A Project Report On

Design And Fabrication of Automatic B-Cradle

Submitted in partial fulfillment of the requirements

for the award of the degree of

BACHELOR OF TECHNOLOGY

in

Mechanical Engineering

by

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(AUTONOMOUS)ANANTHAPURAMU
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2022-2023

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Certificate

This is to certify that the project report entitled Design And Fabrication Of Automatic B-Cradle is the bonafide work carried out by **S.Shahid Salman** bearing Roll Number **194G1A0388**, **R.Venkatapathi Naidu** bearing Roll Number **194G1A03A3, R.Vinay Kumar Reddy** bearing Roll Number **194G1A03A6, K.Vishnu Priya** bearing Roll Number **194G1A03A8, S.Shahir** bearing Roll Number **204G5A0320,** and **V.Vasanth Kumar** bearing Roll Number **204G5A0322** in partial fulfilment of the requirements for the award of the degree of **Bachelor of Technology** in **Mechanical Engineering** during the academic year 2022-2023.

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ACKNOWLEDGEMENT

The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of people who made it possible, whose constant guidance and encouragement crowned our efforts with success. It is a pleasant aspect that we have now the opportunity to express my gratitude for all of them.

It is with immense pleasure that we would like to express my indebted gratitude to my Guide **Mrs. T. Kiranmayee, Assistant Professor, Mechanical Engineering,** who has guided me a lot and encouraged me in every step of the project work. We thank him for the stimulating guidance, constant encouragement and constructive criticism which have made possible to bring out this project work.

We are very much thankful to **Mr. C. Jayapal Reddy, Assistant Professor & HOD, Mechanical Engineering,** for his kind support and for providing necessary facilities to carry out the work.

We are very much thankful to **Dr. D. Sai Chaitanya Kishore, Director of IQAC, Mechanical Engineering,** for his kind support and for providing necessary facilities to carry out the work.

We wish to convey our special thanks to **Dr. G. Balakrishna, Principal & Mr. U. Sreenivas, Vice Principal** of **Srinivasa Ramanujan Institute of Technology** for giving the permissions in doing our project work.

We wish to convey our special thanks to **Dr. M. Ranjith Kumar, TPO & COE of Srinivasa Ramanujan Institute of Technology** for giving the permissions in doing our project work.

Not to forget, we thank all other faculty and non-teaching staff, and my friends who had directly or indirectly helped and supported us in completing our project in time.

We also express our sincere thanks to **Smt.J. Padmavathy, Chairperson** and **Sri A. Sambasiva Reddy, Secretary & Correspondent** of **Srinivasa Ramanujan Institute of Technology** for providing excellent facilities**.**

Finally,we wish to convey our gratitude to our family who fostered all the requirements and facilities that we need.

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ABSTRACT

The project idea develops from the very fact that a parent finds it difficult to concentrate on their child as of their busy life. . The situation aggravates when they have a job or have some household business, since they can neither compromise with their work nor can they ignore their child's needs. The microcontrollers can have eventual breakdowns that would simplify some present Parents problems. It is impossible to manage both house work and office work while taking care of baby so the women has deeply feels stress. so the women facing these problems also increased the solution for these problems introduced “Automatic B-Cradle” have been introduced

Cradle is an appliance which is used to carry a baby and for the comfort sleep of a baby. E-Care is a concept in which automatic movement of cradle when baby is disturbed, keeping track of baby mattress, maintaining hygiene of the baby and much more is possible. Unlike some of the existing models, which uses a microprocessor as the main controlling unit, this model uses slotted lever mechanism used for the cradle swing makes smooth transition. The equipment of Baby care includes a dc motor, and different types of sensors performing different operations. when the baby starts crying its automatically detect the sound and start moving after 10sec and when the baby stop crying it detect and stop swing after 1min. The motor driver attached to the motor maintain constant speed. Good quality, less weight material is used for the manufacturing of The Baby cradle. We can control the speed of automatic swing cradle, its constantly tracking the baby moisture and display the cradle swing speed moisture of baby like(dry or wet mattress) in lcd display, an buzzer sound will be make if any abnormal activity is detected (like wet mattress). Baby care is the most user friendly, automated mechanism for baby care in the modern nuclear family.

Key Words: Slotted lever mechanism, Cradle, Arduino sensor, DC servo motor, Battery

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CHAPTER 1

INTRODUCTION

In today's world, everyone is busy in their own life. Nowadays, even the mothers are working and there is a requirement of unattended cradle. The proposed E-Cradle is a novel solution to this problem. In the proposed design, there will be a circuit placed along the cradle which will sense the sound intensity of the cry of the child and takes necessary actions based on the sound intensity of the child's cry. Generally, the baby cradle is used to relax and help the baby fall asleep. For example, parents must look after their child till the infant goes to sleep. However, traditional cradle does not have provisions such as a battery or an adapter to automate the cradle. These traditional cradles are more common in villages or rural areas due to its less cost and availability. But the fact is that we need human beings to take care of infant and your baby might not feel safe and comfortable in the normal cradle system. so, we would like automate the cradle system to take care of infant that consists of an independent power source. Parents in the present world are busy in their professional life, so they do not get sufficient time to take care of their babies. It may be expensive for the household to afford a nanny. Today’s woman must manage home along with their office work simultaneously.

Cradle system will give parents required time to parent for rest, as if the parents both mother and father goes for the job or even if the mother is house wife. Being stress free will create the great atmosphere which will make great atmosphere around the baby. So, it does not matter if there is no one to swing cradle it will do swing automatically if the baby is crying. It does not matter if baby has done pee and no one knows about for long time, but not need to worry cradle system will also give the alert about the wetness in cradle. This cradle system will help the parents, so that they can take good care of their baby.

The modules in cradle system from which any one will be operated after any kind of situation that are given as follows: If the baby is making noise or baby is crying then sound sensor will hear that frequency and it will start swing. After long working hours, they must take care of the home along with the baby. They may not get enough time to swing the cradle manually and sooth the bSaby. Moreover, in today’s life style, it is very difficult even for the housewives to sit nearby their infants

and sooth them whenever they cry. Hospitals have neonatal and maternity units. Nurses in these units must take care of baby and sooth them whenever they cry.

Table 1.1 Height and Weight Chart for Baby

Months	Boys		Girls	
	Weight(kg)	Height(cm)	Weight(kg)	Height(cm)
0	3.3	49.8	3.31	49.2
1	4.4	54.8	4.35	53.8
2	5.5	58.4	5.3	56.1
3	6.4	61.4	6.03	59.9
4	7	64	6.62	62.2
5	7.53	66	7.17	63.3
6	7.94	67.5	7.53	64.1
7	8.3	69	7.9	67.3
8	8.62	70.6	8.21	68.8
9	8.9	71.8	8.53	70.1
10	9.12	73.1	8.8	71.6
11	9.43	74.4	9.03	72.8
12	9.66	75.7	9.25	74.1
13	9.89	76.9	9.53	75.1
14	10.12	77.9	9.75	76.4
15	10.3	79.2	9.98	77.7
16	10.52	80.2	10.2	78.4

1.1 OBJECTIVE

As developing this project, some project objectives had been specified. The main purpose of this project is to add more safety feature to the baby cradle. Some objectives of this project had been identified and listed as below: -

- The motor driver attached to the motor maintain constant speed.
- In this we use slotted lever mechanism for smooth moment of cradle. We can control the speed of automatic swing cradle.
- its constantly tracking the baby moisture and display the cradle swing speed moisture of baby like (dry or wet mattress) in lcd display, a buzzer sound will be made if any abnormal activity is detected (like wet mattress).

- To make cradle innovation that is more flexible and less expensive to market.
- User friendly- simple and complete with instruction.

1.2 PROBLEM STATEMENT

As to fit into ages of 21st century, there are various types of improvement and changes on baby cradle from manual to automatic. Even though there are many improvements and changes on baby cradle, the baby cradle still lacks safety feature where the kids around age 2 years old to 4 years old tends to drop himself while the cradle still swinging and that might cause the spring over-stretched due to movement the baby inside the cradle and causing the cradle collapsing onto the kids. At the same time, the parents or the babysitter that not being around with the baby may not able to help the baby from the accident as the accident is occurs for long time. Besides, Malaysia surprised by the increased a lot of cases baby fell from the cradle. There were 4 cases involving the babies in accident using the cradle but in 2016 the number of accidents using baby cradle was 2 cases. In the 2017, the number of accidents using baby is rising again as much as 4 cases and slightly increased to 6 cases in 2018. So, the data shows the number of accidents per year using the baby cradle is becoming more serious from year to year and need to be control or solves as soon as possible.

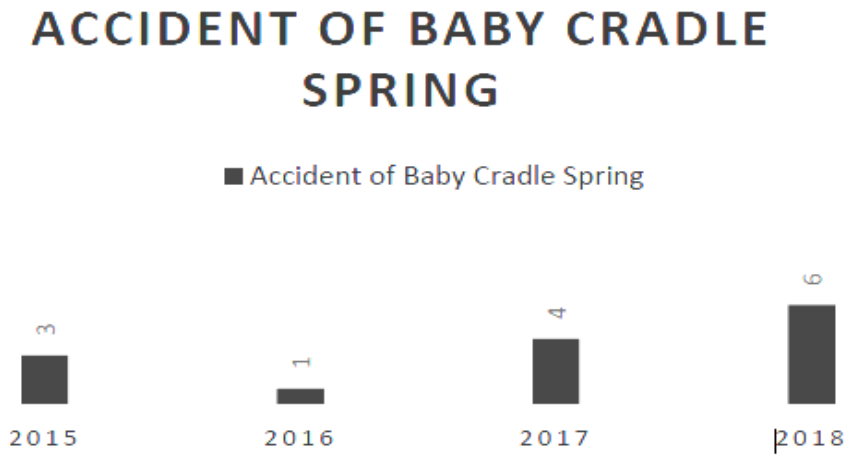

Figure 1.1 No of accidents occurred due to cradle in Malaysia

So, we are focusing on making a safe automatic cradle for the ease of mother to pamper their children and make the babies feel more comfortable on cradle by making it safer.

1.3 IMPORTANCE OF RESEARCH

This project is as the primary steps before entering the working situation or industrial practice. With this kind of experience in making this project successfully, the student will be more prepared with all kind emergency, high pressure and being professional in making decision or solving problems.

The student also able to work as a group or a team and developed a high quality as a worker. Furthermore, the student will be more sensitive about the current issues and try to find a solution to solve the problem. Lastly, being innovative and creative is most likely what our country needs.

CHAPTER 2

LITERATURE REVIEW

From the normal cradle to the automatic swing cradle, there are many types of the cradle. The use of baby cradle came in when the security of the baby was at risk, it would be cozier for a baby to sleep in a cradle or in confinement which is specially made for them with extra bedding such as blankets or quilts. It was further modified in such a way that they are portable. Parenting infants is a difficult task in the initial stages. It becomes difficult for parents to understand the language of their infants but baby monitors help to try and understand their infants by providing them with vitals so the parents can understand the cause of uneasiness experienced by the baby. Mainly, when the parents are not nearby, the swinging motion helps baby relax and take a short nap. This was why some automatic swinging cradle was developed. For taking care of the baby there were some nannies who were getting paid for taking care of baby.

Many home-care systems are available but majority of this system are specially designed for the aged people and patients. These systems can monitor their health status, automatically send out emergency signals, and have other functions. However, the caring methods for infants are not the same. Children and adults require different type of care because they are totally dependent for their normal functions on someone else. Infants cannot give any feedback about their discomfort or health complaints. Infants cannot express themselves like old people, e. g when an infant has a fever, he/she can only express his/her discomfort by crying. Hence, a home-care system specially designed for infants is today's need which would substantially lighten parents' especially mother's burden. In support of this requirement many research papers and patents for healthcare application are studied with the intention of possible solutions to take care of the infant.

Before concluding to the system that we must build, we surveyed some of the research papers that are as follows:

2.1 LITERATURE REVIEW

- **Raja Ramesh**

  They used an electric powered motor which will actuate the links by shaft. Links actuates the rod attached to the bed at constant speed. The

carriage is attached to the metal rod through links which will provide an oscillating motion. It will also ensure the cradle motion even when the baby cries or moves using sensors. Motor, links, and sensors are attached to the side of the cradle frame. When the motor rotates in clockwise direction it pushes the bassinet to front side & when motor rotates in anticlockwise direction it pushes the bassinet on the Either side. And in this way the system will keep working.

- **P M Sirsat**

  They used an DC motor will provide rotational motion according to its rated power. As per microcontroller programming the motor rotates in clockwise direction for given certain time period and in anticlockwise direction for certain time period. When the motor rotates in clockwise direction it pushes the bassinet to front side & when motor rotates in anticlockwise direction it pushes the bassinet on the Either side. And in this way the system will keep working.

- **Misha Goyal and Dilip Kumar**

  They designed a E-Baby Cradle swings automatically when baby cries, for this it has a cry analyzing system which detects the baby cry voice and accordingly the cradle swings till the baby stops crying. The speed of the cradle can be controlled as per the user need. The system has inbuilt alarm that indicates two conditions first when the mattress is wet, which is an important parameter to keep the baby in hygienic condition, second when baby does not stop crying with in a stipulated time, which intimated that baby needs attention.

- **Canute Sherwin**

  They proposed a system that uses a noise sensor which detects the sound of the baby cry and sends signal to the Arduino Mega Board, which then send signals to the motor for the swing of the cradle. In the Wet Bed Sensing system, a wet bed sensor is placed on the bed when the baby wets the bed the sensor detects the water content and signals to the Arduino Mega Board, which then send signals to the Buzzer which acts as the alarm, hence warming the parents about the wet bed.

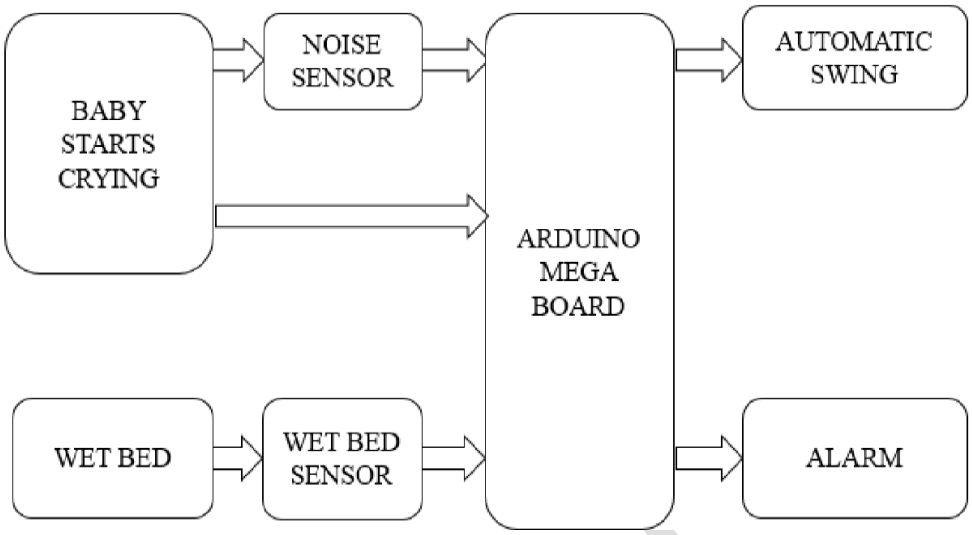

Figure 2.1 Circuit configurations

The automatic swing circuit include a mic which is connected to the Arduino board and a 5V relay which acts as a switch to turn the motor on and off. When the baby starts crying the mic receives the input and gives a signal to the Arduino board which in turn triggers the relay to turn on the wiper motor which has a link connected to the cradle, that will swing the cradle in a rocking motion.

The wet bed sensing system uses a soil moisture sensor to detect that the baby had wet the bed, the soil moisture sensor detects the wetness and then gives a signal to the Arduino board, the Arduino board then triggers the busser connected to it which then sounds the alarm, to notify the parents that the baby has wet the bed.

- **Rekha Devi**

They proposed a system that consists of cry sensor, wet sensor, and application for smart phone. The proposed system is attached to the cradle. When baby cries or wets mattress, sensor detect and send the signal to the microcontroller. Motor driver is attached to the controller after getting signal from controller it starts swinging the cradle. Simultaneously microcontroller also send signal to the server, and server enables webcam. After that webcam clicks the picture of baby. These pictures are uploaded on the server and stored in database. On the other hand, an android application is developed and installed on parent's mobile phone. With the help of this android application parents can login and see the pictures of baby from anywhere anytime.

2.2 SUMMARY

A feasibility study of a system proposal is according to its workability, which is the impact on the organization, ability to meet their user needs and effective use of resources. Thus, when a new application is proposed it normally goes through a feasibility study before it is approved for development.

The document provides the feasibility of the project that is being designed and lists various areas that were considered very carefully during the feasibility study of this project such as Technical, Economic and Operational feasibilities.

The system must be evaluated from the technical point of view first. The assessment of this feasibility must be based on an outline design of the system requirement in the terms of input, output, programs, and procedures. Having identified an outline system, the investigation must go on to suggest the type of equipment, required method developing the system, of running the system once it has been designed.

The project should be developed such that the necessary functions and performance are achieved within the constraints. The project is developed within latest technology. Through the technology may become obsolete after some period, because newer version of same software supports older versions, the system may still be used. So, there are minimal constraints involved with this project. The system has been developed using Java programming.

The developing system must be justified by cost and benefit. Criteria to ensure that effort is concentrated on project, which will give best, return at the earliest. One of the factors, which affect the development of a new system, is the cost it would require. The following are some of the important financial questions asked during preliminary investigation.

- The costs conduct a full system investigation.
- The cost of the hardware and software.
- The benefits in the form of reduced costs or fewer costly errors.

Since the system is developed as part of project work, there is no manual cost to spend for the proposed system. Also, all the resources are already available, it gives an indication of the system is economically possible for development.

CHAPTER 3

DESIGN AND MODELLING

3.1 SYSTEM DESIGN

It may be defined as a process of applying various techniques and principles for the purpose of defining a device, a process, or a system in sufficient detail to permit its physical realization.

The system design develops the architectural detail required to build a system or product. The design phase is a transition from a user-oriented document to a document to the programmers or database personnel. System design goes through two phases of development: Logical and Physical Design.

3.2 CATIA

CATIA is the product design software developed and created by Dassault Systems. This is a multinational software company based in France. The software is commonly used in manufacturing industries and Original Equipment Manufacturers (OEMs) to increase designing, analyzing, and managing new products.

3.3 WHY WE USE CATIA?

- CATIA have multiple platforms but the software is most used for Computer Aided Design (CAD).
- CATIA have six modules in CAD platform.

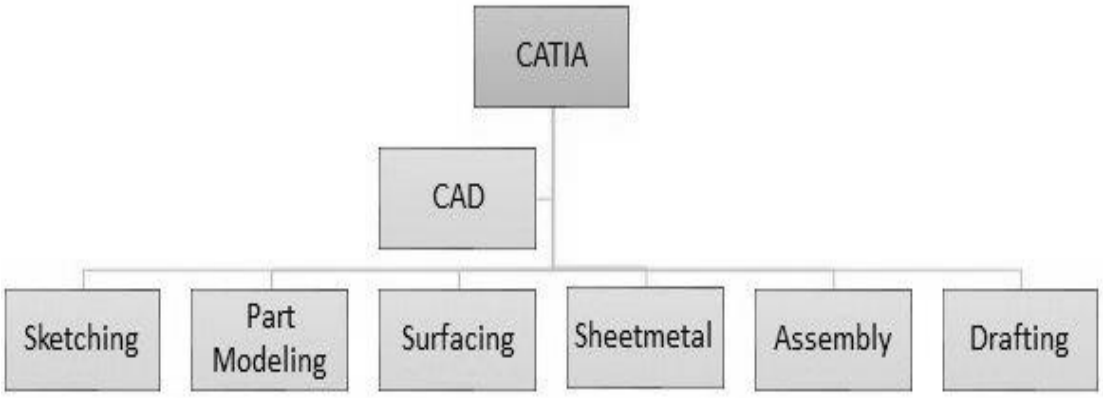

Figure 3.1 Types of modules in Catia

- **Sketching**

1. You can sketch fully defined sketches in CATIA.
2. CATIA is not only the multi-platform software but also fully parametric one.
3. That is why you can use CATIA sketch in any other module like part modeling.

- **Part Modelling**

1. With crazy features like Boolean operation and good CATIA practice you can design almost anything.
2. Mostly use for solid modeling.

- **Surfacing**

1. The most exciting module of CATIA is surfacing, that is why most of automotive and aerospace companies use CATIA for body design.
2. There are 21 types of sweep surface commands in surfacing module which give you the privilege to generate any shape.

- **Sheetmetal**

1. Sheetmetal is module, where you deal with metal formed into thin sheets by rolling or hammering.
2. While designing the Sheetmetal product like car floor pan you need some special tool and the CATIA training.

- **Assembly**

1. Assembly is applying constrains and making mechanism through number of parts.
2. With the CATIA you can also generate simulations.

- **Drafting**

1. Drafting is a way of communication among designer, collaborators, production department and marketing of management personnel.
2. The completion of the set of drawing necessary for the manufacturing of the product.
3. You need to know Geometric Dimensioning and Tolerance (GD&T) for this drafting module.

3.4 CRADLE

The baby cradle is a place where the place for to make the baby fall asleep. The baby is already used at 15th century. At that time, the wood cradles mounted on

rockers was so popular and gradually superseded in the 18th and 19th centuries by sarong cradle that were slung between end supports in order to raise them higher from the ground. In much of the world, cradles were gradually replaced by the barred crib in the early 20th century. The innovations and inventions always have been made on the baby cradle from times to times, due to safety factors of the baby when using the cradle.

The baby cradle can be found in many types in different innovation and invention to more advance than before includes manual to automatic. So, this previous research is mainly separated into Sarong cradle, Stationary cradle cribs, and Bassinet Cradle.

3.4.1 CRADLE TYPES

- **SARONG CRADLE**

Sarong cradle can be found in 2 types such as

1. Manual
2. Automatic.

The manual sarong cradle is a traditional type that has been used for many generations. The manual sarong cradle needs a man power to swing the spring.

The automatic sarong cradle is one kind of advanced technology nowadays, it is computerized which is means the whole operation process of the cradle by receiving the information/signal. It is using the electric source as the main power to start the motor and it is clearly does not use the man power to swing the spring. The timer and speed are can be controlled by adjusting it to avoid Shaken Baby Syndrome (head injury – brain damage).

Figure 3.2 Manual Sarong Cradle

Figure 3.3 Automatic Sarong Cradle

- **STATIONARY CRADLE CRIBS**

Stationary cradle crib is one of the cradles that has been using for a long time since 1600s – 1800s. So, the system of this cradle has been developed and evolved from times to times.

Stationery cradle can be called as an ancient cradle because it is the first cradle have been introduced into the world and early at 15th century and still used nowadays. Stationery cradle is a traditional cradle four-legged structure with a sunken bed surrounded by bars. Co-Sleeping Cots is a crib that can be placed beside the adult's bed with one side lowered as a flap.

Figure 3.4 Stationary Cradle Cribs

- **BASSINET CRIB**

A bassinet is typically a basket like structure on free standing legs, often with casters. A cradle id typically set in a frame, but with the ability to rock or glide.

Figure 3.5 Bassinet Crib

3.5 PARTS MODELLING IN CATIA:

3.5.1 Ball bearing

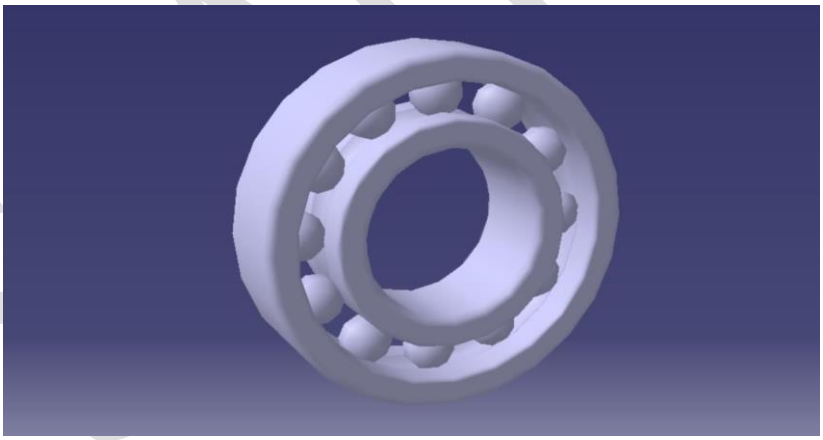

Figure 3.6 Ball Bearing

A ball bearing is a type of rolling-element bearing that uses balls to maintain separation between the bearing races. It is a common component used in various machinery and equipment, including automobiles, aircraft, industrial machines, and household appliances.

The function of a ball bearing is to reduce friction and provide smooth rotation between two surfaces. As the outer ring rotates, the balls roll between the

inner and outer races, reducing friction and minimizing wear. This allows the bearing to handle high speeds and loads, while also providing precision and accuracy in motion.

There are various types of ball bearings available, including deep groove ball bearings, angular contact ball bearings, thrust ball bearings, and self-aligning ball bearings. Each type is designed for specific applications and operating conditions, such as high temperatures, heavy loads, or axial or radial forces.

- **Material property of ball bearing:**

The material properties of ball bearings depend on the specific material used to manufacture the bearing.

- **Steel:** The most common material used for ball bearings is steel, particularly high-carbon chromium steel. Steel bearings offer high strength, durability, and wear resistance, making them suitable for high-speed and high-load applications.
- **Stainless steel:** Stainless steel bearings are corrosion-resistant and suitable for use in harsh environments, such as food processing or chemical plants.
- **Ceramic:** Ceramic bearings offer high strength, low weight, and excellent resistance to wear and corrosion. They are commonly used in high-speed and high-temperature applications, such as aerospace and medical equipment.

3.5.2 Bracket nut

A bracket nut is a type of nut that is used to attach or secure a bracket or other similar component a surface. It is typically a small, hexagonal-shaped nut that is threaded internally to screw onto a bolt or stud.

Bracket nuts are commonly used in various applications, such as automotive, industrial, and construction equipment. They can be made from a variety of materials, such as steel, stainless steel, brass, or nylon, depending on the specific application requirements.

In addition to the standard hexagonal shape, bracket nuts may also be available in other shapes and sizes, such as square, round, or tapered, to suit specific application needs. Some may also include specialized features, such as locking mechanisms, to prevent the nut from loosening over time.

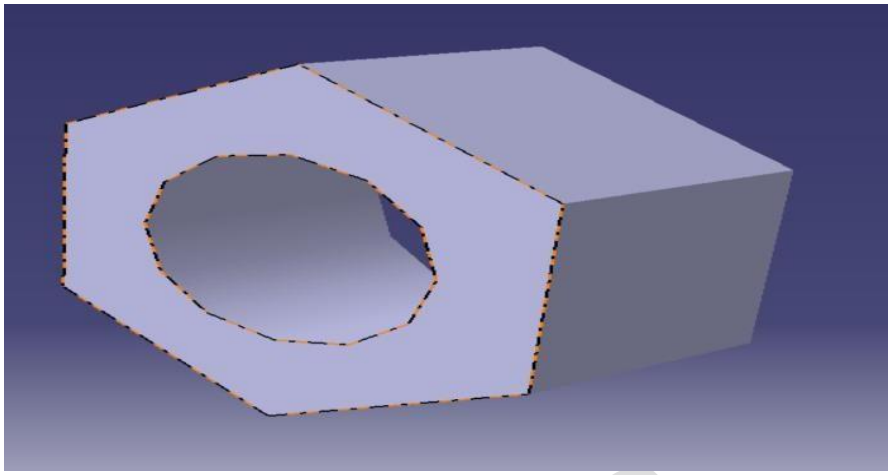

Figure 3.7 Bracket nut

- **Bracket nut types**

- **Hex bracket nuts:** These nuts have six sides and are designed to be used with a hex bolt or screw.
- **Wing bracket nuts:** These nuts have two "wings" that can be easily turned by hand, without the need for a tool.
- **Square bracket nuts**: These nuts have four sides and are often used with square bolts or screws.
- **Flange bracket nuts:** These nuts have a wide flange at one end, which helps distribute the load over a wider area.

3.5.3 Bracket Bolt

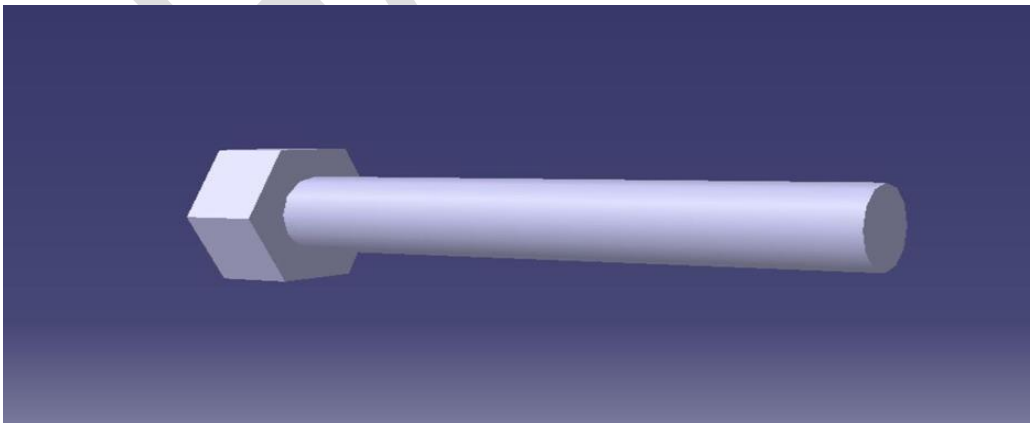

Figure 3.8 Bracket Bolt

A bolt Is a type of fastener that is typically threaded and designed to be used with a nut for attaching two or more objects together. Bolts come in various shapes, sizes, and materials depending on their intended application. They are commonly used in construction, manufacturing, and machinery.

There are several types of bolts, including hex bolts, carriage bolts, lag bolts, and machine bolts. Hex bolts, also known as hex head bolts, have a six-sided head and are often used in construction and machinery applications.

Lag bolts, also called lag screws, have a pointed tip and are used to attach heavy objects to wood or other materials. Machine bolts have a flat or rounded head and are often used in manufacturing and machinery applications.

- **Some common types of bolt materials and their properties**
  - Stainless steel bolts: Stainless steel bolts are corrosion-resistant, strong, and durable. They are also resistant to high temperatures and have a good strength-to-weight ratio.
  - Carbon steel bolts: Carbon steel bolts are strong, but not as corrosion-resistant as stainless-steel bolts. They are typically used in applications where strength is more important than corrosion resistance.
  - Alloy steel bolts: Alloy steel bolts are made from a combination of steel and other materials, such as nickel, chromium, or molybdenum. They are very strong and can withstand high stress and strain.

3.5.4 Basket

A cradle plastic basket is a type of container or carrier made of plastic material that is designed to hold and transport items, typically used for storage or transportation purposes.

The material properties of a cradle plastic basket can vary depending on the specific type of plastic used in its construction.

- **Durability:** Plastic baskets are known for their durability, as they are typically made of high-quality plastics that are resistant to wear, tear, and impact. This makes them suitable for heavy-duty applications and outdoor.
- **Lightweight:** Plastic baskets are lightweight, which makes them easy to handle and transport. This makes them ideal for applications where weight is a concern, such as in logistics and transportation.
- **Corrosion resistance:** Plastic baskets are generally resistant to corrosion, making them suitable for use in environments where they may meet moisture or chemicals.

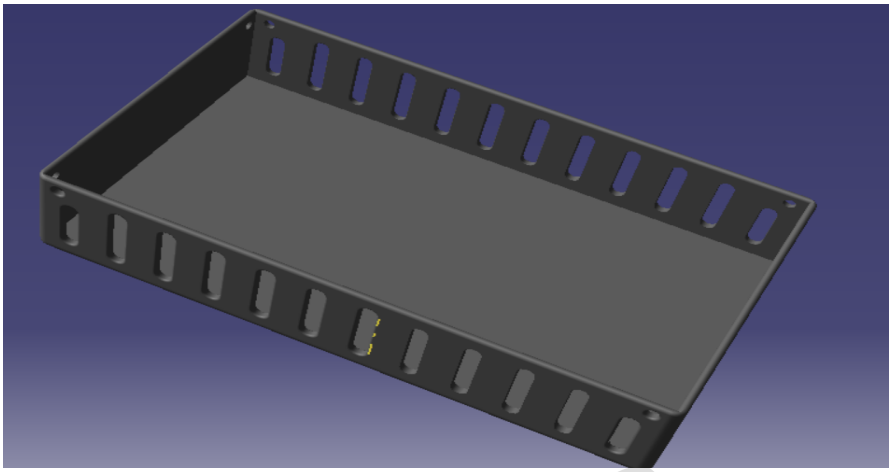

Figure 3.9 Basket

- **Weather resistance:** Plastic baskets are often designed to withstand exposure to various weather conditions, including UV radiation, moisture, and extreme temperatures, without degrading or losing their structural integrity.

3.5.5 Pillow block

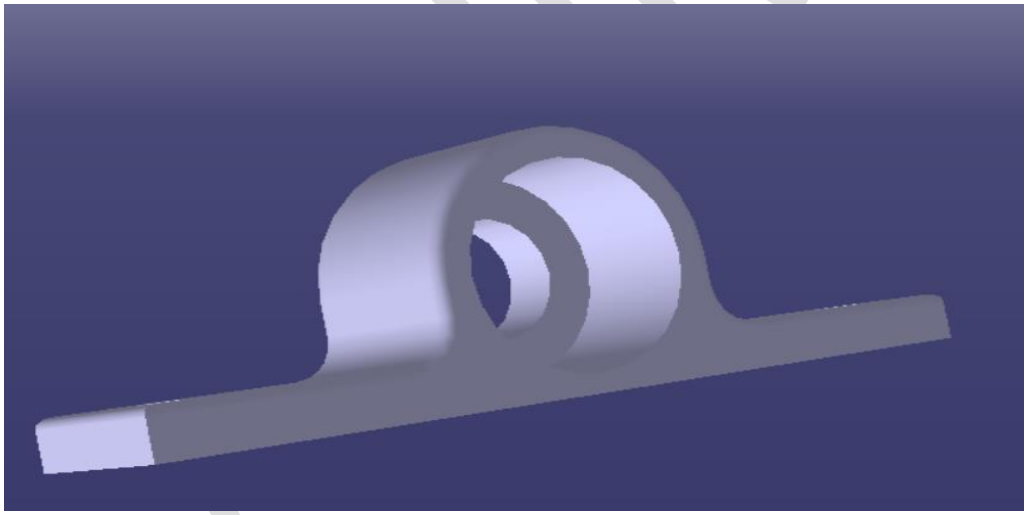

Figure 3.10 Pillow block

A pillow block, also known as a Plummer block or bearing housing, is a specialized type of bearing mount used to support rotating shafts in machinery and equipment. It typically consists of a housing and a bearing installed inside it. The material properties of a pillow block can vary depending on the specific type of material used for the housing and the bearing.

- **Material properties associated with pillow blocks**
- **Cast Iron:** Cast iron is a common material used for pillow block housings due to its durability, strength, and good machinability. Cast iron pillow blocks are

known for their high load capacity and resistance to wear, making them suitable for heavy-duty applications.

- **Steel:** Steel pillow blocks are known for their high strength and corrosion resistance, making them suitable for applications where high loads or harsh environmental conditions are present.
- **Stainless Steel:** Stainless steel pillow blocks are known for their excellent corrosion resistance, making them suitable for applications where moisture, chemicals, or other corrosive substances are present.
- **Plastics:** Plastic pillow blocks are lightweight, corrosion-resistant, and often less expensive compared to metal pillow blocks. They are suitable for applications where weight, chemical resistance, or electrical insulation are important considerations.
- **Bearing Material:** The bearing installed inside the pillow block housing is typically a rolling element bearing, such as a ball bearing or roller bearing. The material used for the bearing can vary depending on the type of bearing and the application requirements.

3.5.6 Frame

A baby swing cradle frame is a structure that supports a cradle or swing for infants or babies. It is designed to provide a safe and comfortable place for babies to rest, relax, or play while being gently rocked or swung.

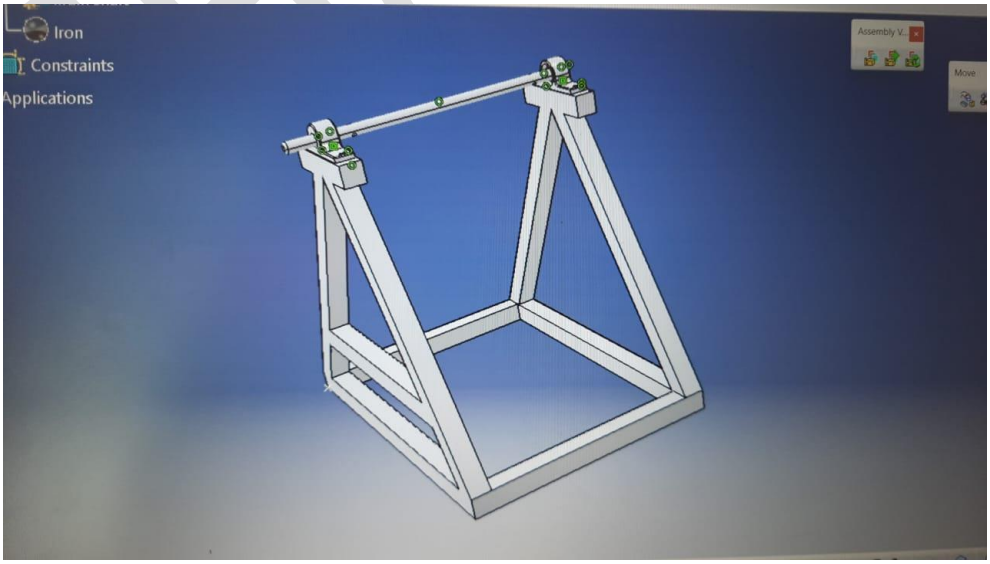

Figure 3.11 Frame

Baby swing cradle frames can come in various types and be made from different materials, each with their own unique material properties.

3.5.6.1 Types of baby swing cradle frame materials

- **Metal Frames:** Metal frames are commonly used for baby swing cradles due to their durability, strength, and stability. They are typically made from materials such as steel or aluminum, which provide excellent structural integrity and support. Metal frames can be designed in various shapes and styles, including tubular, square, or rectangular shapes, and they may feature additional features such as adjustable height or recline options.
- **Wooden Frames:** Wooden frames are another popular option for baby swing cradles, known for their natural look and feel. Wooden frames are typically made from hardwoods such as oak, maple, or birch, which provide strength and stability. They are often crafted with attention to detail and can feature decorative elements such as carvings or engravings. Wooden frames can add warmth and aesthetic appeal to a baby's nursery or home environment.

3.6 QUICK RETURN MECHANISM

3.6.1 History

During the early-nineteenth century, cutting methods involved hand tools and cranks, which were often lengthy in duration. Joseph Whitworth changed this by creating the quick return mechanism in the mid-1800s. Using kinematics, he determined that the force and geometry of the rotating joint would affect the force and motion of the connected arm. From an engineering standpoint, the quick return mechanism impacted the technology of the Industrial Revolution by minimizing the duration of a full revolution, thus reducing the amount of time needed for a cut or press.

3.6.2 Design

The disc influences the force of the arm, which makes up the frame of reference of the quick return mechanism. The frame continues to an attached rod, which is connected to the circular disc. Powered by a motor, the disc rotates and the arm follows in the same direction (linear and left-to-right, typically) but at a different speed. When the disc nears a full revolution, the arm reaches its furthest position and

returns to its initial position at a quicker rate, hence its name. Throughout the cut, the arm has a constant velocity. Upon returning to its initial position after reaching its maximum horizontal displacement, the arm reaches its highest velocity.

The quick return mechanism was modeled after the crank and slider (arm), and this is present in its appearance and function; however, the crank is usually hand powered and the arm has the same rate throughout an entire revolution, whereas the arm of a quick return mechanism returns at a faster rate. The "quick return" allows for the arm to function with less energy during the cut than the initial cycle of the disc.

The mechanism consists of a crank (a rotating lever) and a slotted lever (a sliding lever). The crank is connected to a rotating shaft, and the slotted lever is connected to a reciprocating member, such as a piston or a pump plunger.

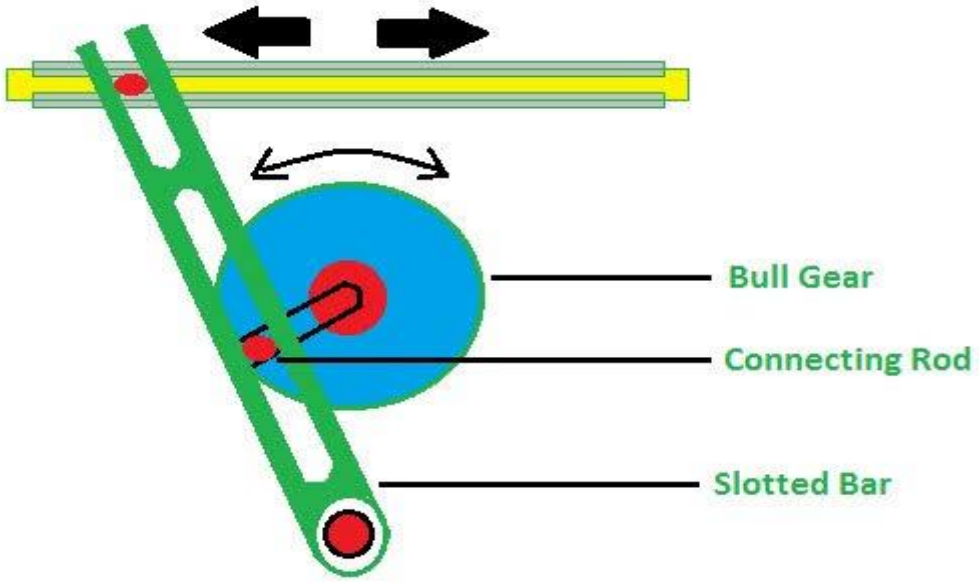

Figure 3.12 Quick return mechanism

3.6.3 Types of quick return mechanisms

- Hydraulic drive.
- Crank and slotted link mechanism.
- Whitworth mechanism.

3.7 CRANK AND SLOTTED LEVER MECHANISM:

The crank and slotted lever are two types of mechanical linkages used to convert rotary motion into linear motion or vice versa.

A crank is a simple mechanism that consists of a handle or arm attached to a rotating shaft. When the shaft rotates, the crank moves in a circular path, causing the arm to move in a linear path. Cranks are commonly used in engines, bicycles, and other machinery where rotary motion needs to be converted into linear motion.

When a crank and slotted lever are combined, they create a mechanism that converts rotary motion into precise linear motion. This type of mechanism is often used in machines such as pumps, engines, and presses.

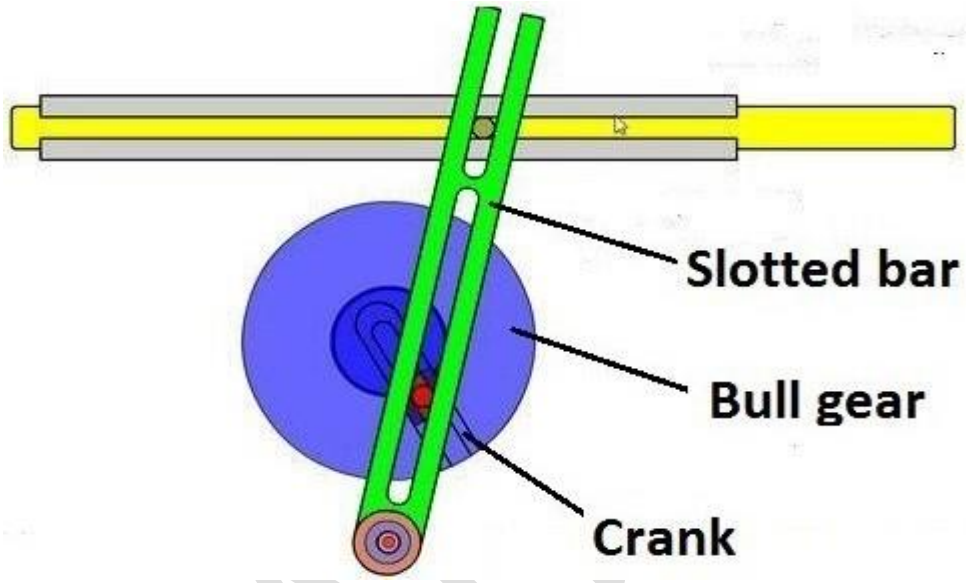

Figure 3.13 Crank slotted lever mechanism

In summary, a crank and slotted lever are two types of mechanical linkages that are commonly used to convert rotary motion into linear motion or vice versa**.** Every machine and machine tool works with a principle to perform a specified action. Few actions are reciprocating and few are rotary type, which sourced by Electrical Motor. So, this type of mechanisms (Crank And Slotted Lever, Whitworth Quick Return Mechanisms) will be used to convert the rotary motion of the Motors into required action and operation.

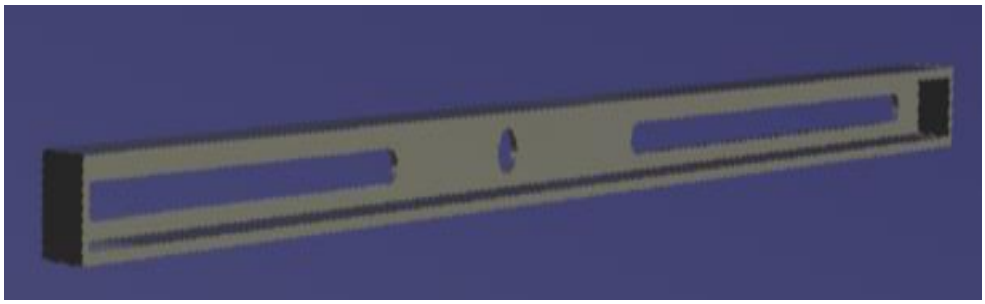

Figure 3.14 Slotted lever

The material properties required for a crank and slotted lever mechanism depend on the specific application, loads, and operating conditions. However, in general, the materials used for the crankshaft and lever should have high strength, stiffness, and wear resistance.

- **Some common materials used for crankshafts and levers include**

- **Steel:** Steel is a popular material for crankshafts and levers due to its high strength, stiffness, and wear resistance. Common steel alloys used include AISI 1045, AISI 4140, and AISI 4340.
- **Aluminum:** Aluminum is a lightweight material that is often used in high-performance applications where weight reduction is important. Common aluminum alloys used for crankshafts and levers include 2024-T4 and 7075-T6.
- **Titanium:** Titanium is a high-strength, lightweight material that is commonly used in aerospace and high-performance applications. It has excellent corrosion resistance and high fatigue strength. However, it is also expensive.
- **Cast iron:** Cast iron is a popular material for large industrial crankshafts due to its high strength and durability. It is also relatively inexpensive compared to other materials.

3.8 CRADLE MODEL IN CATIA

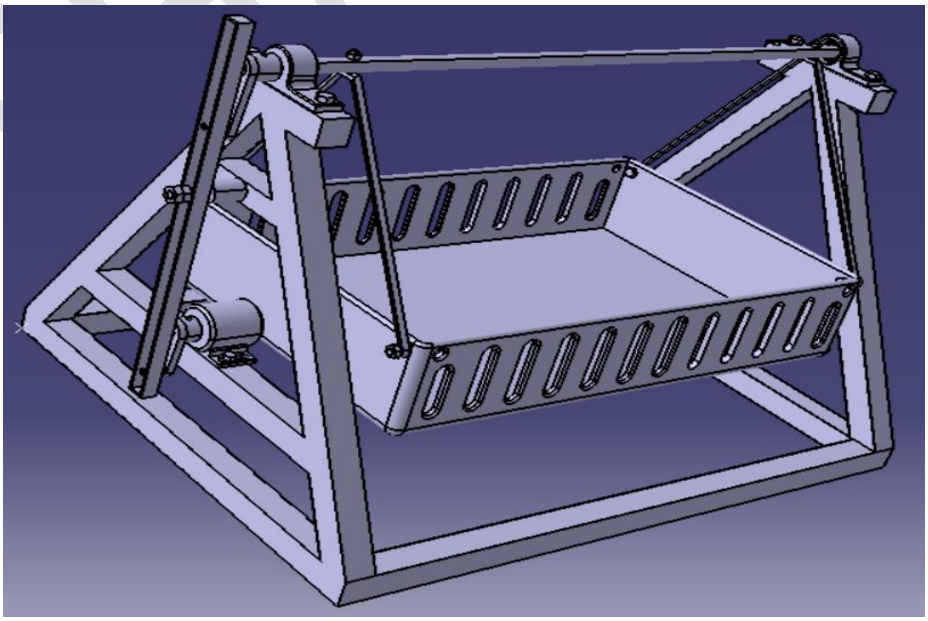

Figure 3.15 Cradle design

CHAPTER 4

HARDWARE COMPONENTS

4.1 COMPONENTS

1. MOTOR DRIVER BTS7960
2. ARDUINO UNO R3
3. WET SENSOR
4. MICROPHONE SENSOR
5. POWER SOURCE (12V BATTERY)
6. 24V 300W GEARED MOTOR
7. LCD DISPLAY I2C
8. SOUND BUZZER

4.1.1 MOTOR DRIVER BTS 7960

The Double BTS7960 43A H-Bridge High-Power Stepper Motor Driver Module is; a fully integrated high current H bridge for motor drive applications using the BTS7960 high current half bridge. the BTS7960 is part of the Novalith ICTM family. This containing one p-channel high side MOSFET and one n-channel low side MOSFET; with an integrated driver IC in one package. Due to the p-channel high side switch; the need for a charge pump is eliminated thus minimizing EMI.

- **Features:**

- PWM capability of up to 25 kHz combined with active freewheeling.
- Switched mode current limitation for reduced power dissipation in overcurrent.
- Overtemperature shut down with latch behavior.
- Overvoltage lockout.
- Undervoltage shut down.
- 74AHC244 Schmitt-trigger Octal buffer/line driver for ESD protection (Inputs accepts voltages higher than VCC).

- **Input port:**

- RPWM: forward level or PWM signal input, active high.
- LPWM: Reverse level or PWM signal input, active high.
- R_EN: forward drive enable input, high-level enable, low level off.

- L_EN: Reverse drive enable input, high-level enable, low level off.
- R_IS: forward drive current alarm output.
- L_IS: Reverse drive current alarm output.
- VCC: +5 V power output, 5V power supply connection with the microcontroller.
- GND: signal common low end.

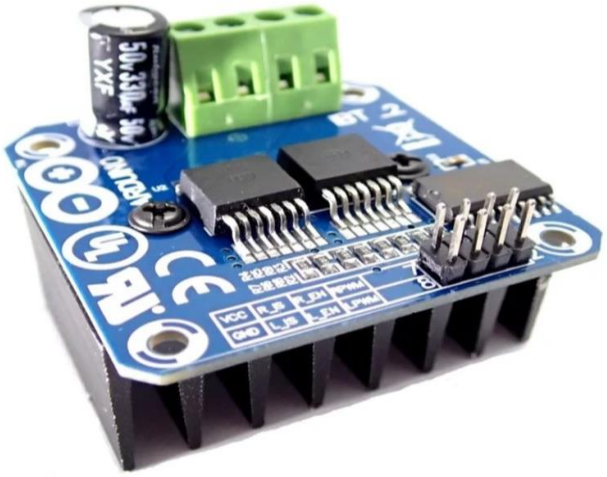

Figure 4.1 Motor driver BTS7960

4.1.2 ARDUINO UNO R3

Figure 4.2 Arduino Uno R3

The Arduino UNO R3 is frequently used microcontroller board in the family of an Arduino. The main advantage of this board is if we make a mistake, we can change the microcontroller on the board. The main features of this board mainly include, it is available in DIP (dual-inline-package), detachable and ATmega328 microcontroller. The programming of this board can easily be loaded by using an

Arduino computer program. This board has huge support from the Arduino community, which will make a very simple way to start working in embedded electronics, and many more applications.

The Arduino Uno R3 comprises 14-digit I/O pins. From these pins, 6-pins can be utilized like PWM outputs. This board includes 14 digital input/output pins, Analog inputs-6, a USB connection, quartz crystal-16 MHz, a power jack, a USB connection, resonator-16Mhz, a power jack, an ICSP header an RST button.

The programming of an Arduino Uno R3 can be done using IDE software. The microcontroller on the board will come with pre-burned by a boot loader that permits to upload fresh code without using an exterior hardware programmer.

The communication of this can be done using a protocol like STK500. We can also upload the program in the microcontroller by avoiding the boot loader using the header like the In-Circuit Serial Programming.

An Arduino can program infinite time. If a new program burns in the Arduino, then previous program will automatically vanish. We can use multiple of sensor at a time and all the instruction should be in one program.

- **Function of Arduino uno:**

Arduino is an open-source electronics platform based on the hardware and software which can be used easily. Arduino boards can read inputs and turn it into an output. The Arduino board functions are done by sending a set of instructions to the microcontroller on the board. To do so we should use the Arduino programming language, the Arduino Software (IDE), based on processing. The Arduino UNO is a microcontroller board based on the ATmega328. It has 14 digital and 6 analog input/output pins. It operates at a clock speed of 16 MHZ, has a USB connection, a power jack an ISCP header and a reset button. It requires an additional power supply. Here, Arduino will receive the input from the wet sensor, audio sensor through the input pins accordingly and will be quantified to acquire the data to assist baby. Used to connect the sensors of the cradle system, takes the signal from them, and controls the whole system.

Applications of Arduino

To develop any sensor-based prototype equipment.

Develop any LED blinking circuit.

Xoscillo: open-source oscilloscope

4.1.3 WET SENSOR

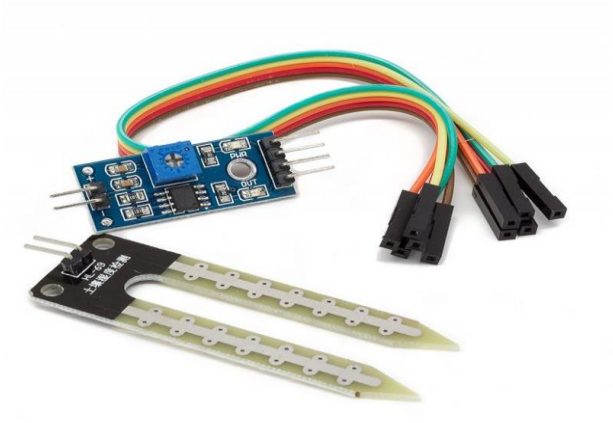

Figure 4.3 Wet sensor

- **Function of a wet sensing sensor:**

The function of this wet sensor will detect any water falling on it and the Arduino board will sense it and can perform required actions. A system like this can be used in many different fields. Wet sensor here it is utilized for distinguishing the wetness of the diaper, when the diaper is wet, the notice is sending to the guardians portable. The support is structured so that to make the child more solace or comfort.

Baby's wetness can be identified by wet sensor. A wet sensor continuously keeps on checking whether the baby's mattress is wet or not. When the wetness is sensed then parents are intimated by sending message through blynk app. This system helps in keeping the baby in a Hygienic environment.

4.1.4 MICROPHONE SENSOR

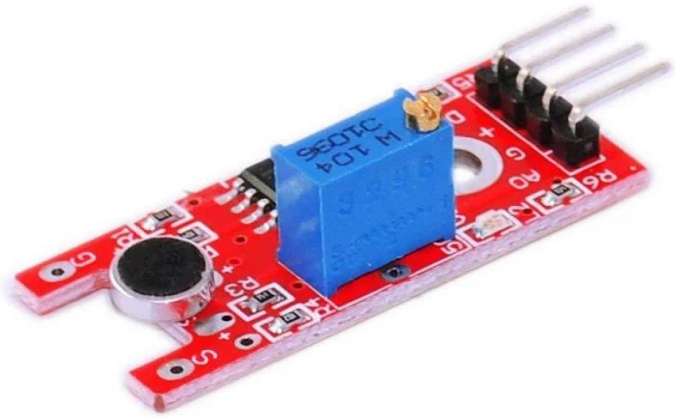

Figure 4.4 Microphone sensor

The microphone sensor detects the baby cry around the cradle through condenser microphone. Whenever the baby cries in the cradle, the microphone detects the sound and converts it into electrical signal to send to the microcontroller.

The sound sensor is one type of module used to notice the sound. Generally, this module is used to detect the intensity of sound. The applications of this module mainly include switch, security, as well as monitoring. The accuracy of this sensor can be changed for the ease of usage. This sensor employs a microphone to provide input to buffer, peak detector, and an amplifier. This sensor notices a sound, & processes an o/p voltage signal to a microcontroller. After that, it executes required processing.

- **Function of a microphone sensor**:

Microphone sensor is portrayed as a module that recognizes sound waves through its power and changing over it to electric signs. A Sound Sensor is an essential framework that recognizes sound. It is basically situated a Microphone with some managing circuit. Using a Sound Sensor, you may measure the power of sound from different sources like bangs, acclaims, riotous voices. In this project the primary reason for the cry discovery unit is to identify the voice of the infant when an infant is crying. At whatever point the crying sound gets identified the support gets swings by utilizing a servo engine.

Sound sensor is used to take input sound of baby only, it will conclude the activity to be performed as per the range of sound in decibels, and if the sound is more than certain amount or baby does not stop crying then an amplified signal is sent to servo motor for automatic swinging of the cradle

4.1.5 POWER SOURCE (12V BATTERY)

A battery is a source of electric power consisting of one or more electrochemical cells with external connections for powering electrical devices. When a battery is supplying power, its positive terminal is the cathode and its negative terminal is the anode. The terminal marked negative is the source of electrons that will flow through an external electric circuit to the positive terminal. When a battery is connected to an external electric load, a redox reaction converts high-energy reactants to lower-energy products, and the free-energy difference is delivered to the external circuit as electrical energy. Historically the term "battery"

specifically referred to a device composed of multiple cells; however, the usage has evolved to include devices composed of a single cell.

A 12V battery is a type of electrical battery that has a nominal voltage of 12 volts. It is commonly used in a wide range of applications, such as in automobiles, boats, RVs, motorcycles, solar power systems, and backup power supplies for electronic devices. 12V batteries are typically rechargeable and can store electrical energy in chemical form, which can be converted into electrical power to run various devices or systems. They come in different sizes, types, and technologies, including lead-acid batteries, lithium-ion batteries, and others, each with its own characteristics, advantages, and disadvantages. 12V batteries are widely available and commonly used in many everyday applications for powering various electrical devices and systems.

Figure 4.5 Battery

- **Characteristics**

- **Voltage:** The theoretical standard cell voltage can be determined from the electrochemical series using E^o values: E^o (cathodic) – E^o (anodic) = E^o (cell) This is the standard theoretical voltage.
- **Discharge Curve:** The discharge curve is a plot of voltage against percentage of capacity discharged. A flat discharge curve is desirable as this means that the voltage remains constant as the battery is used up.
- **Capacity:** The full battery capacity could never be realized, as there is a significant weight contribution from non-reactive components such as binders

& conducting particles, separators & electrolytes, and current collectors & substrates as well as packaging. Typical values range from 0.26 Ah/g for Pb to 26.59 Ah/g for H_2.

- **Energy density:** The energy density is the energy that can be derived peer unit volume of the weight of the cell.
- **Specific energy density:** The specific energy density is the energy that can be derived per unit weight of the cell (or sometimes per unit weight of the active electrode material).
- **Power density:** The power density is the power that can be derived per unit weight of the cell (W/kg).
- **Temperature dependence:** The rate of the reaction in the cell will be temperature dependent according to theories of kinetics. The internal resistance also varies with temperature; low temperatures give higher internal resistance.
- **Service life:** The battery cycle life for a rechargeable battery is defined as the number of charge/recharges cycles a secondary battery can perform before its capacity falls to 80% of what it originally was. This is typically between 500 and 1200 cycles.
- **Cycle life**: The cycle life of a rechargeable battery is the number of discharge/charge cycles it can undergo before its capacity falls to 80%.
- **Cost**: This includes the initial cost of the battery itself as well as the cost of charging and maintaining the battery.
- **Ability to deep discharge**: There is a logarithmic relationship between the depth of discharge and the life of a battery, thus the life of a battery can be significantly increased if it is not fully discharged; for example, a mobile phone battery will last 5-6 times longer if it is only discharged 80% before recharging.
- **Application requirements:** The battery must be sufficient for the intended application. This means that it must be able to produce the right current with the right voltage. It must have sufficient capacity, energy, and power. It should also not exceed the requirements of the application by too much, since this is likely to result in unnecessary cost; it must give sufficient performance for the lowest possible price.

4.1.6 24V 300W DC GEARED MOTOR

Figure 4.6 Dc motor

A DC motor is an electrical machine that converts electrical energy into mechanical energy. In a DC motor, the input electrical energy is the direct current which is transformed into the mechanical rotation.

A magnetic field arises in the air gap when the field coil of the DC motor is energized. The created magnetic field is in the direction of the radii of the armature. The magnetic field enters the armature from the North pole side of the field coil and "exits" the armature from the field coil's South pole side.

Working principle of DC motor

When kept in a magnetic field, a current-carrying conductor gains torque and develops a tendency to move. In short, when electric fields and magnetic fields interact, a mechanical force arises. This is the principle on which the DC motors work.

4.1.7 LCD DISPLAY I2C

Figure 4.7 LCD Display I2C

The I2C 16×2 Arduino LCD Screen is using an I2C communication interface. It can display 16×2 characters on 2 lines, white characters on blue background.

This display overcomes the drawback of LCD 1602 Parallel LCD Display in which you will waste about 8 Pins on your Arduino for the display to get working. Luckily in this product, an I2C adapter is directly soldered right onto the pins of the display. So, all you need to connect are the I2C pins, which shows a good library and little of coding.

4.1.8 SOUND BUZZER

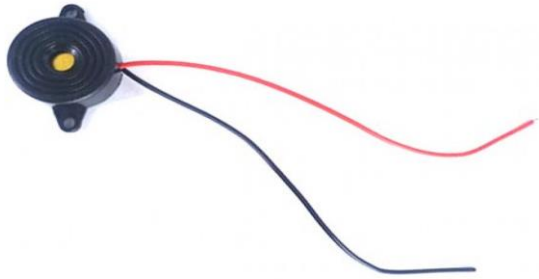

Figure 4.8 Sound Buzzer

An audio signaling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren.

CHAPTER 5

WORKING OF AUTOMATIC B-CRADLE

5.1 INTRODUCTION

An infant bed is a bed specially designed for very young children or newborn. It is called as “cradle” in British English or “crib” in American English and bassinet (derived from French word basin). Generally, the Bassinet is used for newborn to four-month-old babies. Sufficient, uninterrupted sleep is needed to build a good health. The more quality sleep a baby gets, the more he or she grows. Hence from centuries, different types of beds are made especially for babies. By the time according to requirement, advancement is done in the design of this bed or cradle. The traditional baby cradle which was in use from centuries was made up of wood. This cradle hangs from the top of the wooden pole to give swinging facility. A mattress is placed in the cradle to give baby warmth and comfort. The swinging action can only be performed manually in such cradles.

The cradle design goes on changing according to need and comfort. The swinging action of cradle is first made automatic with the help of electric motor. Later, an automatic swinging cradle with safety features was invented by Marie R. Harper.

The side-to-side rocking action facility is given to the cradle with the help of oscillatory action motor. The rocking can be stopped with slight external force. An electronic device was invented to give automatic swinging facility to traditional cradle. Sensitivity control was used to actuate the crib’s swinging based on baby cry sound level. The timer was used to swing up to specific time.

Later research was carried out on baby cry analyzer in which sound is amplified with amplifier circuit. Pulse signal having zero crossings which are aligned with zero crossings of this amplified signal is generated by pulse generator circuit. Then baby cry is detected by signal recognition circuit. Automatic baby rocker was then invented which consists of noise sensor for baby cry detection. Hence the crib would rock automatically if baby cry sound is detected.

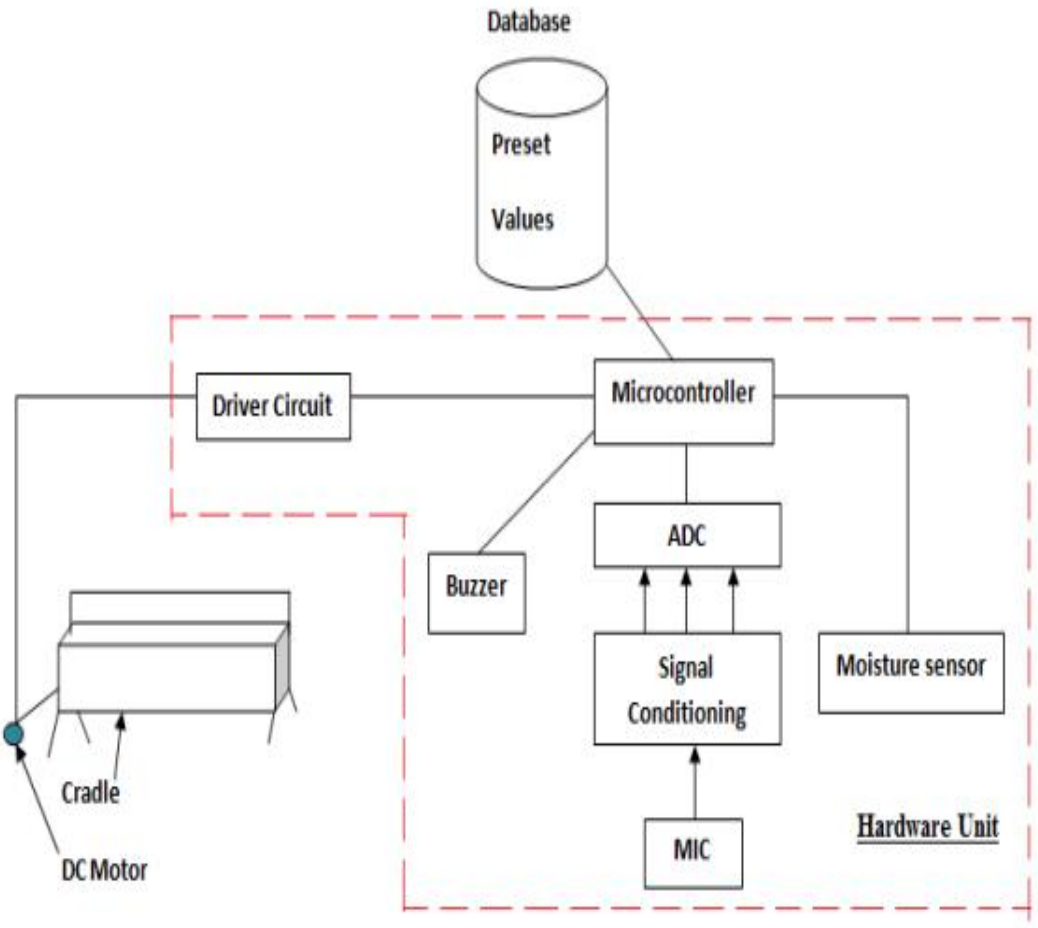

Figure 5.1 Architecture of An Advanced Cradle

5.2 WORKING PROCEDURE

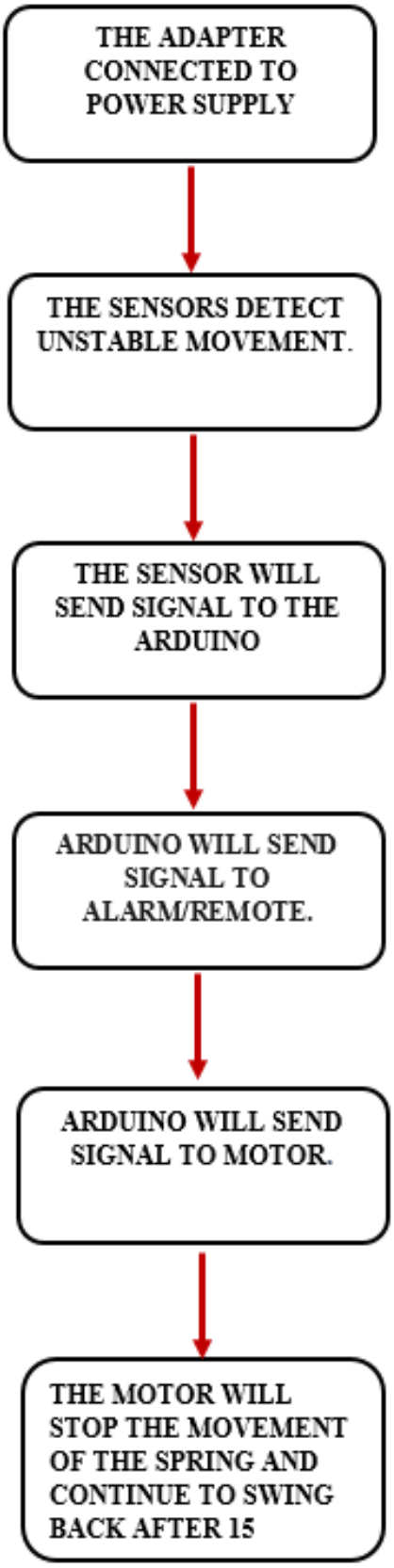

Figure 5.2 Working Procedure

5.3 BLOCK DIAGRAM

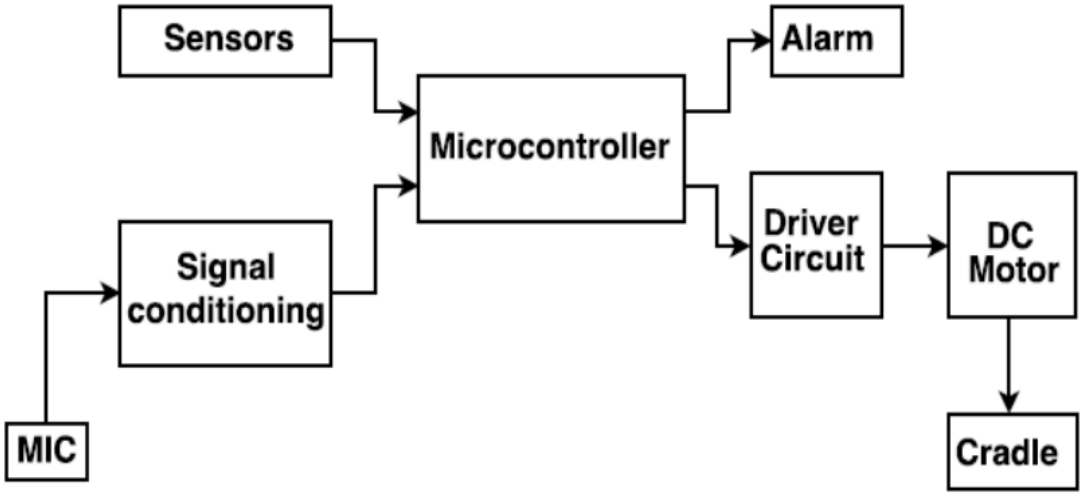

Figure 5.3 Block Diagram of the System

A block diagram is a diagram of a system in which the principal parts or functions are represented by blocks connected by lines that show the relationships of the blocks. The above block diagram shows the complete working of the smart cradle system. The system consists various hardware part like Arduino, Sound sensor, Wet Sensor, dc motor, and buzzer. The individual devices and sensors were assembled and is observed to be working efficiently.

Arduino Uno is the heart of the system. Arduino Uno controls the whole system. When the baby is awake from the sleep, initially the cradle swings automatically with the help of the servo motor respectively. This may help the baby to stop crying and go back to sleep once again. Also, the system checks the wetness of the bed. If there is a change then wet sensor corresponding actions will be carried out. If the wetness is detected, it displays in lcd and sound will be done by buzzer

The above block diagram depicts the complete working of the smart cradle system. When the child is made to sleep on the cradle various sensors like sound detection sensor, wet sensor and dc motor are implemented to monitor the various actions of the child.

The above diagram shows the automatic working of the cradle. When the sound of the baby cry is detected the system checks whether the sound level is above

the threshold value set initially. If the sound is above the mentioned threshold value a signal is sent to the dc motor for the automatic swing. When the baby is sleeping the sound will be less than the threshold value and if the wet sensor senses any kind of wetness in the bed.

5.4 WORKING

Firstly, switch on the plugs. All the components will get power and start working through the data stored. when the baby start crying sound sensor detect the sound and send information to Arduino, Arduino send the information to motor drive and motor driver pass the signal to rotate the motor so cradle start swings after 15sec after baby cry. The cradle will start moving when the adapter successfully connected to the power sources. The motor will start move the spring according to the speed and timer has been set and display the swing ON/OFF and speed of swing in the lcd display as shown in figure 5.2 below. The wet sensor will start detecting any unstable movements in the cradle. If any unstable movements successfully detected in the cradle like wet mattress, the wet sensor will send the signal to the Arduino uno. if the Arduino uno successfully received the signal from wet sensor and the Arduino uno will send the text into lcd display and make sound with the help of buzzer. The motor will stop the swing when there is noise is less for 1min. As the cradle stop from moving, come back to normal stable position.

5.5 PICTURES OF WORKING COMPONENTS

Figure 5.4 Showing as Swing on and baby is wet in Lcd display

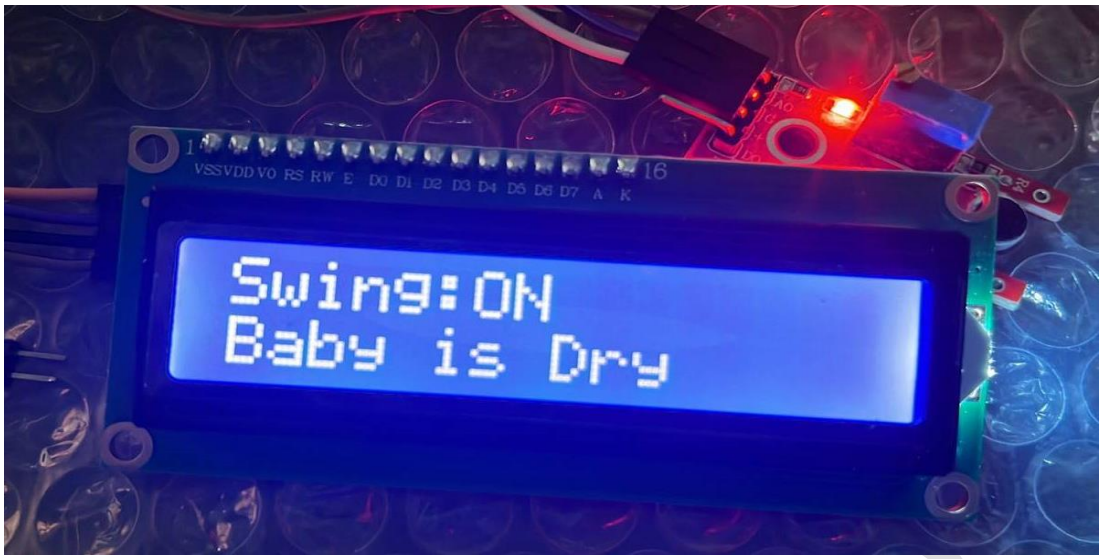

Figure 5.5 Showing as Swing on and baby is dry in Lcd display

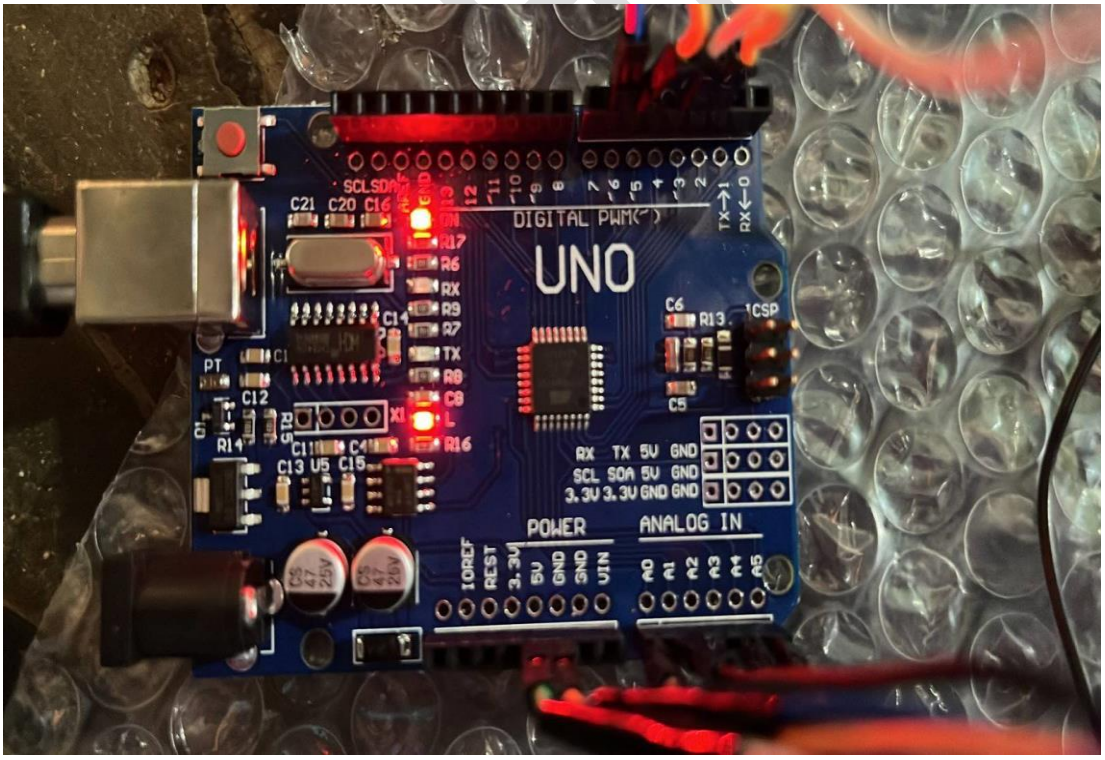

Figure 5.6 Arduino UNO signal

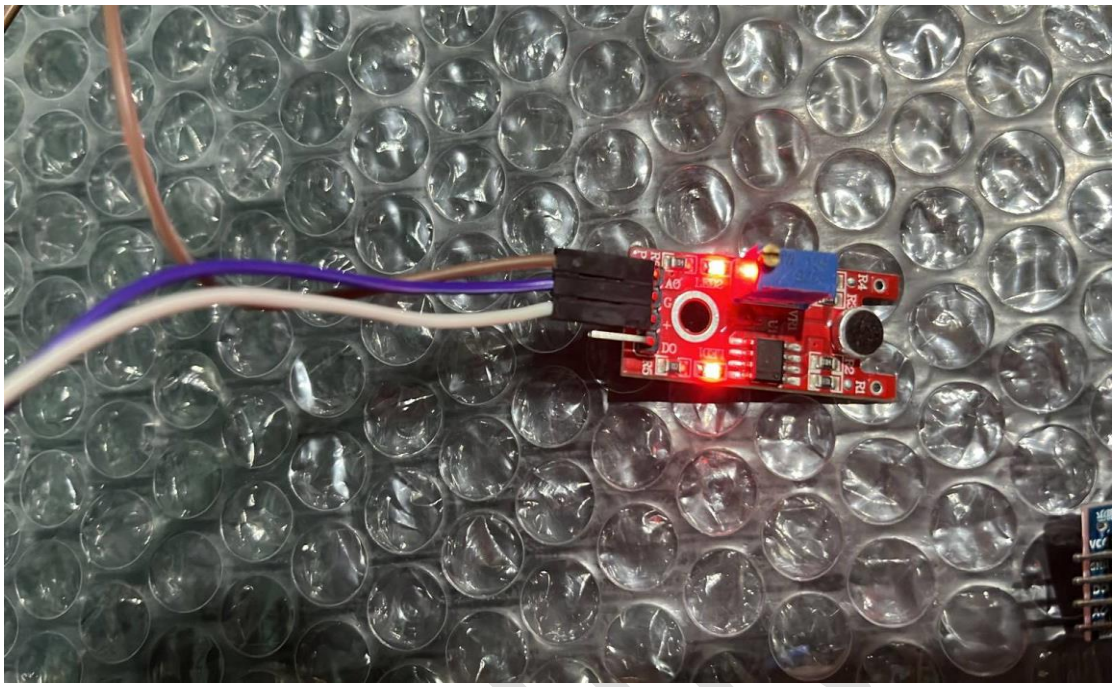

Figure 5.7 Sound Sensor signal

Figure 5.8 Cradle frame

5.6 PROGRAMMING APPLCATION

Arduino programs are written in the Arduino Integrated Development Environment (IDE). Arduino IDE is a special software running on your system that allows you to write sketches (synonym for program in Arduino language) for different Arduino boards.

The Arduino programming language is based on a very simple hardware programming language called processing, which is like the C language. After the sketch is written in the Arduino IDE, it should be uploaded on the Arduino board for execution.

5.7 ARDUINO PROGRAMMING

```
//This code done by B11 batch mech2023
#include <LiquidCrystal_I2C.h>
#include <Wire.h>
LiquidCrystal_I2C lcd(0x27,16,2);

int Mic_Pin = A0;
int Moisture_Pin = A1;
int mic_Value,moisture_Value;
int buzzer = 13;

int r_en = 2;
int l_en = 3;
int r_pwm = 5;
int l_pwm = 6;
int x,y = 0;

int motor_speed = 255;    //Speed control
int Motor_Start_delay = 10000;   //in milliseconds
int Motor_Stop_delay1 = 30000;   //in milliseconds
int Motor_Stop_delay2 = 30000;   //in milliseconds
int Motor_Stop_delay3 = 1000;   //in milliseconds

int Mic_Thd = 300;
```

```
int Moisture_Thd = 700;

void setup()
{
  Serial.begin(9600);
  pinMode(A0,INPUT);
  pinMode(A1,INPUT);
  pinMode(2, OUTPUT);
  pinMode(3, OUTPUT);
  pinMode(5, OUTPUT);
  pinMode(6, OUTPUT);
  pinMode(13, OUTPUT);

  lcd.init();
  lcd.backlight();
  lcd.setBacklight(HIGH);

  lcd.setCursor(0,0);
  lcd.print("Swing:");
  lcd.setCursor(6,0);
  lcd.print("OFF");

  digitalWrite(13,LOW);
}

void loop()
{
  mic_Value = analogRead(A0);
  moisture_Value= analogRead(A1);
  digitalWrite(r_en, HIGH);
  digitalWrite(l_en, HIGH);

  Serial.print("mic_Value = ");
  Serial.print(mic_Value);
  Serial.print("\t\t\t");
  Serial.print("moisture_Value = ");
  Serial.print(moisture_Value);
  Serial.print("\n");
```

```
 delay(80);

//Mic
 if(mic_Value >= Mic_Thd && y == 0)
 {
  delay(Motor_Start_delay);
  Serial.println("Motor on");
  lcd.setCursor(6,0);
  lcd.print("ON ");
  analogWrite(r_pwm, motor_speed);
  analogWrite(l_pwm, 0);
  x = 1;
  y = 1;
 }
 else if(mic_Value >= Mic_Thd && y == 1)
 {
  Serial.println("Motor on");
  lcd.setCursor(6,0);
  lcd.print("ON ");
  analogWrite(r_pwm, motor_speed);
  analogWrite(l_pwm, 0);
 }
 else if(mic_Value < Mic_Thd && x == 1)
 {
  delay(Motor_Stop_delay1);
  delay(Motor_Stop_delay2);
  delay(Motor_Stop_delay3);
  Serial.println("Motor off");
  lcd.setCursor(6,0);
  lcd.print("OFF");
  analogWrite(r_pwm, 0);
  analogWrite(l_pwm, 0);
  x =0;
  y = 0;
 }
 else if(x ==0)
 {
  Serial.println("Motor off");
```

```
    delay(10);
    analogWrite(r_pwm, 0);
    analogWrite(l_pwm, 0);
  }

//Moisture
  if(moisture_Value >= Moisture_Thd)
  {
    digitalWrite(13,LOW);
    lcd.setCursor(0,1);
    lcd.print("Baby is Dry");
    delay(40);
  }
  else if(moisture_Value < Moisture_Thd)
  {
    digitalWrite(13,HIGH);
    lcd.setCursor(0,1);
    lcd.print("Baby is Wet");
    delay(40);
  }
}
```

CHAPTER 6

CALCUALATIONS AND GRAPHS

Table 6.1 Observations of Motor rpm and Cradle oscillations

S.No	MOTOR RPM	CRADLE OSCILLATIONS PER MINUTE
1	30	30
2	45	45
3	60	60
4	70	70
5	80	80

As per design the cradle is swinging for 40° and, we can increase the swinging angle by modifying the distance between fixed point of slotted lever to axis of motor but this may lead to discomfort of baby so the minimum angle of swing is enough.

After conducting experimental run of cradle by placing a baby toy in cradle we fixed the cradle movement to 45 oscillations per minute.

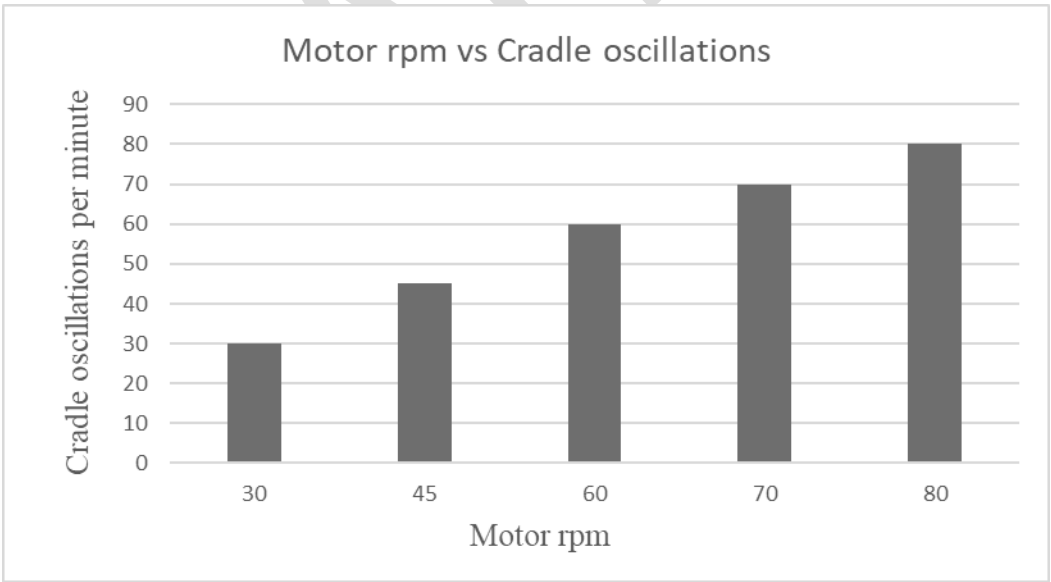

Figure 6.1 Motor rpm Vs Cradle oscillations

CHAPTER 7

RESULT AND ANALYSIS

7.1 DEMOGRAPHIC PROFILE

Basic information for 26 respondents from the questionnaire shows that the respondents consist of 13 parents and 13 babysitters which respond to the feedback form that had been given to the public.

In terms, 2 of parents and 4 of babysitter are agrees and 11 of parents and 9 babysitters strongly agree that this cradle is easily to use and none of both categories disagree nor of them strongly disagree. To wrap the feedback forms, result, all the parents and babysitters are agreeing and strongly agree on developing Automatic B-Cradle which emphasize safety features really help the parents and the babysitter to using the baby cradle in daily life to take care of their child.

7.2 RESULT

In this chapter, it is explaining about result that have been collected from the parents and the babysitter about their thoughts on developing existing Automatic B-Cradle which will help the parents and the babysitter in enhances the safety factor of baby while in the cradle. The total result shows that most of the respondents found that by developing existing baby cradle to an improved one which is Automatic B-Cradle will enhance the safety of the baby while in the cradle with advance technology system to assist the parents in taking cares of child's safety.

7.3 ANALYSIS

Research findings are related to the results of this study. The result should contain result of analysis required to report systematically, review clearly and good interpretation with objective, questions, and hypothesis research. Research finding will be reported in the form of tables, figures and interpretations that will answer to the research question

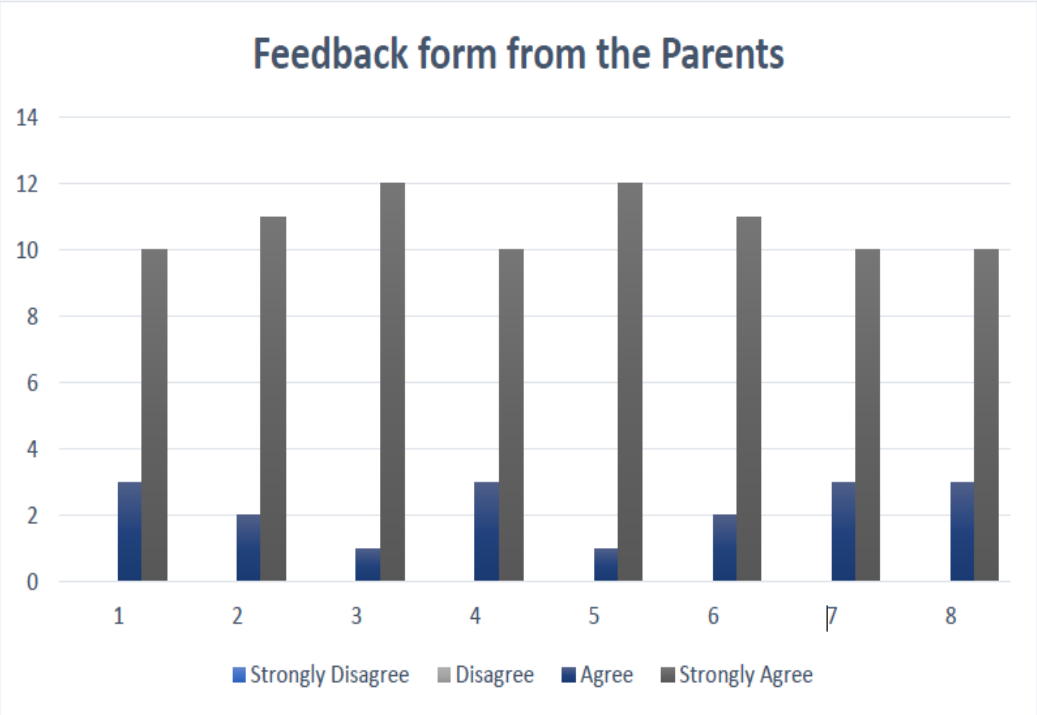

Figure 7.1 The feedback form graph of 2 category parents

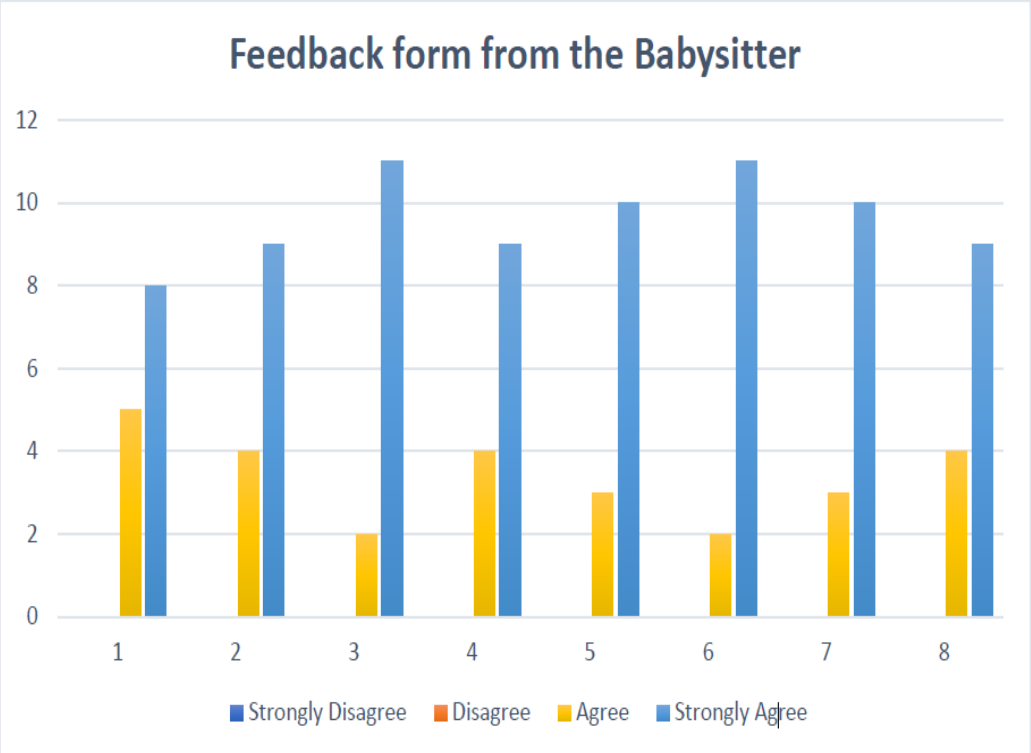

Figure 7.2 Graph of feedback forms 2 category babysitter

Question No.	Strongly Disagree		Disagree		Agree		Strongly Agree	
	Parents	Babysitter	Parents	Babysitter	Parents	Babysitter	Parents	Babysitter
1.0	0	0	0	0	3	5	10	8
2.0	0	0	0	0	2	4	11	9
3.0	0	0	0	0	1	2	12	11
4.0	0	0	0	0	3	4	10	9
5.0	0	0	0	0	1	3	12	10
6.0	0	0	0	0	2	2	11	11
7.0	0	0	0	0	3	3	10	10
8.0	0	0	0	0	3	4	10	9

Table 7.1 Data of feedback

Based on after implementation project survey, there are about 26 respondents from survey carried out. Most of the respondents are parents and babysitter and they are really satisfied with this product. 2 of parents and 4 of babysitter are agrees and 11 of parents and 9 babysitters strongly agree that this cradle is easily to use. Besides, 1 parent and 2 of babysitters are agrees and 12 of parents and 11 of babysitter are strongly agree that the problems that they are facing when using baby cradle is solved. From the survey, 3 of parents and 4 of babysitter are agrees and 10 of parents and 9 of babysitter strongly agree that this product have made their daily life more convenient. 1 parent and 3 of babysitter are agrees and 12 of parents and 10 babysitters strongly agree that this product helps them in making quick action in such emergency. The question ‘’ does this product enhance the safety factor of baby while in the cradle?’’ most of them strongly agree and consist 11 of parents and 11 of babysitter while 2 of parents and 2 of babysitter are just agree. 3 of parents and 3 of babysitter are agrees and 10 of parents and 10 of babysitter strongly agree that this product need more recognition by the worlds with recommends this product to the others. Besides, 3 of parents and 4 of babysitter are agrees and 10 of parents and 9 of babysitter strongly agree that this product should be commercialize at any markets as this product useful.

Some of the respondents recommended that the cradle should be more portable by using apps to control all the function of the cradle. Lastly, the respondents also recommended that the cradle should be more in advance by using rechargeable battery or solar energy to replace the electric source. With replacement of rechargeable battery or solar energy, the cradle can be easily to use at everywhere without the electric source.

CHAPTER 8

ADVANTAGES AND DISADVANTAGES

8.1 ADVANTAGES

- **Safety:** Automatic baby cradles are designed with built-in safety features to prevent accidental injuries to the baby, such as straps, harnesses, and secure locking mechanisms.
- **Convenience:** Automatic baby cradles can be operated remotely, allowing parents to soothe their baby, or put them to sleep without having to physically rock the cradle.
- **Saves time:** Parents can use automatic baby cradles to soothe their baby while they attend to other tasks, saving them time and allowing them to be more productive.
- **Promotes sleep:** The gentle rocking motion of automatic baby cradles mimics the motion of being rocked in a parent's arms, which can help soothe the baby and promote better sleep.
- **Adjustable settings:** Many automatic baby cradles come with adjustable settings, allowing parents to control the speed, intensity, and duration of the rocking motion to suit their baby's preferences.
- **Comfort:** Automatic baby cradles are typically designed with soft, cushioned materials and ergonomic shapes to provide maximum comfort for the baby during sleep or rest.
- **Promotes bonding:** Automatic baby cradles can help promote bonding between parents and their baby by providing a soothing and calming environment for them to connect and bond.
- **Reduces stress:** Using an automatic baby cradle can help reduce stress for parents by providing a convenient and effective way to soothe their baby, especially during the night or when parents are feeling exhausted.
- **Easy to clean:** Many automatic baby cradles come with removable and washable fabric covers, making them easy to clean and maintain.

- **Travel-friendly:** Some automatic baby cradles are portable and lightweight, making them suitable for travel or on-the-go use, providing a familiar sleeping environment for the baby in unfamiliar surroundings.
- **Energy-efficient:** Automatic baby cradles are designed to be energy-efficient, consuming minimal electricity while Durable: Automatic baby cradles are typically made from sturdy materials and built to withstand regular use, ensuring long-lasting durability.
- **Noise reduction:** Automatic baby cradles are designed to operate quietly, minimizing disruptive noises that may disturb the baby's sleep or rest.
- **Health benefits:** The gentle rocking motion of automatic baby cradles can have health benefits for babies, such as improving circulation, promoting digestion, and reducing flat head syndrome.
- **Customizable:** Many automatic baby cradles come with additional features, such as built-in music, nightlights, or timers, allowing parents to customize the cradle to suit their baby's preferences and needs.
- **Supports self-soothing:** Automatic baby cradles can help babies learn to self-soothe by providing a calming and comforting environment for them to fall asleep independently.
- **Suitable for multiple ages:** Automatic baby cradles are often designed to accommodate different age ranges, from newborns to infants, providing a longer period of usability as the baby grows.

8.2 DISADVANTAGES

- **Lack of human interaction:** While automatic baby swing cradles can provide soothing motion, they do not provide the warmth, touch, and human interaction that is essential for a baby's emotional development. Over-reliance on a swing for soothing may result in less bonding time between parents and babies, which can impact the parent-child relationship.

- **Cost:** Automatic baby swing cradles can be expensive compared to other baby gear, which may not be affordable for all families. The cost of batteries or electricity to power the swing can also add up over time, increasing the overall expense.

- **Limited portability:** Automatic baby swing cradles are typically large and bulky, which can limit their portability. They may not be easily moved from room to room or taken on trips, which can be inconvenient for families who need to use the swing in different locations.
- **Noise and distraction:** Many automatic babies swing cradles produce noise from the motor, gears, or music, which can be distracting for babies who are sensitive to sound. Loud noises may also disrupt the baby's sleep or make it difficult for the baby to relax and settle down.
- **Safety concerns:** Like any baby gear, automatic baby cradles come with safety risks. Babies can slide or slump down in the cradle, which may lead to suffocation or positional asphyxiation. There is also a risk of entrapment or pinching in the moving parts of the cradle. It's important to follow the manufacturer's instructions and guidelines for safe use.
- **Overdependence on mechanical soothing:** Over-reliance on an automatic baby cradle for soothing can create a dependency on mechanical motion for sleep. This may make it challenging to transition the baby to sleep without the cradle, and may disrupt sleep patterns when the baby is not in the cradle.

CONCLUSIONS

➢ CONCLUSIONS

In conclusion, safety is the most important aspect that should always be emphasize and point up in our daily life. As parents, their children are their priority in life and that should make a big concern to them if their children especially baby are always exposed to danger while they are in baby cradle. By proposing an advanced baby cradle which focus on safety of the baby, this will help reducing the accident of baby falling from cradle. This is because, the parents are more alert when they are doing their chores and work by hearing alarm if the baby is moving. As shown in our survey, most the respondents agree on inventing the existing baby cradle to a safer one. Apart from that, the testing that we had conducted also shows a positive result where the spring stop swinging as the vibration sensor detects movement on the baby cradle and the alarm rings as soon as the sensor detect movement. This prove that this project gives positive impact in our daily life especially parents where parents no longer worry on accident that will happen to their baby while on the cradle.

➢ FUTURE SCOPE AND ENHANCEMENT

In future we can add more features to make cradle more efficient and user-friendly. The feature we can add to this device such like parents can monitor their baby live via 3G, rotating toy with music and camera.

Camera for the live video footage. Features like PIR sensor for motion detection, checks the presence of baby in the cradle. Temperature sensor for measuring babies body temperature and check the whole room temperature. With the development of technology daily routine has been eased for the parents along with the baby care. Otherwise, mother laps will be the best cradle for baby.

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