DESIGN AND FABRICATION OF STEERING SYSTEM

FOR ELECTRIC GO KART

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UNIVERSITI MALAYSIA PAHANG

DECEMBER 2012

DESIGN AND FABRICATION OF STEERING SYSTEM FOR ELECTRIC GO KART

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Report submitted in partial fulfilment of the requirements
for the award of the degree of
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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this project and in my opinion, this project is adequate in terms of scope and quality for the award of the Diploma in Mechanical Engineering.

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STUDENT'S DECLARATION

I hereby declare that the work in this project is my own except for quotations and summaries which have been duly acknowledged. The project has not been accepted for any degree and is not concurently submitted for award of other degree.

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DEDICATION

Specially dedicated to
My beloved family and those who have
Encourage and always be with me during hard times
And inspired me throughout my journey of learning

ACKNOWLEDGEMENTS

I am grateful and would like to express my sincere gratitude to my supervisors Mr. Mohamad Zairi Bin Baharom for providing this interesting and exciting topic and then providing his guidance, assistance and encouragement throughout the duration of the project.

Sincere thanks to all staff of the Mechanical Laboratory, UMP, who helped me in many ways and provide equipments and information sources that assisted my studies and projects.

To all my group members, thanks for the comments, suggestions and co-operation given which is crucial for the successful completion of this project.

Special thanks to my lovely parents for their support, love, dream and sacrifice throughout my life. I would like to appreciate their devotion, support and faith in my ability to attain my goals. My profound thanks go to all of my classmates, especially to my friends for spending their precious time to give help and support whenever I need during the fabrication process.

ABSTRACT

The objective of this project is to design and fabricate the steering system for electric go kart. Usually, majority of the go kart available at the market are based on petrol engine. The functional for this steering system are based on available product which is evaluated by research on the available source such as Internet. The basic part for the steering system such as steering column, track rods and stub axle are being research thoroughly to understand the function of each part. Before the fabrication process, some research for the milling, lathing, drilling and welding process are done to make sure it is suitable for the material used. To obtain the best designs, it has to be parallel with the scope of the project and suited with the criteria needed. Three concepts design are generated and final design are choose based on the Evaluation Table and discussion between team members and supervisor. Material selection is chose by surveying the available raw material from the store. Materials based on mild steel are choose due to its characteristic which can be weld and fabricate easily. Measuring, cutting, drilling, turning, milling, bending, welding, grinding and finishing process are done to complete this project. The final phase of this project is to assemble all the components and parts of the electric go kart fabricate from the team members. The purpose of this project is to allow the driver of go kart to change the direction during handling.

ABSTRAK

Objektif projek ini adalah untuk merekabentuk dan membina sistem stereng untuk go kart elektrik. Biasanya, majoriti go kart boleh didapati di pasaran adalah berteraskan kepada enjin petrol. Berfungsi untuk sistem stereng ini adalah berdasarkan pada produk yang ada dipasaran dan diselidik melalui sumber yang ada seperti Internet. Komponen asas bagi sistem stereng seperti kolum stereng, rod trek dan gandar puntung telah diselidik dengan teliti untuk memahami fungsi setiap bahagian. Sebelum proses pembinaan, beberapa kajian untuk proses milling, lathing, penggerudian dan kimpalan dilakukan untuk memastikan ia sesuai untuk bahan yang digunakan. Untuk mendapatkan reka bentuk yang terbaik, ia perlu selari dengan skop projek dan sesuai dengan kriteria yang diperlukan. Tiga reka bentuk konsep telah dihasilkan dan konsep terakhir dipilih berdasarkan kepada Jadual Penilaian dan sesi perbincangan diantara ahli kumpulan dan penyelia. Pemilihan bahan dipilih dengan meninjau di stor bahan mentah. Bahan mentah yang berteraskan keluli lembut telah dipilih kerana ciri-cirinya yang senang dikimpal dan senang diproses. Proses mengukur, memotong, menggerudi, melarik, milling, membengkok, mengimpal mencanai dan proses penutup. Langkah terakhir untuk projek ini ialah menyambung semua komponen dan bahagian-bahagian go kart elektrik yang telah dibuat oleh ahli kumpulan yang lain.Tujuan utama projek ini adalah untuk membolehkan pemandu untuk mengubah haluan go kart elektrik semasa memandu.

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mm	Millimeter
RPM	Revolution per minute

LIST OF ABBREVIATIONS

IFK	International Kart Federation
HPS	Hydraulic Power Steering
FYP	Final Year Project
MIG	Metal Inert Gas
UMP	Universiti Malaysia Pahang
PIC	Person in charge

UNIVERSITI MALAYSIA PAHANG

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JUDUL: DESIGN AND FABRICATION OF STEERING SYSTEM FOR ELECTRIC GO KART

SESI PENGAJIAN: 2012/2013

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CHAPTER 1

INTRODUCTION

1.0 PROJECT BACKGROUND

This chapter explained about the problem statement, objectives of the project, and the methodology of this project. The methodology covers the flow of the project and progress of the project.

1.1 PROBLEM STATEMENT

Majority of go kart available in the market are using a small 2 stroke or 4-stroke engines. Electric go karts are also available, but hardly to be seen. Spare parts for the steering system are also hard to purchase in Malaysia. This is because go kart are only played by a citizen in the urban place such as big city. Price for buying go kart is also high.

1.2 OBJECTIVES OF THE PROJECT

The objective for this project is to design and fabricate the steering system for an electric go kart.

1.3 SCOPES OF THE PROJECT

This project is focusing on the design and fabrication of steering system for an electric go kart. This focus area is done based on the following aspect:

(i) The wheel can be steered parallel to the both side of the tire.

(ii) The steering inclination angle should be suitable to the driver's hand.

(iii) The steering system can be assembled with scope dimension of Aslam's chassis.

1.4 PROJECT PLANNING

Figure 1.1 shows the flow chart for this project. From the beginning until the end of the project, the sequences are followed through this flow chart.

Firstly, the project titles are discussed with the consultation of the project's supervisor. A lists of problem statement are listed, before deciding the suitable title, thus the objective and scope are decided. Then, literature reviews are done to guide the flow of this project.

After the main problem was identified, conceptual designs are generate based on the scope of the project. The best designs are selected for the final design.

When the final design are decided and approved, the fabrication process started. Schematic dimensions from the final design are used during the fabrication process. All material defined early to ensure its availability in the mechanical store.

During the fabrication process, closed supervision from the project supervisor are important in order to gets the improvement during the process. The best recommendations which give a better performance will be proposed for this project.

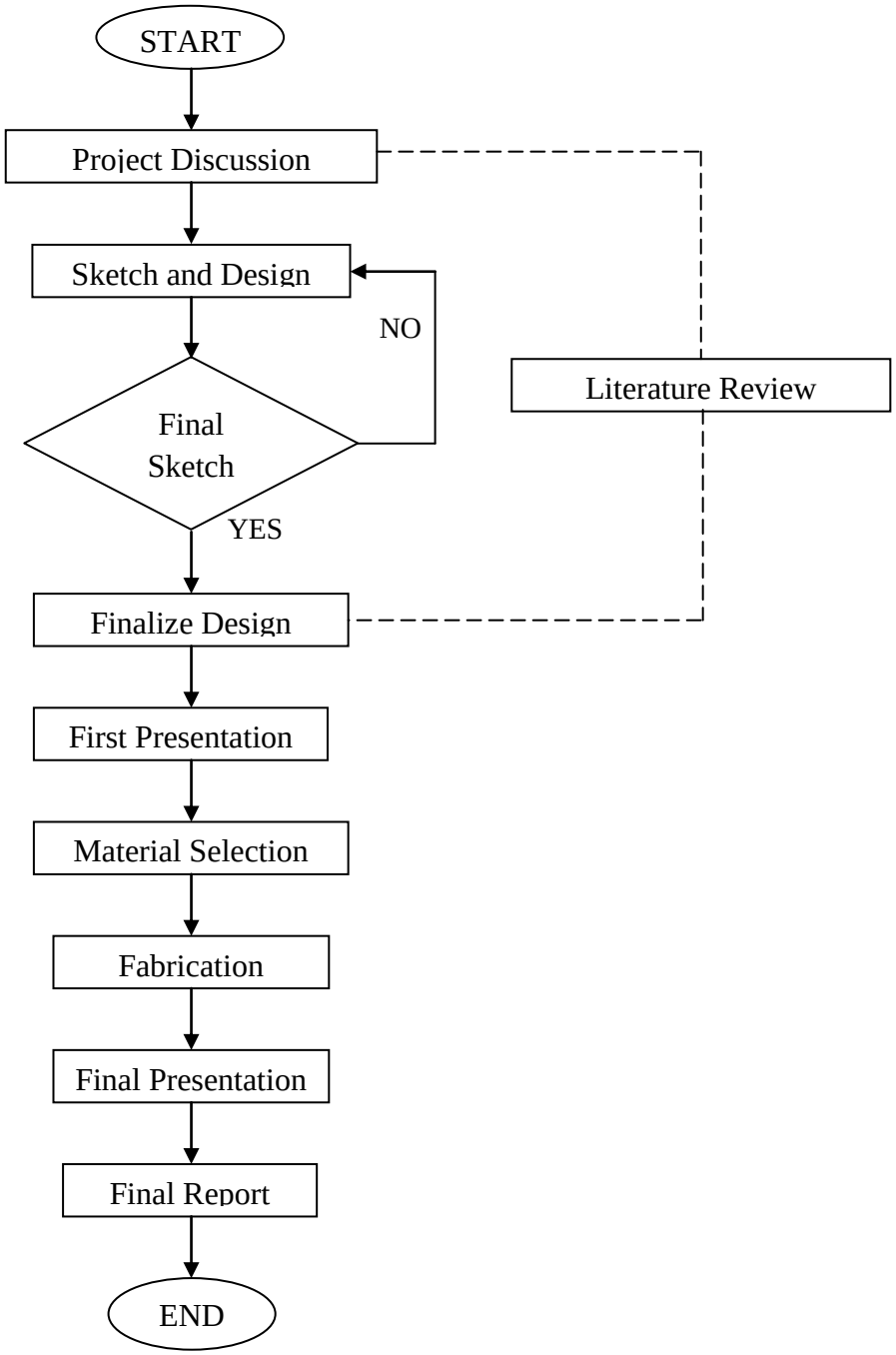

Figure 1.1: Project Flow Chart

Figure 1.2 below show the Gantt chart for this project respectively. The duration of time needed for the whole project is shown for the reference scheduled.

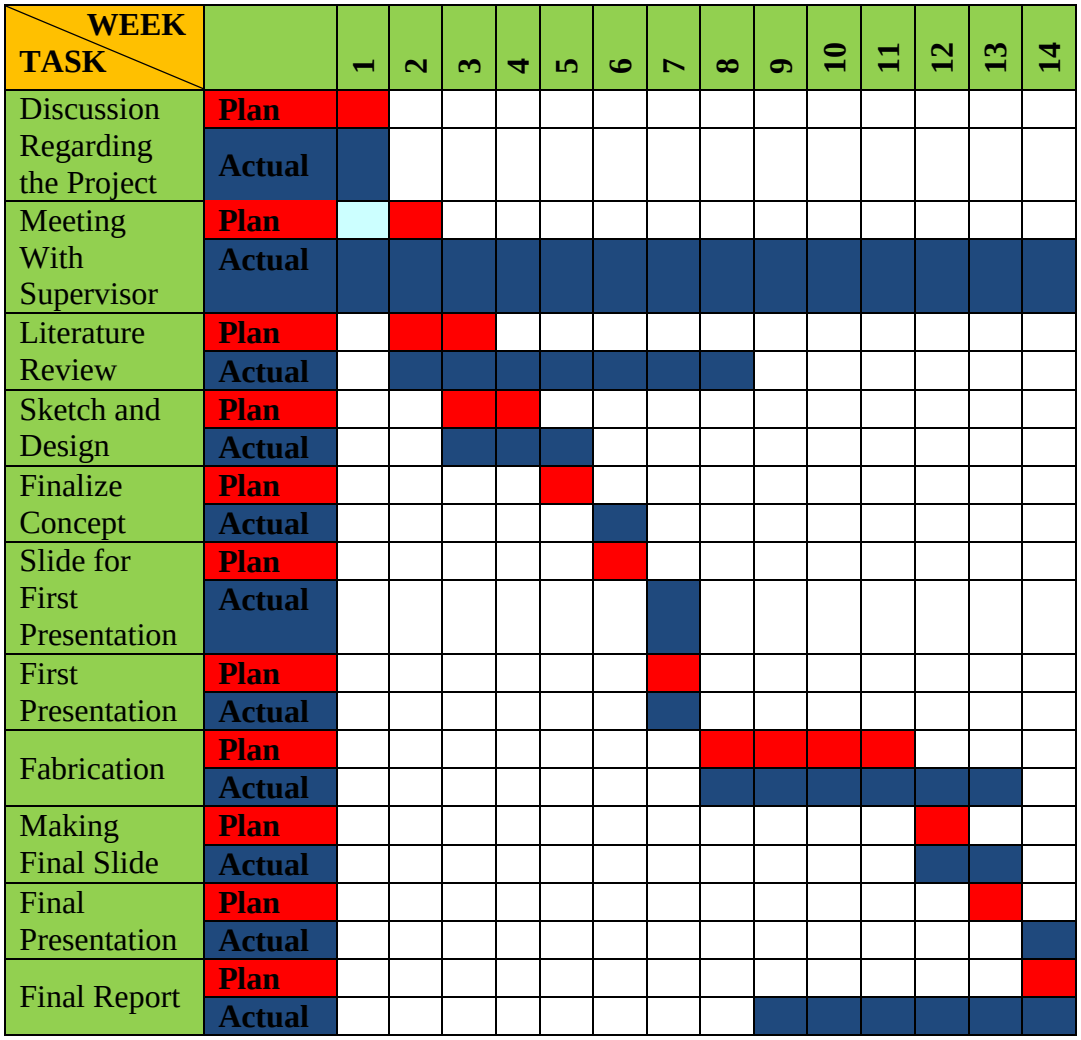

Figure 1.2: Project Gantt Chart

Based on the Gantt chart, the title has been discussed and confirmed by the supervisor at week 1. Thus, the literature has been researched until week 8. Meeting with the supervisor are held every week during this semester to report the progress about this project.

Sketching of concept designs are done during week 3 to 5, one week late from the planning because of the problem occurred, especially when to decide the suitable

process for the crucial parts. In week 6, the final design are produced and approved for the fabrication process.

In week 7, mid presentation are held as planned. Preparation are done a week on the same week due to the problem with the concept designs. After the mid presentation, fabrication process is started at week 8 until week 13. The process takes times because of the limitation used in milling machine and lack of tools in the lab.

The report of this project is planned to start on week 14, but due to the problems, the report start in progress earlier on the week 9. The final presentation is held on week 14, which is late a week from the planning.

1.5 STRUCTURE OF THESIS

Chapter 1 introduces the introduction of this project. It is generally discussed about the background of the project, objectives, scope and the flow of the project. Besides, it tells about the duration to complete this project.

Chapter 2 is the literature review of the project. This chapter will explain about the research of the project chose and explained about the steering system of go kart. The basic components needed to build the steering system are also explained in this chapter.

Chapter 3 is the design concept and selection of this project. Its discuses about the data and information for get design. This chapter explain about to get the final design by using concept variants.

Chapter 4 is the fabrication process. It explains about to fabricate the product based on the final design and it consists of material selection.

Chapter 5 is the result and discussion. It explains about operating procedure to run the product and also discuss about the problem during fabrication process.

Chapter 6 is the last chapter for this project report. It covers the overall result of this project.

1.6 CONCLUSION

This chapter can give a clear brief about the project's objective and scope. For the fabrication of the steering system for electric go kart, the scopes are used to be the referral in order to achieve the required specification of the steering system itself.

CHAPTER 2

LITERATURE REVIEW

2.0 INTRODUCTION

This chapter will explain about the research of the project that has been chosen and explained about the history of go kart. It will review the basic components of the system itself. This chapter also shows the research for the machinery that will be used for the fabrication process.

2.1 HISTORY OF GO KART

Art Ingels developed the first go-kart in 1956 in Los Angeles, California. Ingels was a race car builder for Kurtis Kraft, a race car designer and developer. In 1958, Go Kart Manufacturing Co. Inc. became the first company to manufacture and distribute go-karts. In 1959, McCullough was the first company to manufacture go-kart engines. The design of the first go kart is shown in Figure 2.1.

In the late 1940s and 1950s, the cost of automobile racing began to increase in the United States, and competitors were cutting back--even quitting auto racing altogether. The prices to attend a race increased as well, as many race car drivers and race car owners demanded a higher incentive to cover the cost and risk of their race cars. Fans were no longer purchasing tickets to attend these events. However, the recently introduced go-kart machine did not entail a high expense to compete. Many drivers satisfied their need to race by racing go-karts.

In 1957, the International Kart Federation, or IFK, began establishing rules for go-kart competitions. By 1960, go-kart racing began to appear at local tracks across the United States. Throughout the decade, new go-kart tracks surfaced in many different cities and states. Go-karts continued to evolve thanks to the innovation of builders and designers. Go-karts originally were simple and straightforward machines. Despite the advancement in styles, go-kart racing remains the least expensive form of professional auto racing.

Different forms of go kart racing materialized through the IKF, such as Sprint Racing, Shifter Karts, Road Racing Karts and Speedway Karts.

Figure 2.1: First go kart build by Art Ingels

Sources: http://rearenginekarts.com

2.2 BASIC COMPONENT OF STEERING SYSTEM FOR GO KART

2.2.1 Steering Column

The combination of parts connecting the steering wheel to the track rods is called steering column. The primary function, of steering column, is to transmit the turning moment of the steering wheel to the track rods. Therefore, steering column convert the rotary movement of the steering wheel in driver's hand into the angular turn of the front wheels on road. The steering column is shown in Figure 2.2.

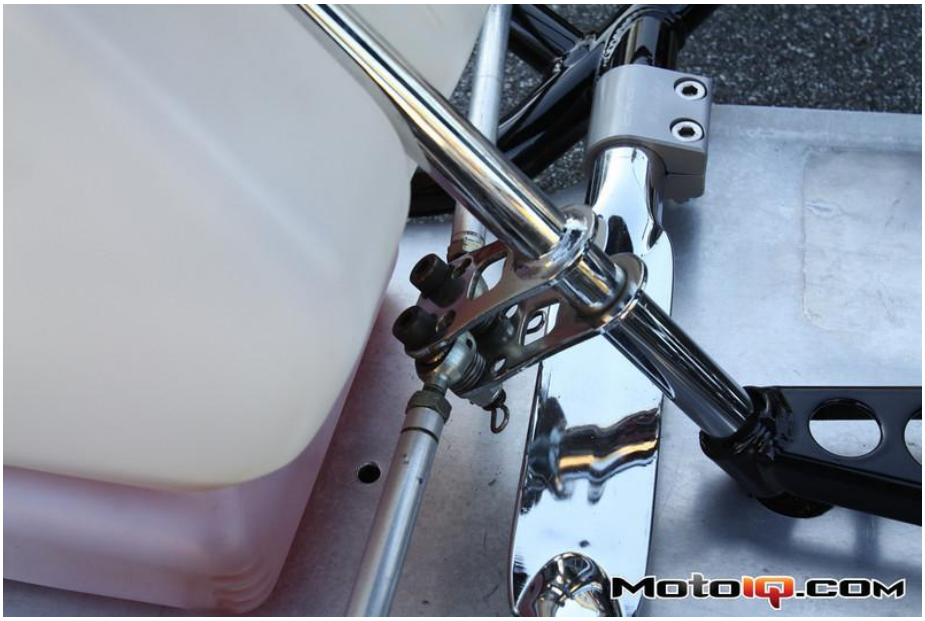

Figure 2.2: Steering Column

Source: http://www.motoiq.com

2.2.2 Track Rods and Ball Joint

A tubular track-rod spans the wheel track and pivots together the two stub-axles. The ends of this rod carry ball-joints, which in turn are bolted to the track-rod arms of each stub axle. These ball-joints are allowed to move only in the horizontal plane. The drag-link movement is either a pull or a push action and rotates one of the stub-axles. This motion is transferred to the other stub-axle through the track-rod. Figure 2.3 and Figure 2.4 had shown the track rods and the ball joint respectively. The function of the ball joint allows the wheels to swivel so the driver can steer. It is also a flexible joint with a ball and socket type. It is used for the steering knuckle.

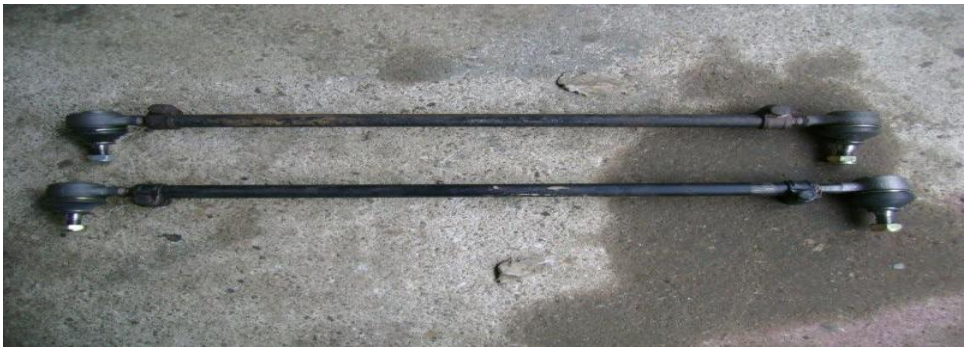

Figure 2.3: Track Rods

Source: http://transporterhaus.com

Figure 2.4: Ball Joint

Source: http://www.bizrice.com

2.2.3 Stub Axle

The stub-axle is a short axle-shaft to which one steered road-wheel is mounted. It uses two extended horizontal prongs that fit over the ends of the axle-beam. The king-pin, a short circular bar, passes vertically through both prongs and the eye of the axle-beam to form the hinge pivot. The stub-axle acts as the wheel axle as well as the pivot support member in the horizontal plane. Figure 2.5 show the example of stub axle.

Figure 2.5: Stub Axle

Source: http://www.motoiq.com

2.2.4 Steering Wheel

The steering wheel as shown in Figure 2.6 is the part of the steering system that is manipulated by the driver; the rest of the steering system responds to such driver inputs. This can be through direct mechanical contact as in recirculating ball or rack and pinion steering gears, without or with the assistance of hydraulic power steering, HPS, or as in some modern production cars with the assistance of computer controlled motors, known as Electric Power Steering.

Figure 2.6: Steering Wheel

Source: Wikipedia, Steering Wheel

2.3 MILLING PROCESS

Figure 2.7: Vertical Milling Machine

Source: Wikipedia, Milling Machine

A milling machine shown in Figure 2.7 is a machine tool used to machine solid materials. Milling machines are often classed in two basic forms, horizontal and vertical, which refer to the orientation of the main spindle. Both types range in size from small, bench-mounted devices to room-sized machines. Unlike a drill press, which holds the workpiece stationary as the drill moves axially to penetrate the material, milling machines also move the workpiece radially against the rotating milling cutter, which cuts on its sides as well as its tip. Workpiece and cutter movement are precisely controlled to less than 0.001 in (0.025 mm), usually by means of precision ground slides and lead screws or analogous technology. Milling machines may be manually operated, mechanically automated, or digitally automated via computer numerical control.

Milling machines can perform a vast number of operations, from simple (e.g., slot and keyway cutting, planing, drilling) to complex (e.g., contouring, die sinking). Cutting fluid is often pumped to the cutting site to cool and lubricate the cut and to wash away the resulting swarf.

2.4 TURNING PROCESS

A lathe shown in Figure 2.8 is a machine tool which turns cylindrical material, touches a cutting tool to it, and cuts the material. The lathe is one of the machine tools most well used by machining.

A material is firmly fixed to the chuck of a lathe. The lathe is switched on and the chuck is rotated. And since the table which fixed the byte can be moved in the vertical direction, and the right-and-left direction by operating some handles. It touches a byte's tip into the material by the operation, and make a mechanical part.

Figure 2.8: Lathe Machine

Source: http://www.nmri.go.jp

2.5 CONCLUSION

For this chapter, it can conclude that this chapter is a body of text that aims to review the knowledge before start this project. Besides, this chapter shows the project guidelines to accomplish this project successfully. More information is given on this project as a base for designing the steering system.

CHAPTER 3

DESIGN CONCEPT AND SELECTION

3.0 INTRODUCTION

This chapter consists of conceptual design, concept selection, and selection for the final design. It also explained about the concept selection and concept generation to get the final design.

3.1 DESIGN

The designs of the steering system must comply with several aspects. The design consideration must be done carefully so the design can be fabricated and the parts are all functioning. The aspect that must be considered in designing the product is the ability of the system to steer the go kart. Another important criteria is the steering system fabricated should be fit with the chassis.

3.2 DRAWING

All the ideas for the steering system are sketched on the paper first to ensure that idea selection can be made. The final idea is drawn into the Solidworks 2009 drawing format with details features.

3.3 CONCEPT SELECTION

For this project, three concepts has been generated. From the three concepts, one of the best concept has been chosen based on the discussion with the supervisor.

3.3.1 CONCEPT 1

Figure 3.1 show the design of concept 1. This concept has been generated with some criteria. This concept use a square bar as the steering wheel. This is the disadvantage for this design due to the lack of safety. The sharp edge at the steering wheel can cause a serious injury to the driver if the accidents occur. Another disadvantage for this design is long steering column are not suitable for go kart. As for the advantage of this design, the fabrication process can be easy because only a simple geometry used for this design.

Figure 3.1: Concept 1

3.3.2 Concept 2

Figure 3.2 show the design of concept 2. This concept has been generated with some criteria. This concept use round steering wheel. For the advantage, this concepts is easy to fabricate because it consist of a simple geometry design. Lower effect if accident occurs due to round edge. For disadvantage, long steering column are not suitable for go kart.

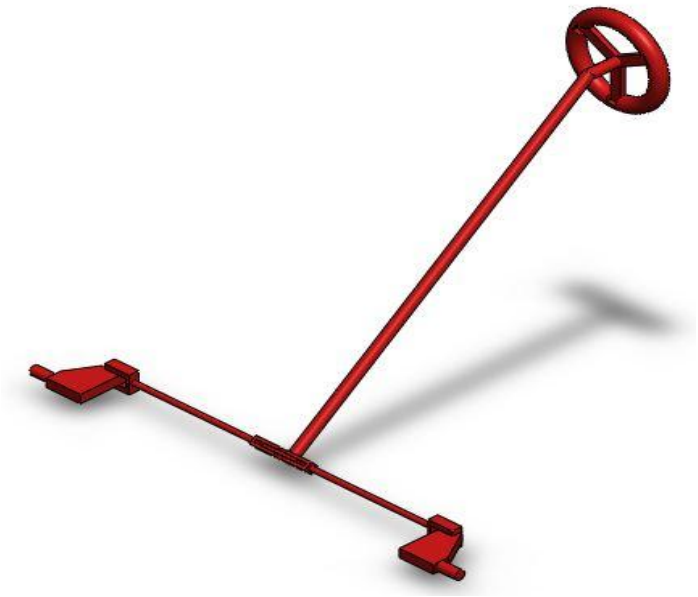

Figure 3.2: Concept 2

3.3.3 Concept 3

Figure 3.3 show the design of concept C. This concept has been generated with some criteria. This shaft of the steering column is not at the end of the rod, thus allow the driver's feet to control the throttle and brake in front of it. For the advantage of this part, the shorter column is suitable for the go kart. The design is also much more attractive compared to the other concepts. For the disadvantage, the fabrication process is very complex because of round shape at the stub axles. Possible way to make a round shape is by using a Computer Numerical Control Machine, (CNC), which takes a lot of work to do. Another disadvantage of this design is the sharp edge at the steering wheel.

Figure 3.3: Concept 3

3.4 EVALUATION TABLE AND CONCEPT DISCUSSION

Characteristic	Concept 1	Concept 2	Concept 3
Easy to fabricate	√	√	
Attractive		√	√
Low cost	√		
Easy to handle	√	√	√
Simple	√	√	
Safe		√	

Table 1.1: Evaluation Table

Table 1.1 shows the evaluation table for the concept designs. Five characteristics such as easy to fabricate, attractive, low cost, easy to handle, simple and safety of each designs are valued. After some discussion with the supervisor, final design is generated based on all of the three designs. Some parameters are noted as the guidelines for the sketching of final concept. The parameters are shorter steering column, round steering wheel for the safety of the driver, and the design with a acknowledge process only to be selected.

3.5 FINAL DESIGN

Figure 3.4 show the alteration from the design concepts. This design has been generated with some criteria. A slight addition at the track rods, steering wheel, design for the stub axle and the steering column are the improvement made from the other concepts. With consultation from the supervisor, the ball joint is added at the end of the track rods to enhance the smooth flow when steered. The design of steering wheel is also much easier to fabricate. Round edge of stub axle are modified with a simpler geometry design which can be done by using milling process. Shorter steering column with a small lock at the holder

Figure 3.4: Final Design

3.6 CONCLUSION

For this chapter, it is conclude that is important to generate the best concept by doing the concept selection and concept discussion. By showing the design to others, brainstorming ideas, opinion, and recommendation for the best design can be improved. The final design for this project is decided by discussion between supervisor and team members.

CHAPTER 4

FABRICATION PROCESS

4.0 INTRODUCTION

Manufacturing process in which an item is made (fabricated) from raw or semi-finished materials instead of being assembled from ready-made components or parts. This process is about using the material selection and makes the product base on the design and by followed the design dimension. Method used for this project involves measuring, cutting, bending, milling, lathe, drilling, grinding, welding and finishing. Fabrication process is difference from manufacturing process in term of production quantity. Fabrication process is a process to make only one product rather than manufacturing process that focus to large scale production. In the project fabrication process includes all part of components, except for bolt and nut, finishing accessories and ball joint which have to buy at the hardware.

4.1 MATERIAL OF THE PROJECT

Material of the project is only used mild steel. This material has excellent forming and welding characteristics. The balanced austenitic structure enables it to be severely deep drawn without intermediate annealing, which has made this grade dominant in the manufacture of drawn stainless parts such as sinks, hollow-ware and saucepans. Round hollow bar and flat bar are used as the base of this project.

4.2 PROCESS INVOLVE

To realize the final concept drawn, the fabrication process has to be done first. The fabrication process starts from dimensioning the raw material until it is finish as a desired product. The processes that involved are measuring, cutting, lathe, bending, milling, drilling, welding, grinding and lastly is finishing.

4.2.1 Measuring

Materials are measured to desired dimensions or location. To dimension and location it use the measurement tape. Basically it measure by use in millimeter. It must carefully when measure to get the same dimension with the drawing. The Figure 4.1 had shown the measurement process. All components are using this process.

Figure 4.1: Measurement process

4.2.2 Cutting

After measuring, marked materials are then cut into pieces. This part use cut-off to cutting large material. Clamp the material properly to avoid any accident and must wear goggle. The Figure 4.2 shown the cutting process by use cut off. Round hollow bar and flat bar are cut using hand cutter.

Figure 4.2: Cutting Process

4.2.3 Drilling

Drilling involves the creation of holes that are right circular cylinders by drill machine. For the drill bit used, it must be consider by looking back at the dimensions of the design. Before do drill, make sure the material is clamp properly. It must calculate the revolution per minute (RPM) to avoid any accident if the speed is very fast. The Figure 4.3 had shown the drilling process. Steering holder, tracks rods and steering column are components which undergoes this process.

Figure 4.3: Drilling process

4.2.4 Milling

Milling a material removal process, this can create a variety of features on a part by cutting away the unwanted material. For this design, main part which includes this process is stub axles. The machine must be operated with a supervision of person in charge, due to high risk of accidents. The workpiece must be clamped properly and the user should wear a safety goggle due to hot flying chips which can cause injuries to the eyes. Calculation for the right revolution per minute, (RPM) should be right. The milling process is shown in Figure 4.4. Face milling are mostly used to fabricate the geometry of the design of stub axles and for the finishing, Drilling process is also done using milling machine to make two holes at the stub axles.

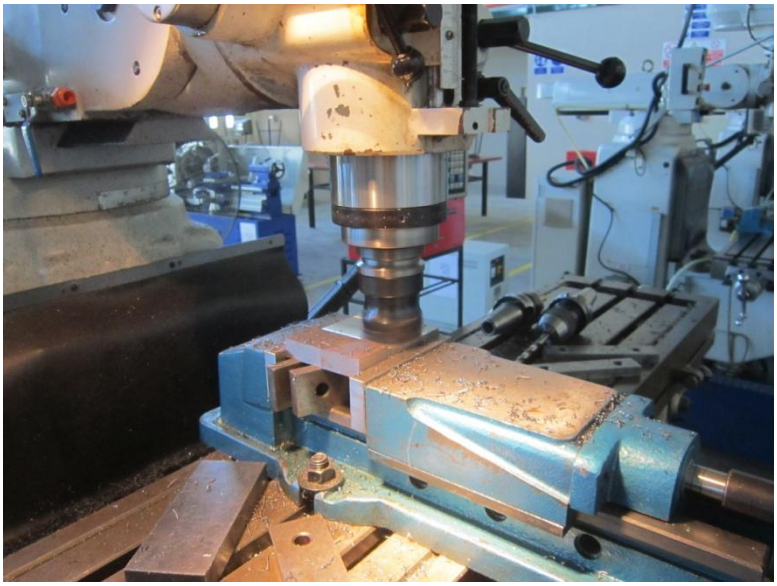

Figure 4.4: Milling Process

4.2.5 Turning

Turning is a form of machining, a material removal process, which is used to create rotational parts by cutting away unwanted material. The workpiece are clamped properly as it turns during the process. Choosing a sharp cutting tool resulted in getting a nice surface product. Figure 4.5 show the turning process, which involve during fabricating the stub axles. Raw material which is round bar are processed using this machine to create a short shaft for joining with the tires.

Figure 4.5: Turning Process

4.2.6 Bending

Bending is a process by which metal can be deformed by plastically deforming the material and changing its shape. Before operate this machine, safety precaution must be taken seriously. The hand of a user must be away from any rotating part. Emergency button must be pressed if the users want to change the placement of the workpiece. The bending process is shown in Figure 4.6. A component include for this process is only to fabricate the steering wheel.

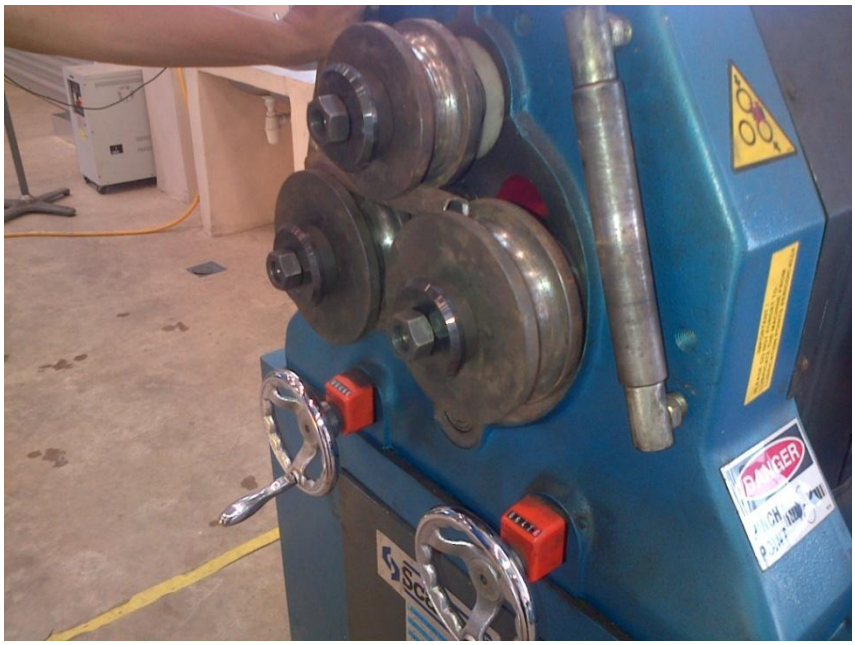

Figure 4.6: Bending Process

4.2.7 Welding

Welding is the process of permanently joining two or more metal parts, by melting both materials. For this project, it has many part of welding. When do the welding make sure wear the mask and glove to avoid any accident and welding it must carefully. The Figure 4.7 had shown the welding process by using Arc welding. All of the components are using this method of joining.

Figure 4.7: Welding Process

4.2.8 Grinding

Grinding is a finishing process used to improve surface finish, abrade hard materials, and tighten the tolerance on flat and cylindrical surfaces by removing a small amount of material. Hand grinder machine is used to remove unwanted crust from the welding process by abrade the materials. Safety goggle should be wear during this process. Grinding process is shown in Figure 4.8.

Figure 4.8: Grinding Process

4.2.9 Finishing

Any rough surface cause by welding spark were grind to give smooth and safe surface using grinding machine and followed by painting process. All of the components are painted white by using an oil paint as the base color as shown in Figure 4.9 in order to avoid corrosion. Then, the components are colored by using a spray to enhance its ergonomic value as shown in Figure 4.10. As for the steering wheel, it is wrapped with a badminton grip, in order to increase its gripping performance and for the driver's comfort as shown in Figure 4.11.

Figure 4.9: Components painted with white oil paint

Figure 4.10: Components sprayed with blue colour

Figure 4.11: Steering wheel wrapped with badminton grip

4.3 ASSEMBLY OF ALL COMPONENTS

The final phase of this project fabrication process is to assembly all parts and components. Suitable tools are required to tighten the bolt and nut. All of the part must be assembled in a correct ways in order to make it functional. The figure 4.12 shown the overall of final product, assembled with all or other main part, done by the team members. The details of each component such as dimensions are shown in the appendices section.

Figure 4.12: Final Assembly

4.4 CONCLUSION

For this chapter, it can be conclude the fabrication process is important to make a product with use mechanical lab equipment. High skills when operating the machines, equipments and tools are required to achieve a better quality of the product.

CHAPTER 5

RESULTS AND DISCUSSION

5.0 INTRODUCTION

The final fabrication of the steering system of an electric go kart is done from only limited times due to several problems occur to the project. In this chapter show how to assemble this steering system and the problem encountered during the whole project was been carried out.

5.1 OPERATING PROCEDURE

The steering system fabricated must be tested after being assemble with the chassis. Full functional of the steering only can be showed if the steering was assembled. The steering was steered to right and left side as shown in Figure 5.1.1 and Figure 5.1.2.

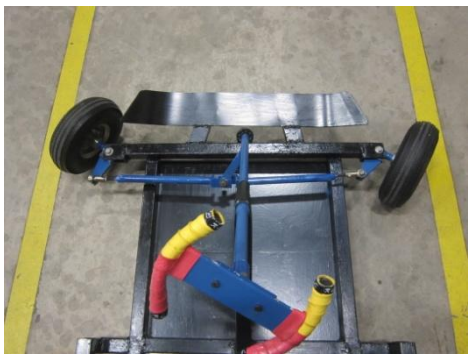

Figure 5.1: Steered to right

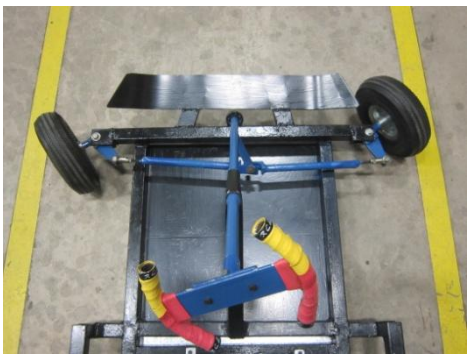

Figure 5.2: Steered to left

5.2 PROBLEM ENCOUNTER

The bearing used in front of the steering cannot be weld by using arc welding. The bearing expands, thus the ball inside of the bearing cannot rotate properly. As for the backup plan, the steering column has some two small lock at the steering holder to hold the steering column at its place.

There are so many things happen in fabrication the product during welding process such as defect. This defect happens because lacks of skill to operate a machine such as when handling arc welding. There is many type of defect occur during the fabrication such as gap, and bead.

Problem during this stage is very critical that make the project schedule is delayed. The problem comes when the use of tools and equipment inside the workshop are limited. Less power tools such as grinder inside the workshop delayed the schedule when the only process needed to complete the fabrication process of a certain part is only grinding process.

5.3 CONCLUSION

This chapter can conclude the operating procedure to use correctly. It also discuss about project problem during fabrication process.

CHAPTER 6

CONCLUSION AND RECOMMENDATION

6.0 INTRODUCTION

For the final chapter it represent about conclusion and recommendation for the project. In this chapter will discuss mainly about the conclusion of the project, concluding all the process that involved. Besides that this chapter also contains recommendation about the project. So for this recommendation it can make improvement about the project in the future

6.1 CONCLUSION

The objective of the project is to design and fabricates. The objective has successfully done and achieved. This product is already available in the market, but the cost is expensive and it only available in a urban place such as city. Thus, the idea to fabricate low cost and simple design of steering system for electric go kart is induced.

The title obtain from the supervisor seems to be simple at first, but after gone through some readings and research, the selecting a suitable fabrication process might be troublesome. Skills which have been learned during first semester and second semester at Universiti Malaysia Pahang, UMP, are the most challenged. Within short time, the basic procedure to operate the milling and lathe machine are revised with the help from the person in charge for the General Machining Lab. Selections of a suitable cutting tools, safe cutting speed to avoid tools failure are all supervised by the person in charge, PIC.

During the Final Year Project, FYP, session, the many skills have been improved. Most of the skills improved are technical and the communication skills. All of the processes are done with effort and knowledge. It can be conclude that the Final Year Project is very important to test the skills and the quality of the students. Punctuality, achieve the work objective and the scope of work are truly important as the industry nowadays are looking for an employee who can follow those parameters.

6.2 RECOMMENDATION

Lighter material for this design can be change for a better appearance. As for a certain component such as track rods, smaller diameter of round hollow can be used to make it more attractive. Another important thing for a recommendation is the maintenance. For majority of the components, all of them which can be dismantled are useful if any of the components need to maintenance. However, the steering column which has been weld with the front bearing and hold with a stopper are harder to maintenance. Slight change at the design of steering column by using a fastener such as bolt and nut can be used instead of welding process.

Based on the progress of the project during the fabrication process, so many things in facilities aspects can be improved especially in welding process. Metal Inert Gas, MIG, welding machine which is easier to use are limited and only can be used by a degree student for their project. The faculty should upgrade their lab facilities because most of the student delayed their work and progress due to lack of machines, power tools and equipments.

Another recommendation which should be taken seriously is the budget problem. The students have to use their own money first to buy materials which are unavailable in store. Claim process which takes times to be approved might be a problem for the student which has some financial problems. The faculty should provide the budget first for the student before the project start, thus it can be considered before designing any project which required a high cost.

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5) http://www.superkartworld.net/news/news06/news25_jan07/news25_jan07.html, dated on October 4th, 2012

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8) http://what-when-how.com/automobile/steering-systems-automobile/, dated on November 4th, 2012

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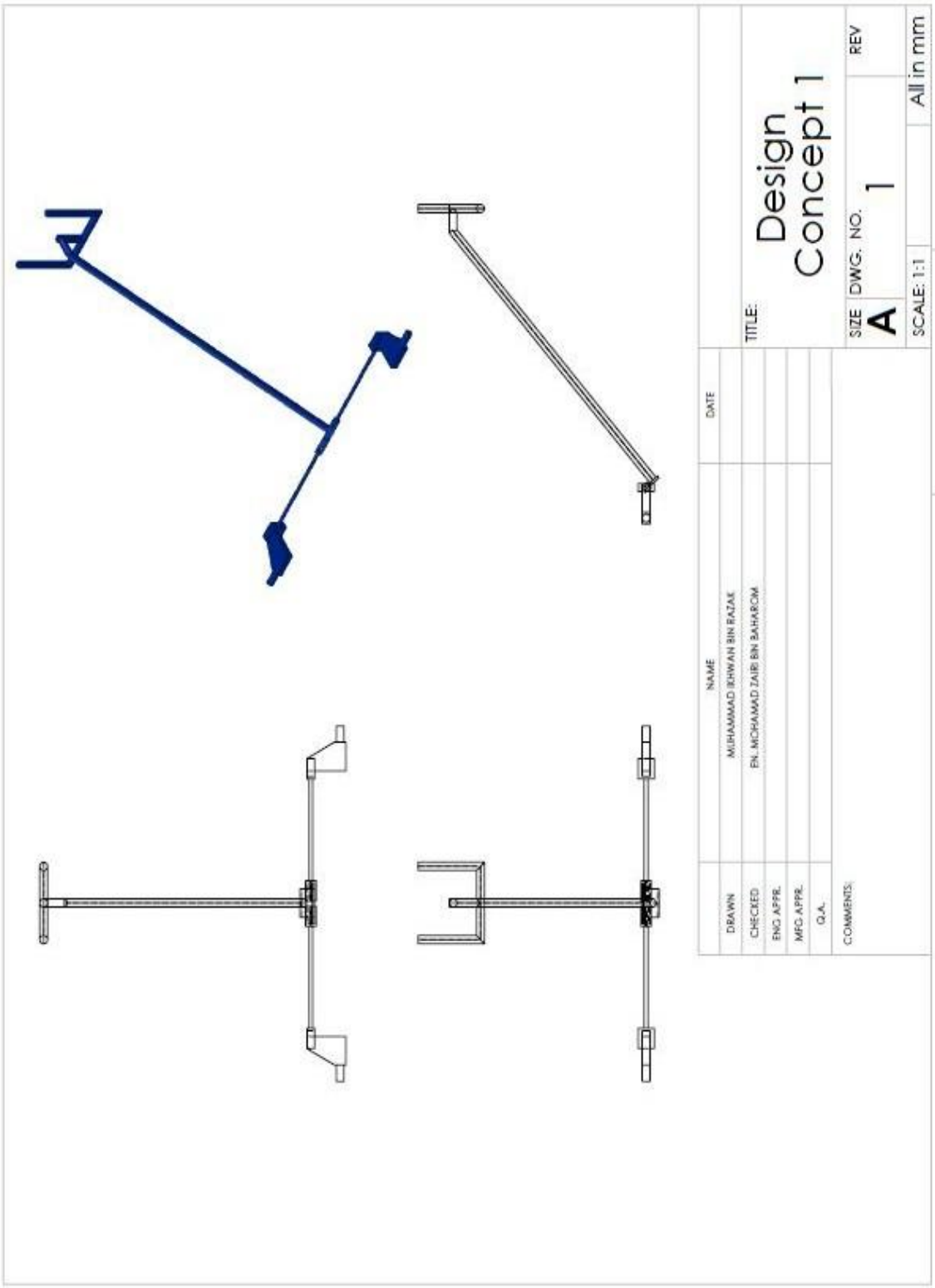
10) http://en.wikipedia.org/wiki/Milling_machine, dated on November 4th, 2012

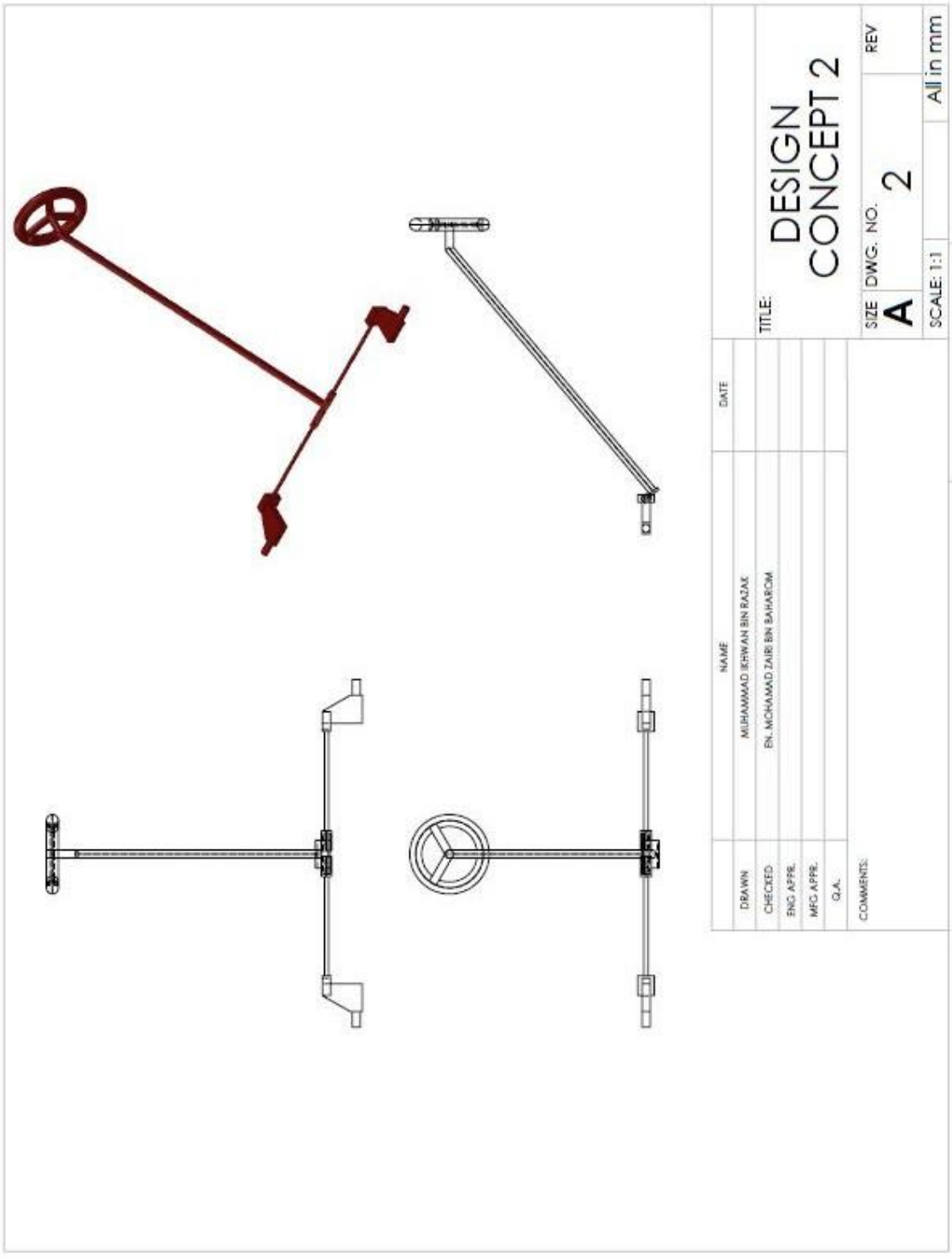
APPENDIX A1

Blueprint Design Concept 1



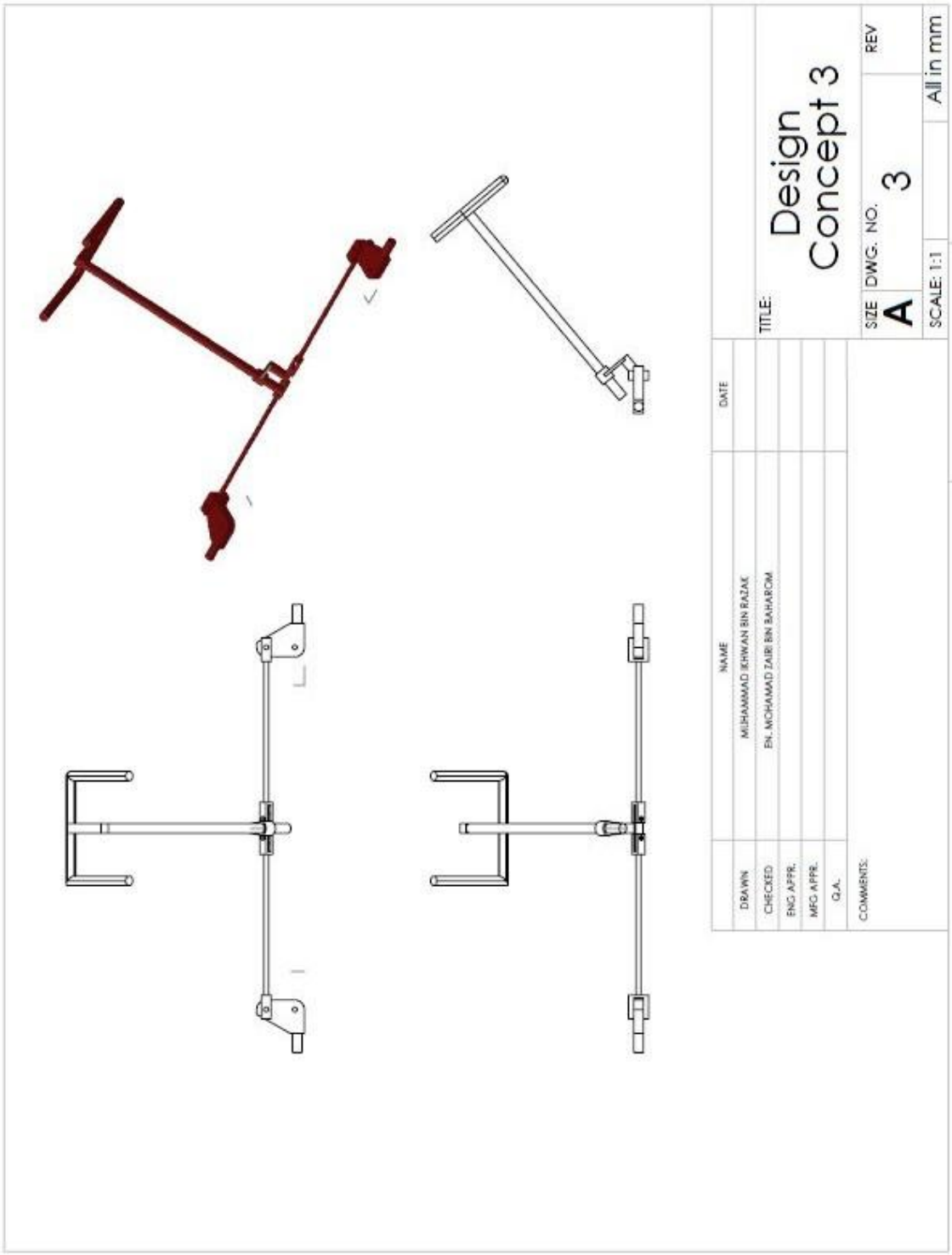
APPENDIX A2

Blueprint Design Concept 2



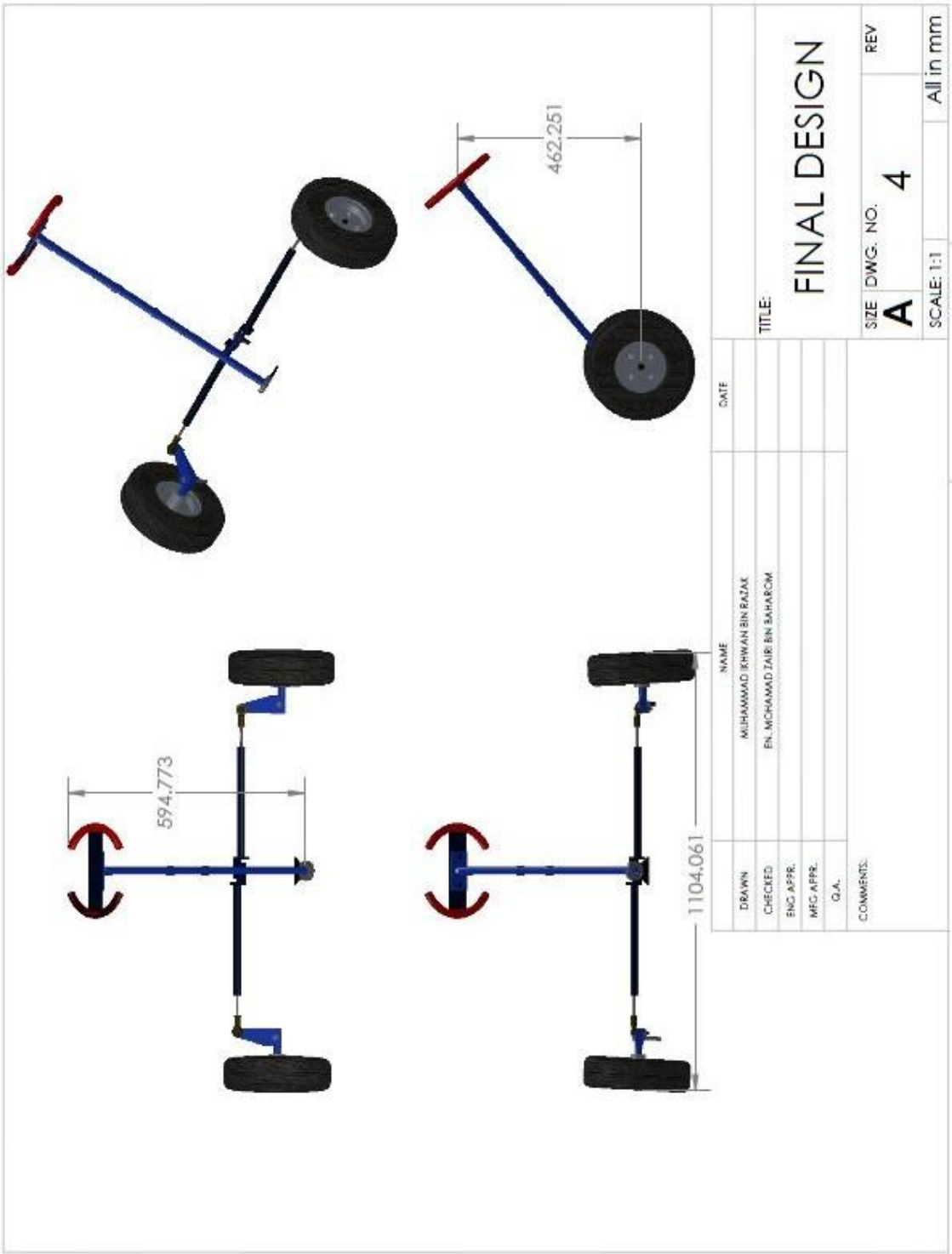
APPENDIX A3

Blueprint Design Concept 3



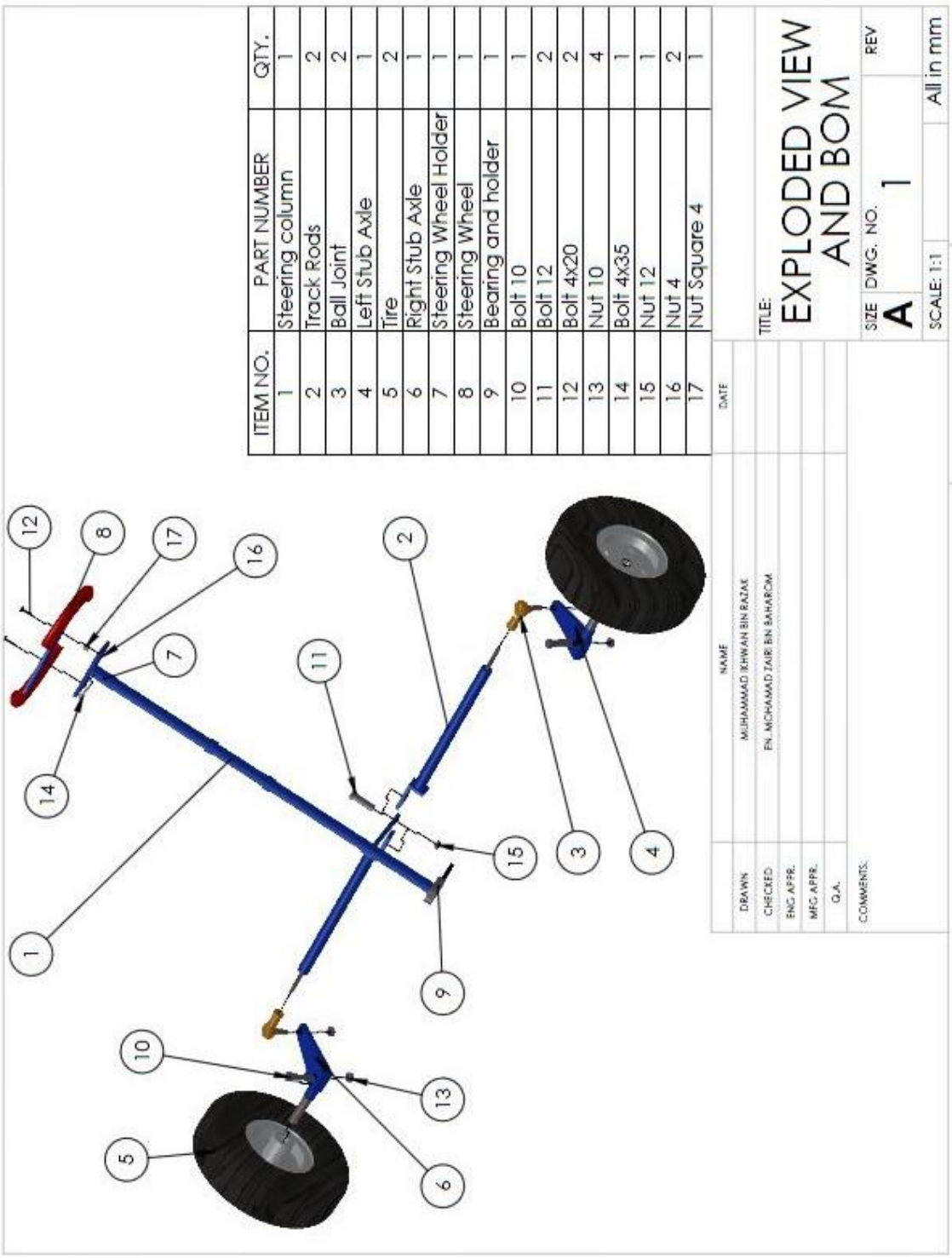
APPENDIX A4

Blueprint Final Design



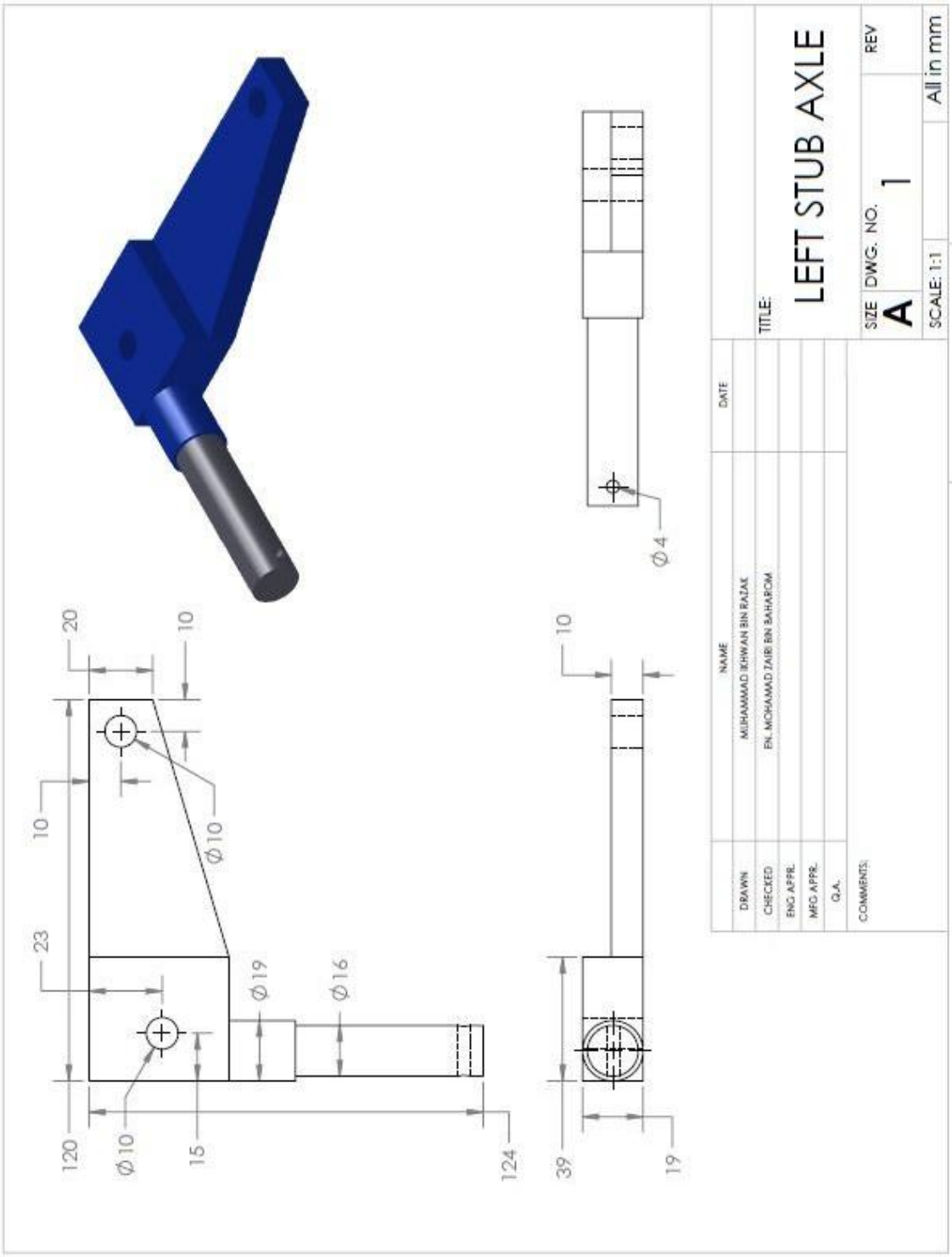
APPENDIX B1

Exploded View and Bill. Of Material (BOM)



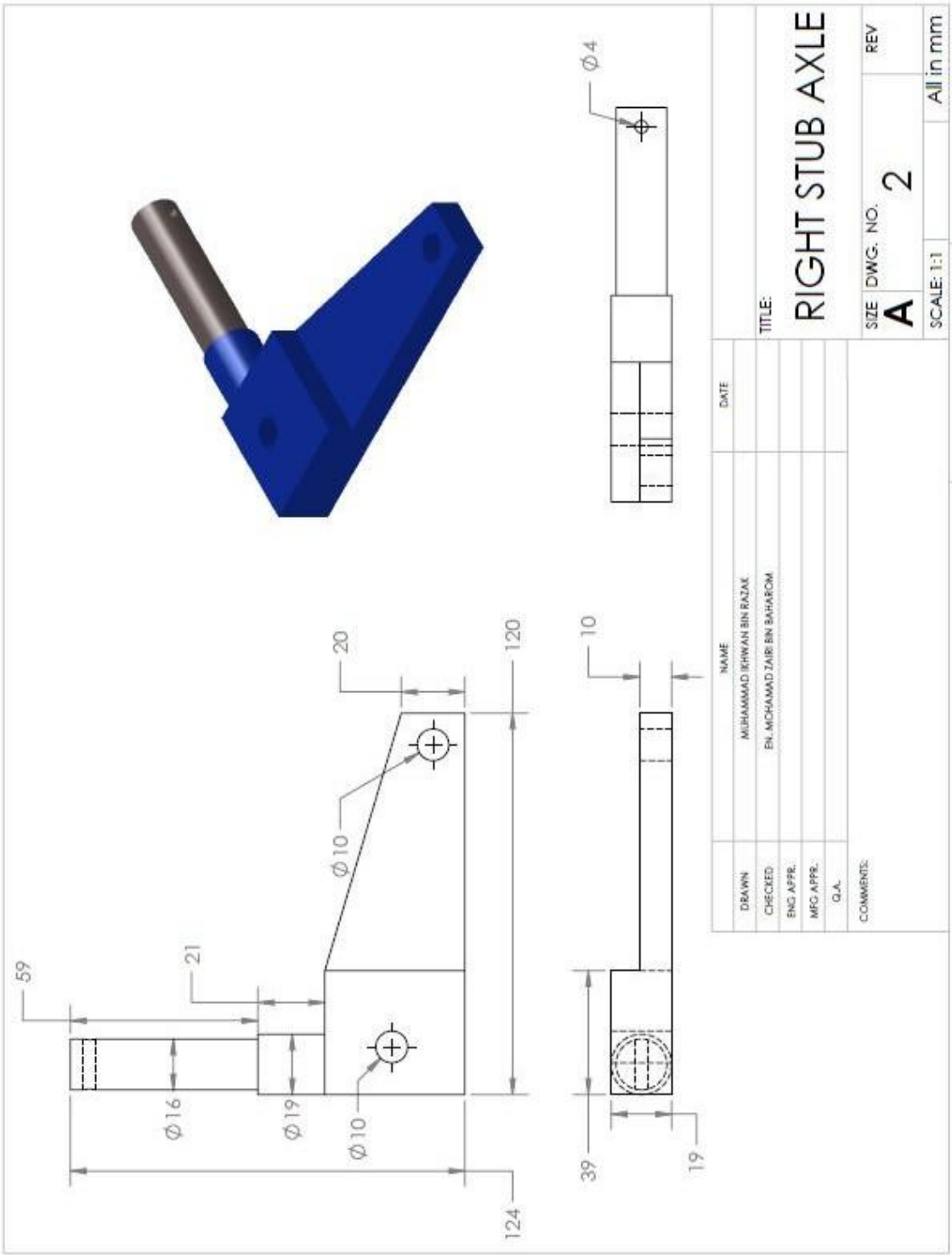
APPENDIX C1

Blueprint for Component (Left Stub Axle)



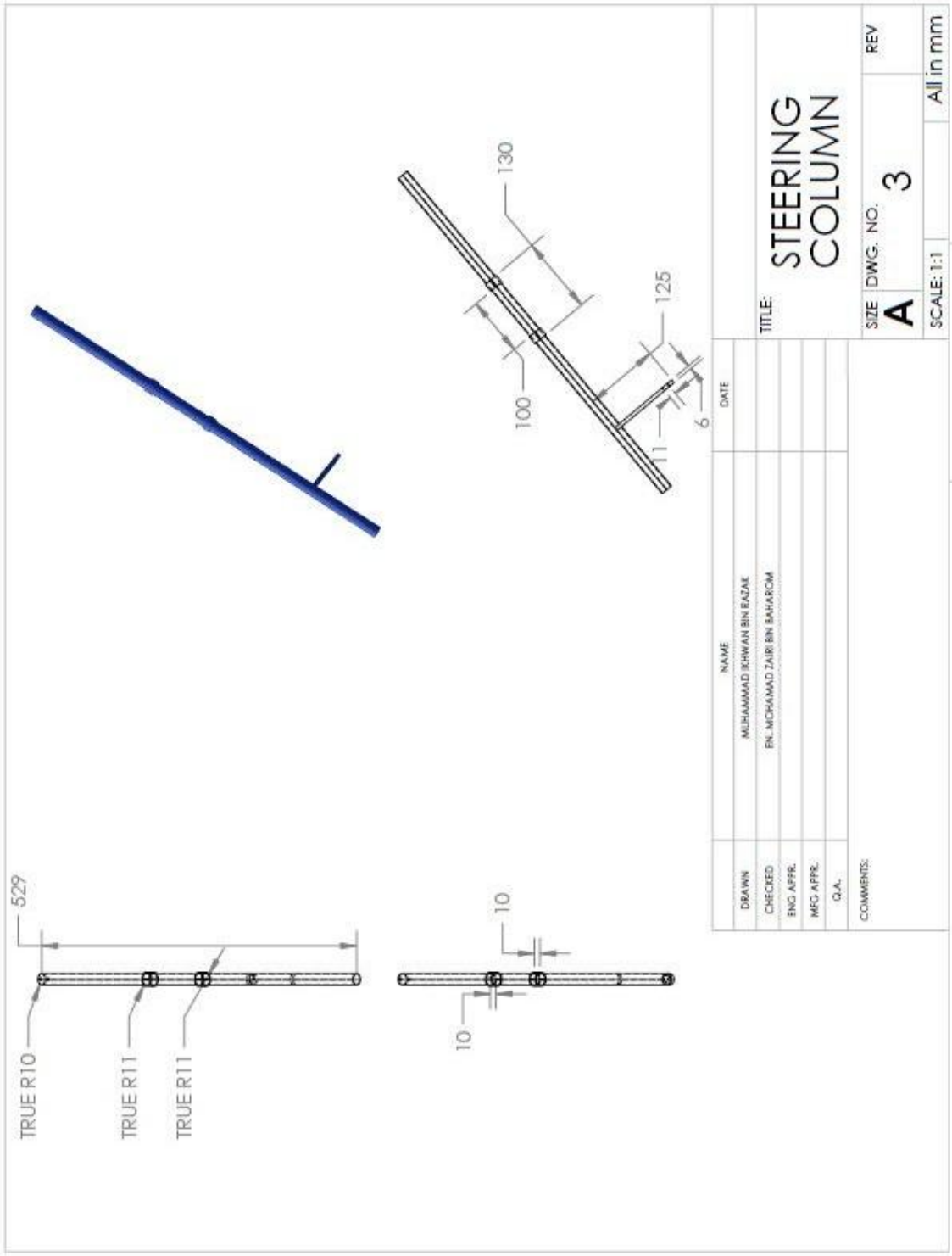
APPENDIX C2

Blueprint for Component (Right Stub Axle)



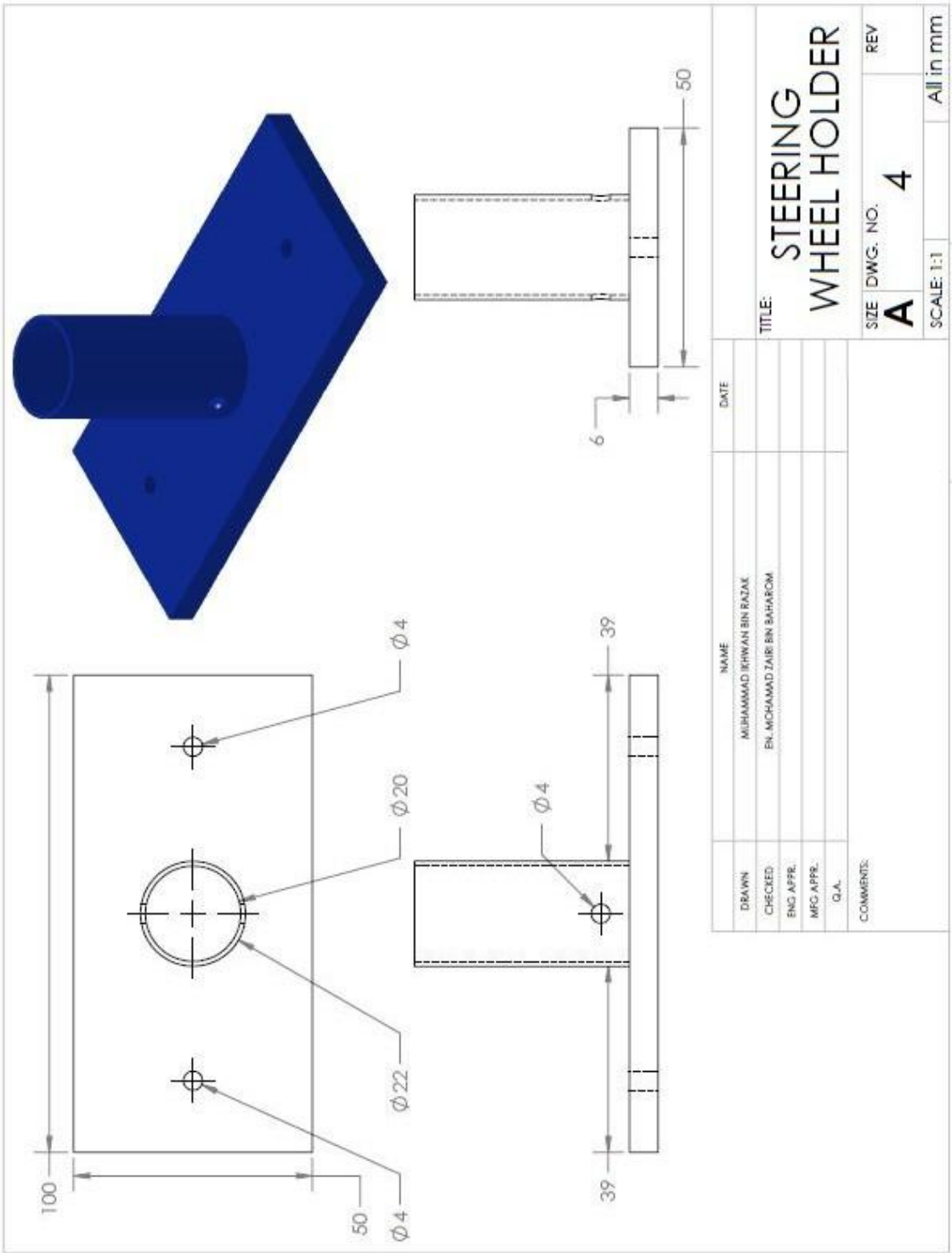
APPENDIX C3

Blueprint for Component (Steering Column)



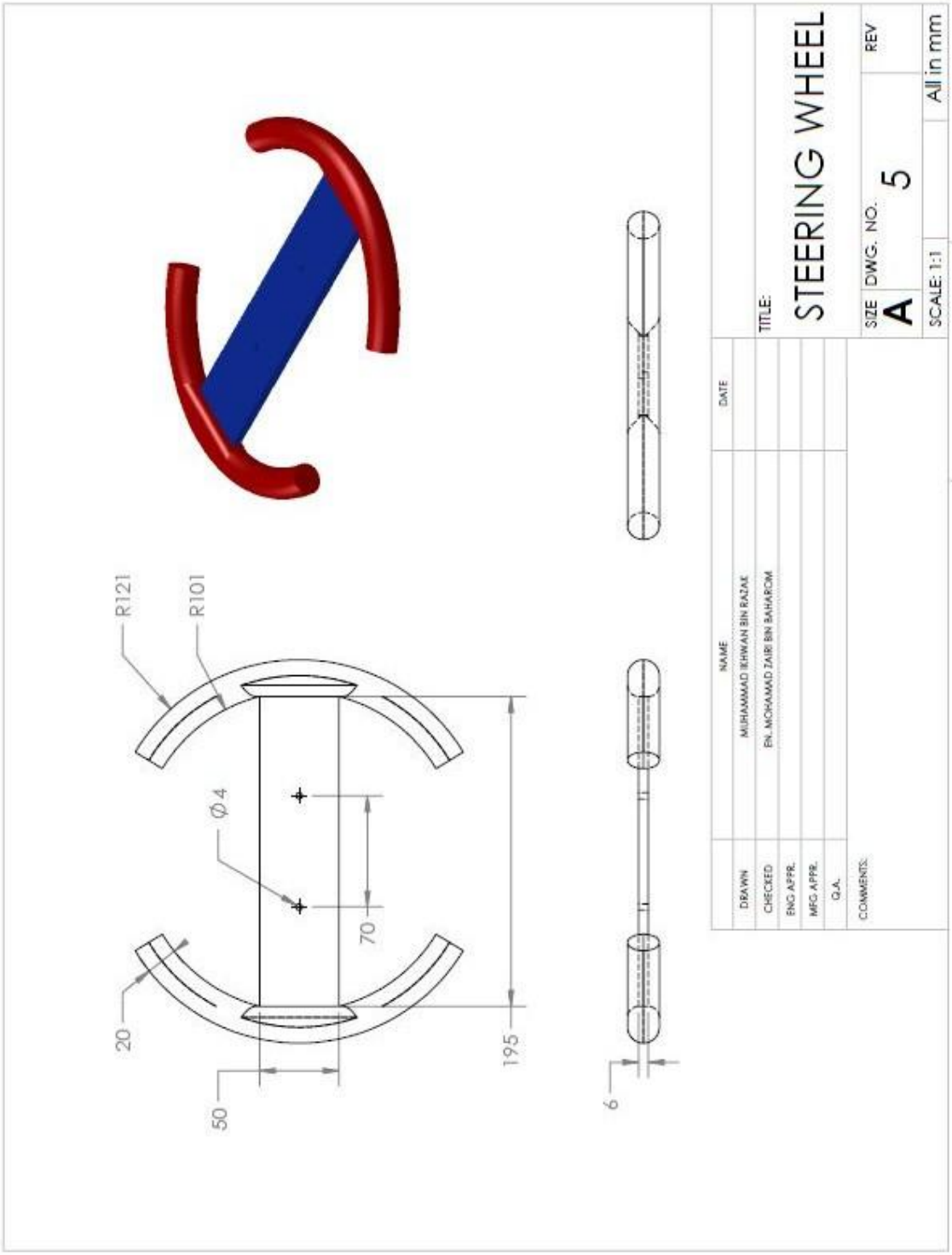
APPENDIX C4

Blueprint for Component (Steering Wheel Holder)



APPENDIX C5

Blueprint for Component (Steering Wheel)



APPENDIX C6

Blueprint for Component (Track Rod)