the Arduino Mega 2560. So when receive the information or instruction from wireless controller PS2 it will sent to Arduino mega to move the motor according to the button that was press. The range for the controller can exceed to 100m line of sight

3.4.3 PS2 Wireless Controller

The PS2 wireless controller is a standard controller for the PlayStation 2. It features twelve analogue (pressure-sensitive) buttons and have two button of joystick. This controller can control in dual mode. The mode is analogue and digital mode. This controller are sent the data byte and the receiver will receive the data

Figure 3.6 Wireless Controller Ps2

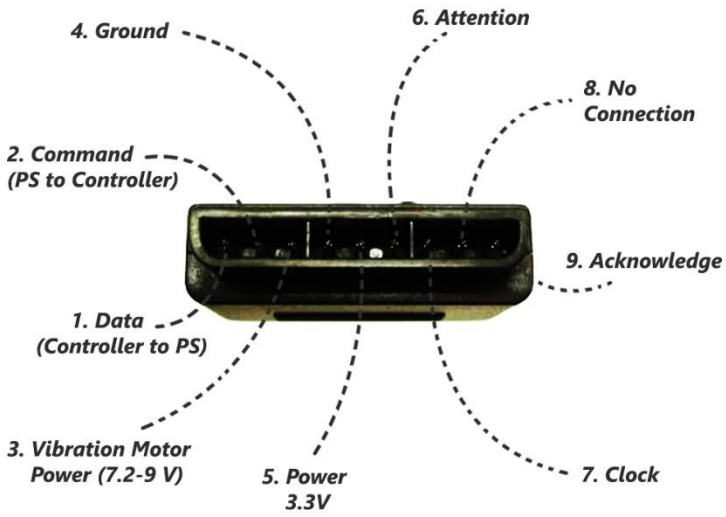


Figure 3-7 PS2 Controller Pin Out

Pin Out	Details
DATA	Sent data control to PS
COMMAND	Sent data Ps to controller
Vibration MOTOR POWER	Motor Vibration Supply voltages 7.2volt- 9 volt
GND	Grounding
VCC	VCC can vary from 5V down to 3.3 Volt
ATT	Chip select pin and for prepare the connection
CLK	Pin for clock
ACK	Inform signal on the controller to the receiver port

Table 3-1 Pin Out For PS2 Controller

3.4.4 Linear Actuator

A rod inside the case is pushed and pulled by this linear actuator. There are multiple gears and magnets inside the bottom part of the linear actuator for moving the rod and pulling the rod. This linear has two wires that are positive and negative wire, so it is so easy to manage and just easy to reverse polarity if you want to change direction. For this project the linear actuator are the steering motor because the linear actuator are connected to the ATV front shaft tyre. This Linear are connected to the shaft by welding the linear front to the ATV front shaft.

Figure 3-8 Linear Actuator

With a 20:1 gear reduction, this linear 12 V light-duty (LD) actuator can lift loads up to 50kgf[110lbs or 500N] and withstand static loads up to 250kgf[550lbs or 2500N]. It has a maximum velocity of 14.6mm / s[0.57″/s] without load and a maximum load of 12.3mm / s[0.48″/s]. Limit switches at each end make it easy for the actuator to control its full range of motion, and the worm drive ensures that even when unpowered, the shaft holds its position. This version has a stroke of 10 inches (usable for 9.8″) and no potential feedback . This 12 V light-duty (LD) linear actuator can lift loads up to 1000N at rated load (Push/Pull). It has a maximum speed of 5mm/Second. This version has feedback from potentiometer.

3.4.5 MDD10A Motor Driver

For this project, MDD10A motor driver is the main motor driver that was use to control Linear Actuator as Steering Motor and the Main brushed motor act as throttle also brake motor. MDD10A are motor driver that come with high current support which is the maximum higher current that can bring is 10A. For this motor driver selection, it can control 2 dc motor at the same compare to the mdd10a that can control only one motor driver. The special of this motor driver are it have manual button for testing. For manual testing DC motor, it can control the movement of the motor direction. Choosing this

motor driver is for controlling both movement direction steering motor and brushed motor at the same time.

Figure 3-9 MDD10 Cytron Motor Driver

Element	Description
Direction	Can control two direction.
Voltage	Up to 30V
Current	Up to 10A

Table 3-2 Specification MDD10A

3.4.6 Electrical DC Brushed Motor

For this project, the existing brushed motor was use. The original existing ATV have its own electrical brushed motor. In this project, the modification are need to do for power up the brushed motor that have higher power rate. The modification have been done in this project so the brushed motor can been power up and move without having problem or error.

Figure 3-10 500 Watt Brushed Motor

Element	Details
Output	500W
Rated speed	2750-3045 RPM
Rated voltage	36V DC
Rated current	24.5A
Peak efficiency at 36V	80 percent
Reversible	With polarity swap

Table 3-3 Specification Electrical Brushed Motor

3.4.7 GoPro Action Camera

For this project, Go pro hero camera are use to capture and to display image on the smartphone as medium to receive the image of the video. Go pro Hero camera capable to recording, capture and display image of the area that was travel by the ATV. The frame rate of the picture and video are 4K 30 and 60 fps of wide angle. The advantages of using this camera are the distance range are about 15 meter compare to other action camera

Figure 3-11 GoPro Action Camera

General	Details
Wireless Connection	Bluetooth and Wireless LAN
Optical Sensor	CMOS
Protection	Shock proof and Water proof
Weight	3.1 oz

Memory	Micro SD up to 64GB
Charging	Micro USB
Battery	1160mAh , Lithium Ion

Table 3-4 Gopro Specification

3.5 Fabricate Steering And Brake Module In ATV

To apply the system, this project are using the Existing electrical ATV. The previous project are using different motor driver to control the ATV. The previous motor driver was test and the result is the motor driver having problem. The problem is the motor driver need to trigger lot of switch that make the troubleshoot having problem. More than that, the motor driver are burn in the last minute when testing are running. The step are been taken to complete the objective replacing the motor driver. For the steering motor, the motor driver are using the mdd10a to control the steering. For the braking module or braking system, the system are connecting to the throttle. This is because the brushed motor are also use for throttle motor and for brake it use the brushed motor. The brake are bypass the system of the brushed motor. By modified the motor driver to using the mdd10a motor driver, the specification and performance of the atv are different. The Atv are using 12v Battery to power up also to move the steering module and brushed motor

3.5.1 Fixed Position design For Linear Actuator

Figure 3-12 Steering Module Before Attach to Shaft ATV

The figure show the position of the steering motor that not attach to the shaft ATV. In the design, the position of the steering module are choose according to the idea and discussion around team member. The position are suitable for reducing error and reducing the hard to control the steering. The previous project are using the linear by connecting to the steering pole. The problem that have by attaching the linear actuator at the pole are the time for linear actuator for moving forward and reverse are high. This is because the position that make the linear actuator hard to move to forward and reverse. The pressure or the force that need the linear to move are bigger so for this project we are choosing the position to reduce the force and error for the steering module.

Figure 3-13 Linear Actuator attach to ATV Shaft

Based on the picture above ,what can be conclude that is the linear actuator succeed to attach with the ATV front shaft tyre. The base of the linear actuator that was design for easy to adjust the position one of the benefit because the angle of cornering can be adjust by adjusting the base screw to move it to different angle. The attachment method that use to combine the linear to the shaft ATV are using the welding method. The suggestion that attach the linear actuator and the shaft has been choose because of the strength of the welding so the attach will not broken if big force are apply to the shaft. The first test for the linear actuator was done by directly touch the terminal positive and negative to 12v battery. The movement to turn left and right are easy because position that attach to the ATV front shaft that control the position of the ATV. The manual test are test a few time. The test take a few time because to observe and to see if their any error or problem before proceed to next stage of development the module.

3.5.2 Installation Of Electrical Component

The electrical part are important in this system. For controlling the movement steering module the, the MDD10A motor was use to move the motor direction. The installation of the mdd10a motor driver are important because it function to control both of the motor module. The mdd10a motor driver was connected with 12v battery as it main source so the motor driver are power up. The polarity of the motor driver was connected with the pin of positive and negative pin. The polarity can be control with the mdd10a to move if forward or reverse. Figure below show the connection of the linear actuator with mdd10a motor driver

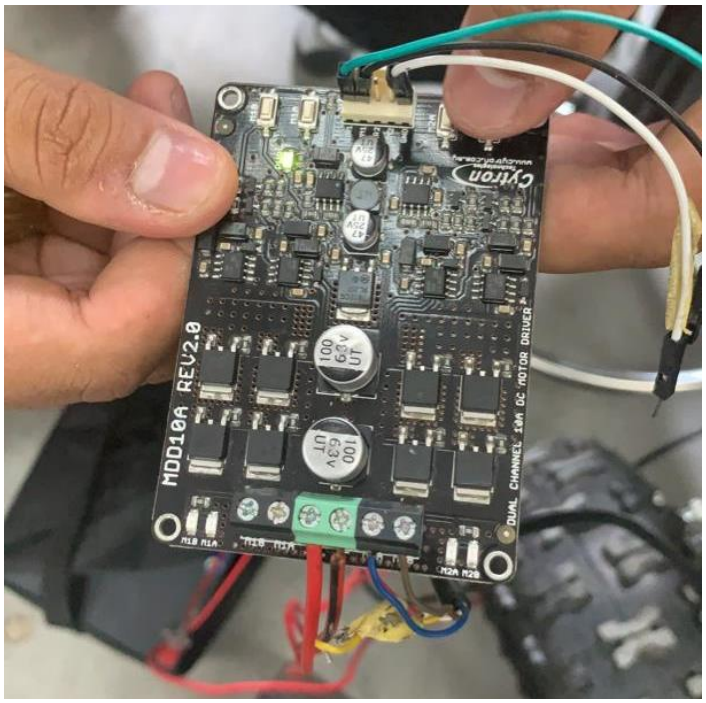


Figure 3-14 Linear actuator with MDD10A

The testing using motor driver for moving then linear actuator was done. The movement for the linear actuator for forward and reverse in good condition. When the manual button for testing was press linear actuator moving forward the steering will move to the left. For the second test, manual button was press and the linear actuator moving reverse the steering move to right. The movement of the linear actuator to control the steering shaft are in good condition. The time take to turn left and right are good without taking long time to react.

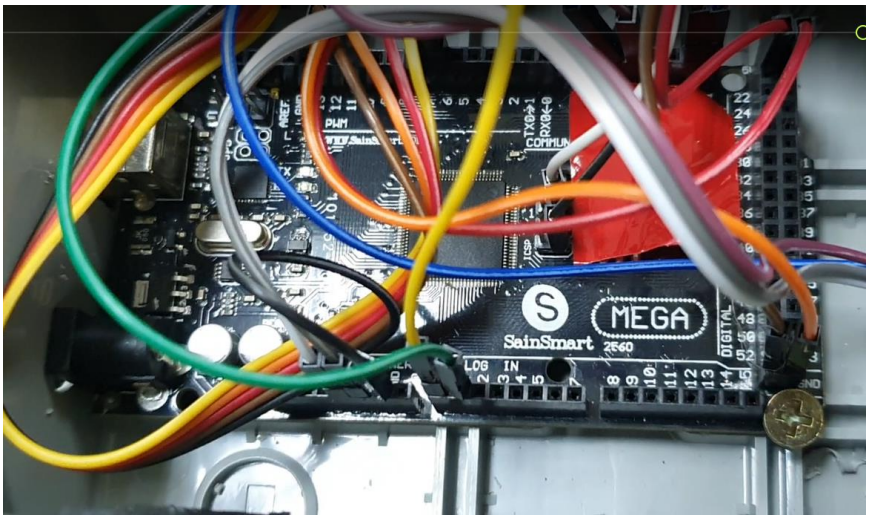


Figure 3-15 Arduino attach with MDD10A

Figure above show that the motor driver of the mdd10a were attach with the Arduino mega 2560. The connection between Arduino and the motor controller are need so the Arduino can send the program that was keep in the Arduino to move the motor. Arduino will send the instruction to the motor driver so the motor driver will move the motor same as the command that was given. Arduino is the main microcontroller in this project. Mdd10a also control the brushed motor so it can control the throttle and braking module

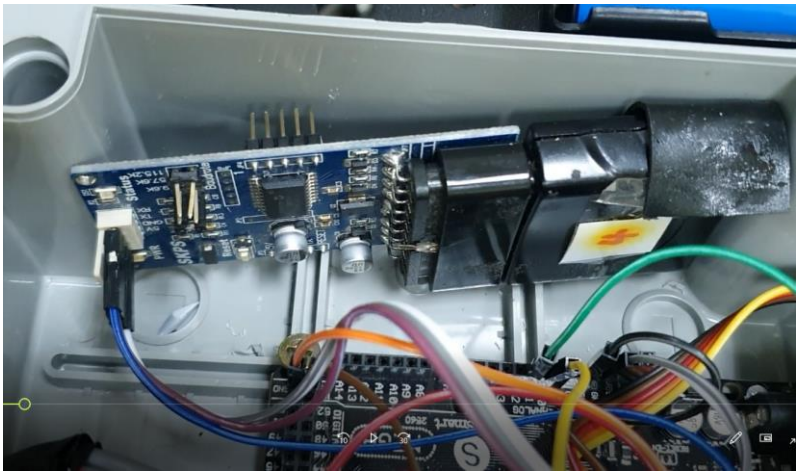


Figure 3-16 SKPS PS2 Receiver Attach with Arduino

Figure above show that the receiver for SKPS PS2 controller kit was attach with Arduino. The connection is need to be done because the receiver will receive all the instruction from the wireless joystick and it will send the information to the Arduino. The information that was receive from the receiver will move to the motor driver mdd10a to move the motor. When the button turn right was press, the receiver will receive the data and will sent it to the Arduino. The information that was get from the receiver will sent to motor driver mdd10a through Arduino to move linear motor to forward so the steering will turn to the right. For turning the steering to the left, the process also same but the linear motor will move reverse so the steering will turn to the left according to the information that receive in the receiver and Arduino.

3.5.3 Establish Communication Program With Arduino and SKPS PS2

For this project, a few troubleshoot of the program are need to be done. For this project, it use a few file or data that not have in the Arduino library. For SKPS PS2 module, the header or the program need to be add in the library so the Arduino can declare the control module. Without the data program to declare the controller module the Arduino will have problem to understand or to declare the controller. The data program for the controller can be download at the citron website. The process to add the library program for the controller are very simple and only take a few minute to add the program file

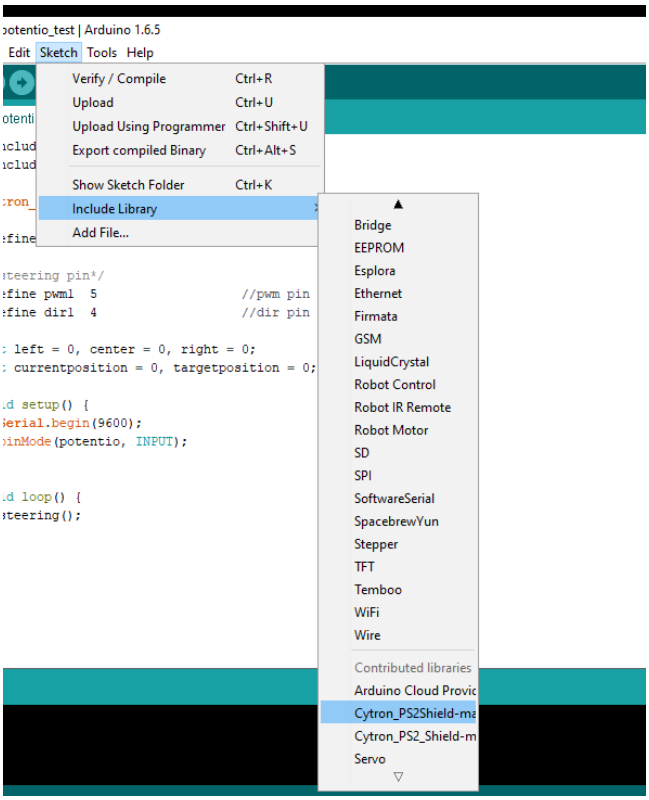


Figure 3-17 Add PS2 Program File to Arduino Library

3.6 Final Product

Lastly for this project, the assembly equipment and component has been done. The system of the steering module and Brake module has been install in the ATV. The ATV now ready to testing in fully control by the Wireless controller. Figure below show the final look of the product when all the component and equipment has been attach together

Figure 3-18 Final product of Autonomous ATV

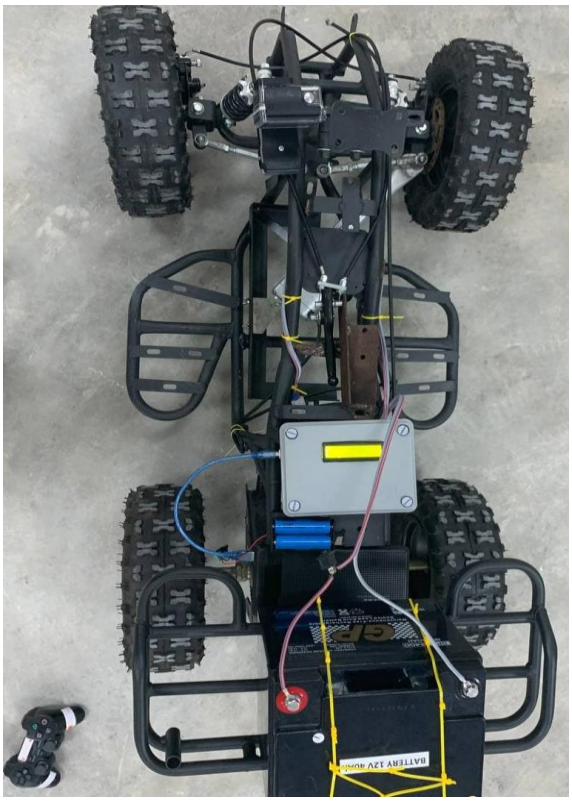


Figure 3-19 Final Product from Up

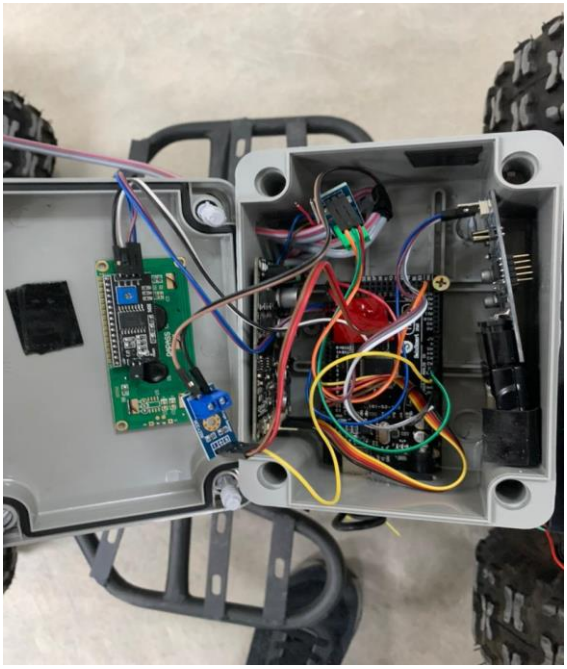


Figure 3-20 Electrical Circuit

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Introduction

In this project, a few test has been done to observe the result for the cornering and the braking system. The test took place at the Faculty of FTKEE in the laboratory and at the hallway first flow of A1. In the lab, the test that was run in the cornering test without moving the ATV. The test are run for a few minute to test the movement of the steering which is to turn left and right. The result of the test is collected when the test are running. In the hallway, the test is about the throttle and the braking system. The ATV travel on the hallway by using the wireless control and wireless camera. The result of cornering, speed of the ATV and braking are collected and has been analyse for the improvement

4.2 Test Turn Left And Right

In this test, the ATV is in the static position without moving any distance or any movement. For this test, the wireless controller was use to move the steering module. For this test, the button of right direction was press and the steering of the ATV are turn right direction. Also when the left button was push the steering are moving to the left to its maximum turn left. The test we run a few minute to make sure the condition of the steering module are in the great condition before move to the other test.

Figure 4-1 Test Turn Left test

Figure 4-2 Test Turn Right

4.3 Test of Angle Left And Right

For the next test is the test about to see the maximum of the angle cornering left and right. This test was run to determine the angle of the maximum right and left when the ATV are corner position. The angle are important for the ATV to make a turn. The specific angle need to know to improve the cornering section of the ATV if need to improve the product.

Figure 4-3 Angle Of Turn Right

Figure 4-4 Angle Of Turn Left

The angle of the turning left and right was collected and measure. Figure above show that when the ATV are turn to right the angle of the tyre or shaft is 22 degree right tyre and 35 degree left tyre. For turning to the left the result of the angle is for left tire are 22 degree and for right tire are 35 degree. The test to find the angle of cornering have complete. The data about the right and left turning angle was recorded.

Condition	Angle of Right Tyre	Angle of Left Tyre
RIGHT	22^{o}	35^{o}
LEFT	35^{o}	22^{o}

Table 4-1 Angle Of Cornering

4.4 Measure Length Of Linear Actuator

The length was measure by using the measurement tape in cm. This was run because it need to measure what the maximum of the and minimum of the length to avoid error or to avoid the linear actuator push to overload that make the motor broken. The figure below show how the measurement are being done to get the length of the linear actuator in three position

Figure 4-5 Length in Straight Position

Figure 4-6 Length in Right Position

Figure 4-7 Length in Left Position

Condition	Length Right Shaft (cm)	Length Left Shaft (cm)
RIGHT	15 cm	17 cm
LEFT	17 cm	16 cm
STRAIGHT	17 cm	17 cm

Table 4-2 Length Of Linear Actuator

The length of the linear actuator was taken and has been record in the table above. As it can see the different are happen. The length that change is depend on the position that the linear actuator move so the length was record to see the different in three position. This process are important because the linear actuator only move to maximum and minimum length of its strength. So to avoid over move that make the linear damage the measure was taken to set the limit of the linear actuator. By doing this process the linear actuator can use in long term without damage the motor

4.5 Cornering And Brake Test In Laboratory

In this project test, after done the basic of the cornering in the lab, the test are proceed to the cornering test when ATV are moving using the wireless remote control joystick. For the first step the ATV in the static position without any movement. The button at the wireless joystick was press to move the brushed motor to forward. When the ATV are moving the button to control the steering was pressed to turn the ATV to left and the steering of the ATV are turning to the left. The test are continue by pressing the right button and the ATV is turning to the right. Finally the brake of the Brushed motor of the ATV has been trigged when the reverse button was press so the ATV immediately stop from movement. The brake was trigger by bypass the polarity of the motor using the motor driver mdd10a.

Figure 4-8 ATV in Static Position

Figure 4-9 ATV Turn Left

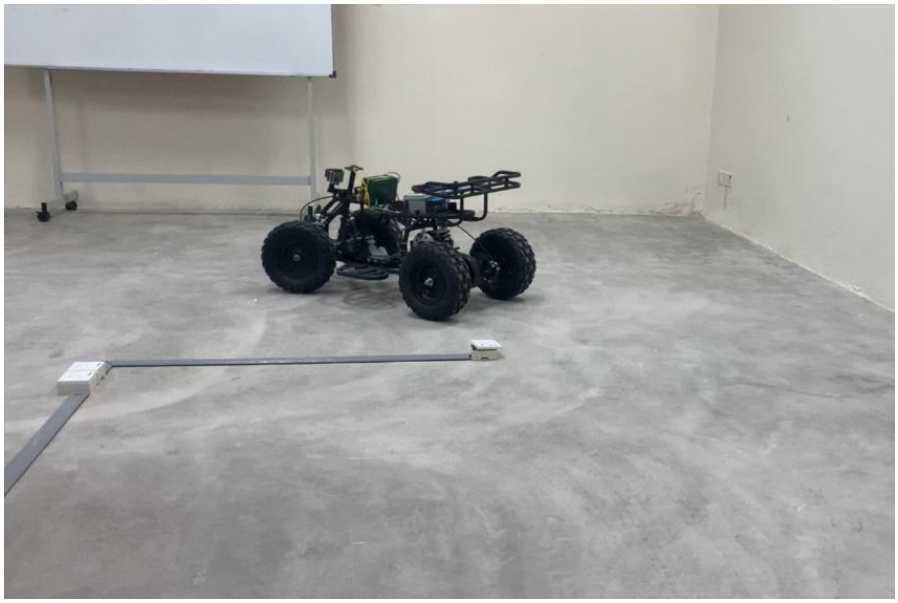


Figure 4-10 ATV Turn Left And Brake

4.6 Test Using Wireless Camera

For the test using the wireless camera, the smartphone is connected to the wireless camera. This test are doing because want to see the ATV are controlling on been seen in the image of video. Using the smartphone as the medium that receive video image from the camera, the ATV is control by referring the image video of the surrounding ATV. The first test using the wireless remote camera a doing in the lab. The camera capture the image in the area surrounding ATV so the person can control the ATV well without hit the obstacle. The image that appear in the smartphone screen are in high resolution so its easy to control the ATV without having problem by seeing at the smartphone screen. The test that involve is the movement of the ATV forward and reverse. Also the testing cornering also involve with the braking test.

Figure 4-11 Control ATV with Wireless Camera

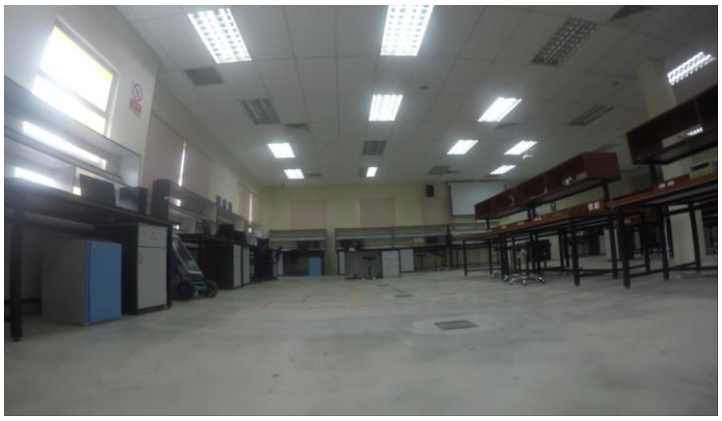


Figure 4-12 Image Wireless Camera On Smartphone

4.7 Test Drive At Hallway

For the last test, the ATV are moving around the FTKEE hallway. This final test are involve at A1 level in faculty. For this test, the ATV are control by using the joystick and see the image at the smartphone screen. The range of the move that has been travel around 200 meter along the hallway. The test are to make sure the ATV can be control and can move without any problem or error. After finish the task, the condition of the ATV need to check. The full inspection has been made to check the status of each module and each component. The range that travel by the ATV and the video has been record for more investigation and for more improvement if the ATV need to development more good.

Figure 4-13 Driving Test At Hallway

Figure 4-14 Image From Camera During Test

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Introduction

Using Arduino, PS2 Controller Kit, Linear Actuator and Mdd10a motor driver, Autonomous system for ATV can be made, For this project shown that, the objective project have been achieve by completing the system of the Autonomous that was put inside at the Electrical ATV. By using the correct equipment and component, the project are successfully work and the project rub with good condition and result without error. The system also upgrade the control system and the steering system that control from manual at the first place and now can control without human on the ATV. The manual controller now has been replace by the wireless control for long range.

5.2 Future Recommendation

- For camera, the improvement that need to take are by replacing the wireless remote camera to long range wireless camera
- For the system, can upgrade the system by adding the GPS that can detect the movement of the ATV in the map
- For system, can be upgrade by adding the sensor that can stop the ATV when obstacle are close

5.3 Impact To Society

For this project impact to society is the ATV can move without human on the ATV and the system are fully remove the manual mechanical system. The system is improve in safety and can reduce injury for human and surrounding

REFERENCES

Wu, Chien-Hsun, et al. “Mechatronics and Remote Driving Control of the Drive-by-Wire for a Go Kart.” MDPI, Multidisciplinary Digital Publishing Institute, 23 Feb. 2020, www.mdpi.com/1424-8220/20/4/1216/htm.

A Control Design Approach for Controlling an Autonomous ... www.researchgate.net/profile/Edward_Ordonez/publication/42803795_A_Control_Design_Approach_for_Controlling_an_Autonomous_Vehicle_with_FPGAs/links/0deec520e40563e572000000/A-Control-Design-Approach-for-Controlling-an-Autonomous-Vehicle-with-FPGAs.pdf.

Baek, Woonhyuk, et al. “A CAN-Based Distributed Control System for Autonomous All-Terrain Vehicle (ATV).” IFAC Proceedings Volumes, Elsevier, 25 Apr. 2016, www.sciencedirect.com/science/article/pii/S1474667016404830.

Subramanian, Vijay, et al. “Development of Machine Vision and Laser Radar Based Autonomous Vehicle Guidance Systems for Citrus Grove Navigation.” Computers and Electronics in Agriculture, Elsevier, 17 Aug. 2006, www.sciencedirect.com/science/article/abs/pii/S016816990600069X.

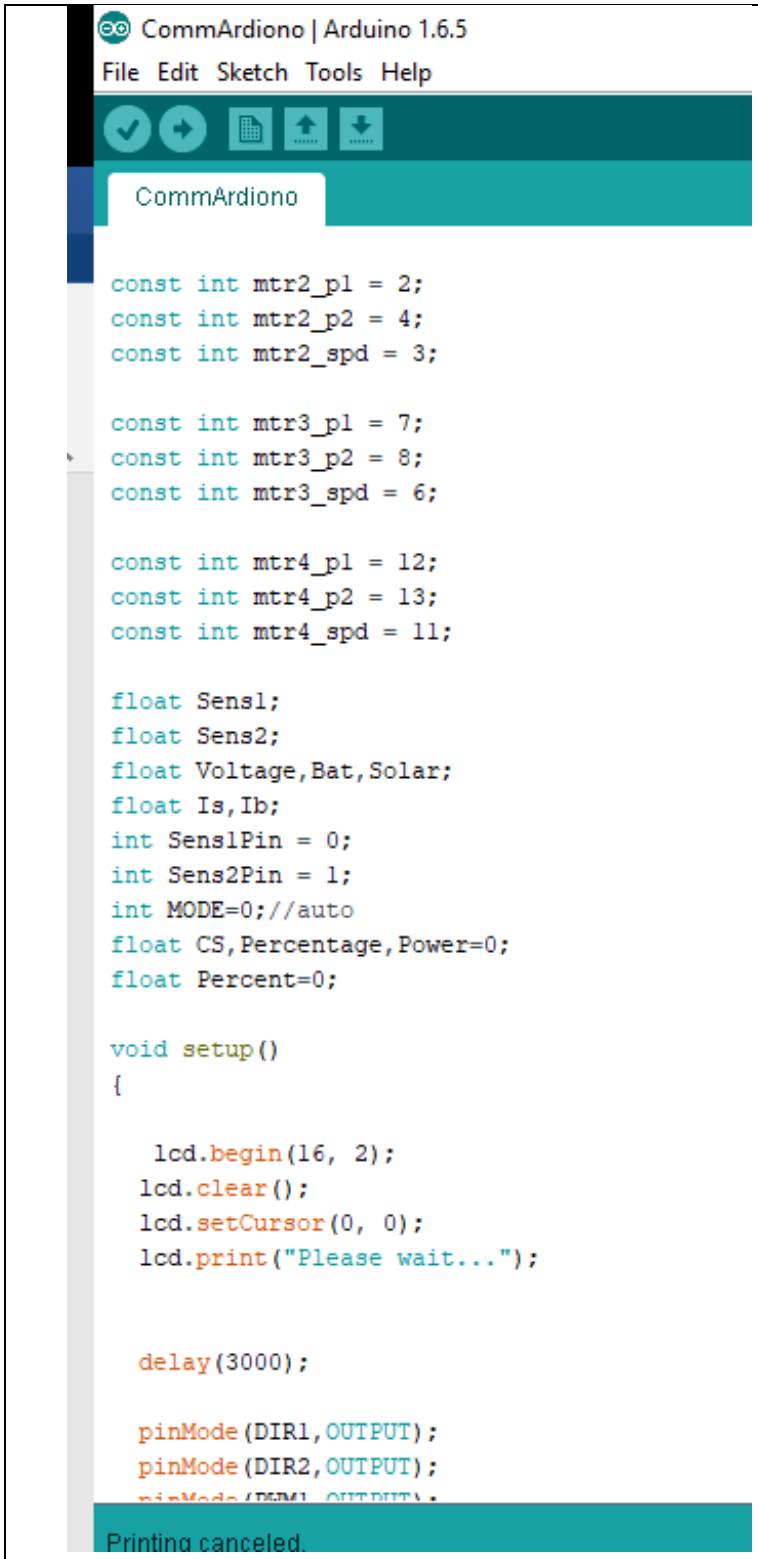
APPENDICES

Appendix A:

Title Coding Project

```
//skps protocol

#include <Wire.h>  // Comes with Arduino IDE
#include <LiquidCrystal_I2C.h>



LiquidCrystal_I2C lcd(0x27, 2, 1, 0, 4, 5, 6, 7, 3,

#define p_Up      4
#define p_Right     5
#define p_Down      6
#define p_Left      7
#define p_L2      8
#define p_R2      9
#define p_L1      10
#define p_R1      11
#define p_Triangle  12
#define p_Circle    13
#define p_Cross     14
#define p_Square    15

#define DIR1 6
#define DIR2 7
#define PWM1 10
#define PWM2 11

int SPD1=100;
int SPD2=255;

//constant variable
const int rx = 0;
const int tx = 1;

const int mtr2_p1 = 2;
const int mtr2_p2 = 4;
```

Printing canceled.


CommArdiono | Arduino 1.6.5
File Edit Sketch Tools Help
CommArdiono
const int mtr2_p1 = 2;
const int mtr2_p2 = 4;
const int mtr2_spd = 3;
const int mtr3_p1 = 7;
const int mtr3_p2 = 8;
const int mtr3_spd = 6;
const int mtr4_p1 = 12;
const int mtr4_p2 = 13;
const int mtr4_spd = 11;
float Sens1;
float Sens2;
float Voltage,Bat,Solar;
float Is,Ib;
int Sens1Pin = 0;
int Sens2Pin = 1;
int MODE=0;//auto
float CS,Percentage,Power=0;
float Percent=0;
void setup()
{
lcd.begin(16, 2);
lcd.clear();
lcd.setCursor(0, 0);
lcd.print("Please wait...");
delay(3000);
pinMode(DIR1,OUTPUT);
pinMode(DIR2,OUTPUT);
Printing canceled.

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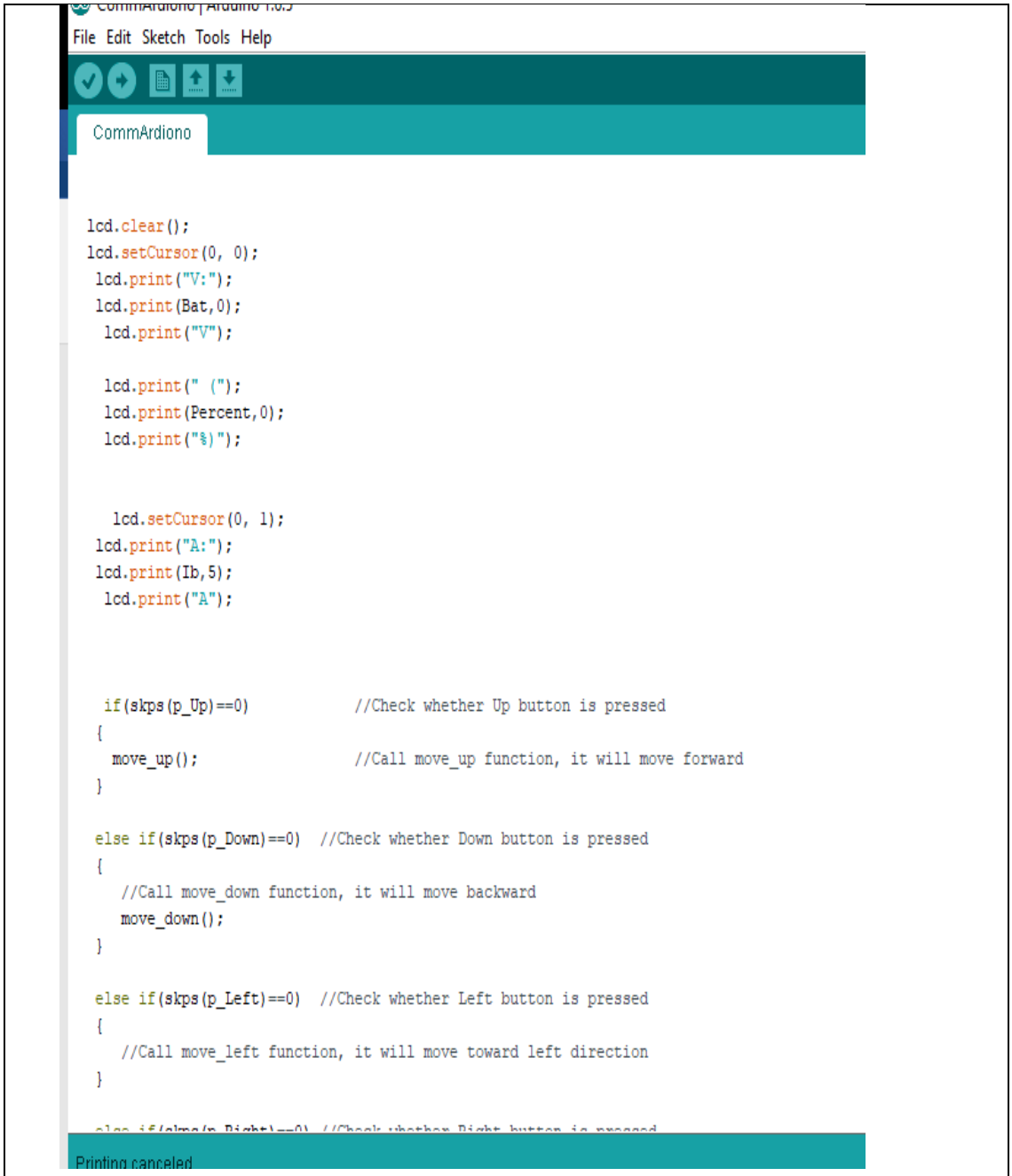
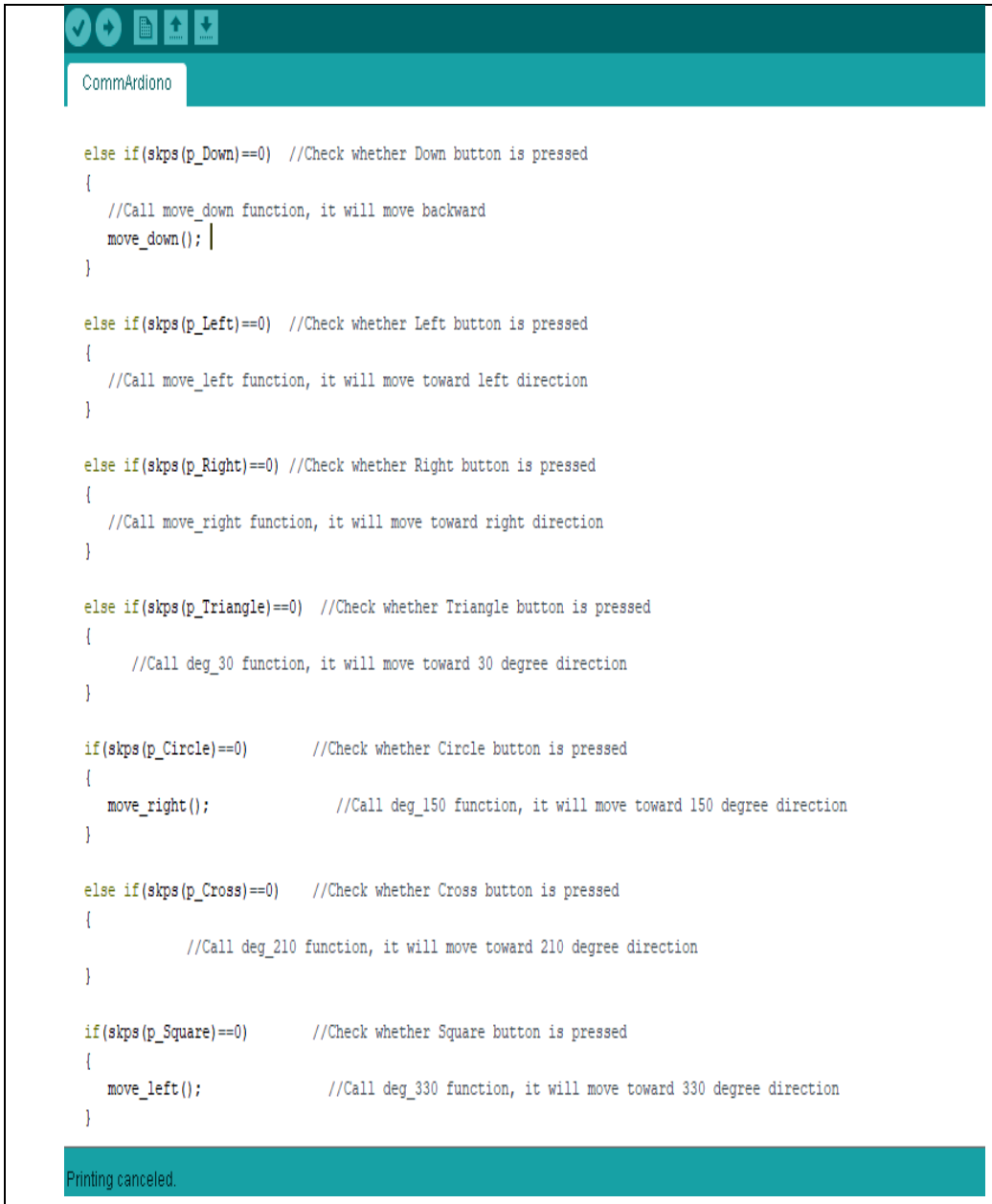
CommArdiono

```
  pinMode(DIR1,OUTPUT);
  pinMode(DIR2,OUTPUT);
  pinMode(PWM1,OUTPUT);
  pinMode(PWM2,OUTPUT);
  Serial2.begin(9600);      //Set serial baud rate as 9600
  Serial2.flush();          //Waits for the transmission of outgoing serial data to complete.
  Serial.begin(9600);

  //Set the mode for each digital pins whether input or output
  pinMode(rx, INPUT);
  pinMode(tx, OUTPUT);

  pinMode(mtr2_p1, OUTPUT);
  pinMode(mtr2_p2, OUTPUT);
  pinMode(mtr2_spd, OUTPUT);

  pinMode(mtr3_p1, OUTPUT);
  pinMode(mtr3_p2, OUTPUT);
  pinMode(mtr3_spd, OUTPUT);

  pinMode(mtr4_p1, OUTPUT);
  pinMode(mtr4_p2, OUTPUT);
  pinMode(mtr4_spd, OUTPUT);
}

void loop()
{



    Sens2 = analogRead(A0);           //read the value from the sensor
  Sens2= (5.0 * Sens2 * 100)/1024.0;  //
  Bat=Sens2*0.123076;
  Bat=Bat*0.36428571;
  Percent=100.0-((15-Bat)/5 * 100.0);
  if (Percent>100){
```


File Edit Sketch Tools Help
CommArdiono
Sens2 = analogRead(A0); //read the value from the sensor
Sens2= (5.0 * Sens2 * 100)/1024.0; //
Bat=Sens2*0.123076;
Bat=Bat*0.36428571;
Percent=100.0-((15-Bat)/5 * 100.0);
if (Percent>100){
Percent=100;
}
if (Percent<0){
Percent=0;
}
CS = analogRead(A1); //read the value from the sensor
CS= (5.0 * CS)/1024.0; //
if (CS >2.5){
Ib=(CS-2.5) * 0.185;
Ib=Ib*1000.0;
Power=Bat*Ib;
}
if (Bat<=1){
Ib=0;
Percent=0;
}
Serial.print(Bat);
Serial.print("\t");
Serial.print(Ib);
Serial.print("\t");
Serial.println(Power);
lcd.clear();


File Edit Sketch Tools Help
CommArdiono
lcd.clear();
lcd.setCursor(0, 0);
lcd.print("V:");
lcd.print(Bat,0);
lcd.print("V");
lcd.print(" (");
lcd.print(Percent,0);
lcd.print("%)");
lcd.setCursor(0, 1);
lcd.print("A:");
lcd.print(Ib,5);
lcd.print("A");
if(skps(p_Up)==0) //Check whether Up button is pressed
{
move_up(); //Call move_up function, it will move forward
}
else if(skps(p_Down)==0) //Check whether Down button is pressed
{
//Call move_down function, it will move backward
move_down();
}
else if(skps(p_Left)==0) //Check whether Left button is pressed
{
//Call move_left function, it will move toward left direction
}
Printing canceled



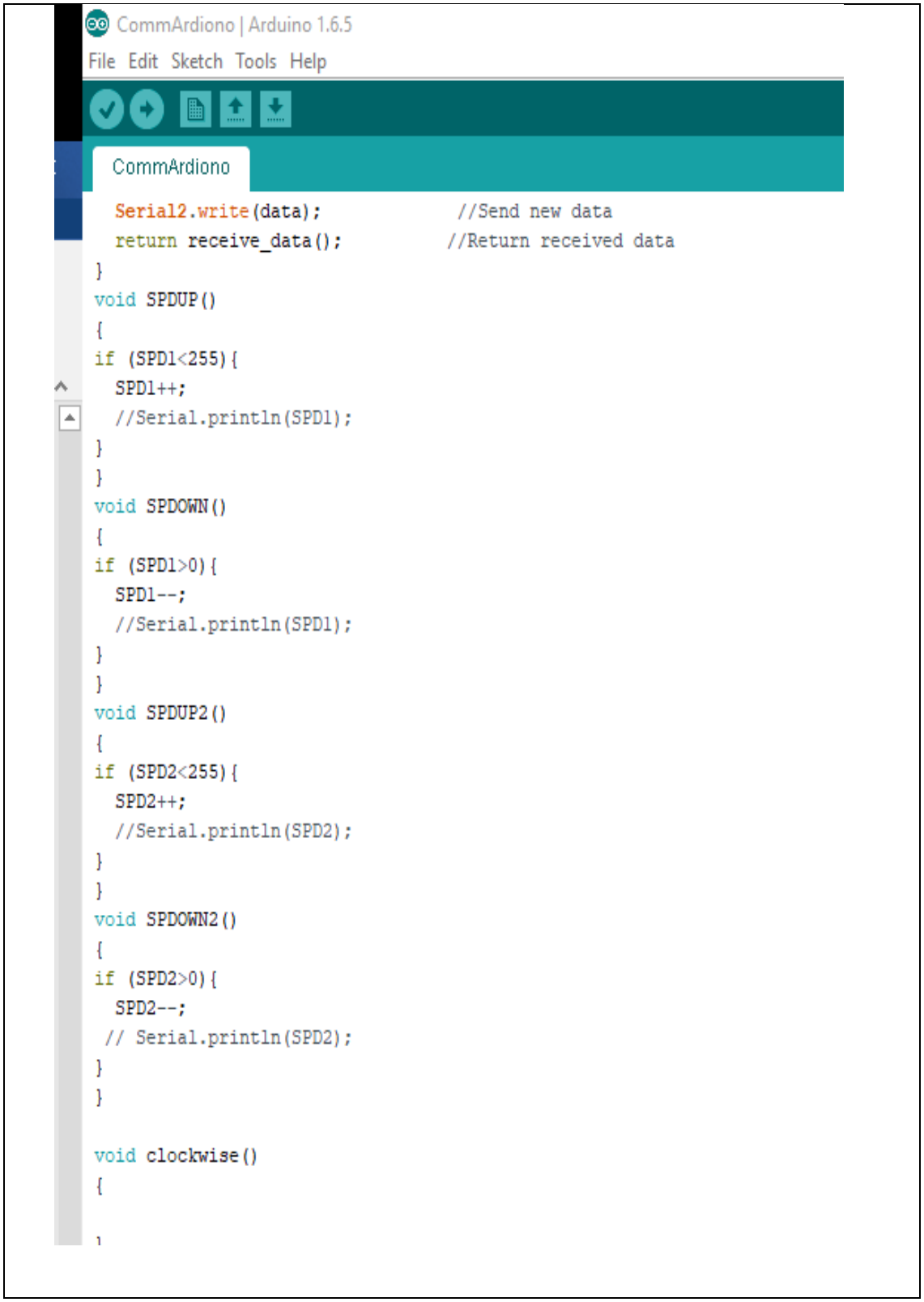
CommArdiono

```
else if(skps(p_Down)==0)  //Check whether Down button is pressed
{
   //Call move_down function, it will move backward
   move_down();
}

else if(skps(p_Left)==0)  //Check whether Left button is pressed
{
   //Call move_left function, it will move toward left direction
}

else if(skps(p_Right)==0) //Check whether Right button is pressed
{
   //Call move_right function, it will move toward right direction
}

else if(skps(p_Triangle)==0)  //Check whether Triangle button is pressed
{
     //Call deg_30 function, it will move toward 30 degree direction
}

if(skps(p_Circle)==0)        //Check whether Circle button is pressed
{
   move_right();               //Call deg_150 function, it will move toward 150 degree direction
}

else if(skps(p_Cross)==0)    //Check whether Cross button is pressed
{
            //Call deg_210 function, it will move toward 210 degree direction
}

if(skps(p_Square)==0)        //Check whether Square button is pressed
{
   move_left();               //Call deg_330 function, it will move toward 330 degree direction
}
```

Printing canceled.

CommArdiono

```
  {
     move_left();                //Call deg_330 function, it will move toward 330 degree d
  }

  else if(skps(p_L1)==0)        //Check whether L1 button is pressed
  {
   SPDUP();
  }
  else if(skps(p_L2)==0)        //Check whether L1 button is pressed
  {
   SPDOWN();
  }

  else if(skps(p_R1)==0)         //Check whether R1 button is pressed
  {
    SPDUP2();
  }
  else if(skps(p_R2)==0)         //Check whether R1 button is pressed
  {
    SPDOWN2();
  }

  else                           //Check whether no button is pressed
  {
    stop();                      //Call stop function, it will stop all the motors
  }
}

unsigned char receive_data(void)  //Function to wait for a byte receive from UART
{
  unsigned char temp;
  while(!Serial2.available());    //Wait until data received
  temp=Serial2.read();
 // Serial.print(temp);
  return temp;                    //Return the received data
}
```


CommArdiono | Arduino 1.6.5
File Edit Sketch Tools Help
CommArdiono
Serial2.write(data); //Send new data
return receive_data(); //Return received data
}
void SPDUP()
{
if (SPD1<255){
SPD1++;
//Serial.println(SPD1);
}
}
void SPDOWN()
{
if (SPD1>0){
SPD1--;
//Serial.println(SPD1);
}
}
void SPDUP2()
{
if (SPD2<255){
SPD2++;
//Serial.println(SPD2);
}
}
void SPDOWN2()
{
if (SPD2>0){
SPD2--;
// Serial.println(SPD2);
}
}
void clockwise()
{


```
{

}

void move_up(void)
{

  digitalWrite(DIR1,LOW);
  analogWrite(PWM1,SPD1);
}

void move_right(void)
{

  digitalWrite(DIR2,LOW);
  analogWrite(PWM2,SPD2);
}

void move_down(void)
{

  digitalWrite(DIR1,HIGH);
  analogWrite(PWM1,SPD1);
}

void move_left(void)
{

  digitalWrite(DIR2,HIGH);
  analogWrite(PWM2,SPD2);
}

void deg_30(void)
{

}
```


CommArdiono
digitalWrite(DIR1,HIGH);
analogWrite(PWM1,SPD1);
}
void move_left(void)
{
digitalWrite(DIR2,HIGH);
analogWrite(PWM2,SPD2);
}
void deg_30(void)
{
}
void deg_150(void)
{
}
void deg_210(void)
{
}
void deg_330(void)
{
}
void stop()
{
analogWrite(PWM1,0);
analogWrite(PWM2,0);
}
Printing canceled.

Appendix B: Material Bill Cost

No	Component	Quantity	Cost/Unit (RM)	Total (RM)
1.	Rechargeable battery 12V	1	46.00	46.00
2.	500W DC Brushed Motor	1	221.61	221.61
3.	Linear Actuator	1	317.43	317.43
4.	Arduino Mega	1	38.90	38.90
5.	LCD	1	7.20	7.20
6.	MDD10A DC Motor Driver	1	81.00	81.00
7.	SKPS PS2 Controller Kit	1	23.99	23.99
8.	Current Sensor	1	9.70	9.70
9.	Voltage Sensor	1	5.57	5.57
			Total	751.40