VISVESVARAYATECHNOLOGICALUNIVERSITY

JNANASANGAMA, BELAGAVI - 590018

Project Report

On

"Design and Development of IOT Based Piston Type Cardiopulmonary Resuscitation Machine"

Submitted in partial fulfillment for the award of degree

BACHELOR OF ENGINEERING

IN

"MECHANICAL ENGINEERING"

Submitted By

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2022-2023

JSS ACADEMY OF TECHNICAL EDUCATION

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CERTIFICATE

Certified that the project work entitled "**Design and Development of IOT Based Piston Type Cardiopulmonary Resuscitation Machine**" carried out by **Mr. ATHREYA A (1JS20ME404), Mr. BALAJI R (1JS20ME406), Mr. CHARAN M (1JS20ME410), Mr. DARSHAN PRABHU (1JS20ME412),** respectively, are bonafide Students of JSS Academy of Technical Education, Bengaluru in partial fulfillment for the award of **Bachelor of Engineering in Mechanical Engineering** of the **VisvesvarayaTechnical University, Belagavi** during the academic year **2022-2023**, it is certified that all corrections/Suggestions indicated for internal assessment have been incorporated in the Report deposited in the in the departmental library, The Project Report has been approved has it satisfies the Academic requirements in respect of project work prescribed for the said Degree.

Signature of Guide	Signature of HOD	Signature of the Principal
Dr. J S Srikantamurthy	**Dr. B V Raghavendra**	**Dr. Bhimasen Soragaon**
Assistant professor	Associate professor	Professor
Dept of ME	Dept of ME	JSSATE, Bangalore
JSSATE, Bangalore	JSSATE, Bangalore	

NAME OF EXAMINERS	**SIGNATURE WITH DATE**
1.	
2.	

DECLARATION

We hereby declare that the Project Phase-2 report entitled **“Design and Development of IOT Based Piston Type Cardiopulmonary Resuscitation Machine”** is submitted to JSS ACADEMY OF TECHNICAL EDUCATON BANGALORE, in partial fulfillment of the requirement for the award of the degree of bachelor of Engineering in Mechanical engineering of Visvesvaraya Technological University Belagavi, during the academic year 2022-23 is a record of bonafide work carried out by me under the guidance of **Dr. J S Srikantamurthy**, Assistant professor, Dept. of ME, JSSATE, Bangalore.

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Abstract

Cardio Pulmonary Resuscitation (CPR) is the first step in treating victims of sudden cardiac arrest (SCA). Though manual CPR has been prevalent for many years, mechanical CPR has proven to be easier for the rescuer, safer for the patient, and more effective in pumping blood through the body, utilize a load-distributing band to apply circumferential chest compressions. However, it is very expensive and heavy, thus prohibiting its distribution to the general public. We propose to fabricate an automatic piston type mechanical CPR device which will be cost-effective. The device will provide 2-3 inch deep anterior-posterior chest compressions to victims and will be able to be used in the hospitals & public places.

The major components of the device include the board, motor assembly, microcontroller and power source. Upon completion of the project, it is expected that the device will be able to achieve the aforementioned goals of anterior-posterior displacement, easy application, and will be distributable to the various health care sectors. Remote health monitoring systems in hospitals or homes are required to reduce the overall healthcare cost and optimizing healthcare processes. especially for adults and children. The project focuses on the automatic artificial Cardiopulmonary Resuscitation (CPR) for Adults and Children who suffer sudden cardiac arrest through a mechanical CPR for effectively pumping the blood to all the organs and simultaneously the activities can be controlled and monitored by the IoT. The motto of the project is to increase the survival rate of the cardiac arrest victims thus providing the high – quality healthcare world.

Keywords; CPR, victim, chest compressions

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CHAPTER 1

1.1 INTRODUCTION

Cardiopulmonary resuscitation (CPR) is an emergency procedure that combines chest compressions often with artificial ventilation in an effort to manually preserve intact brain function until further measures are taken to restore spontaneous blood circulation and breathing in a person who is in cardiac arrest. CPR involves chest compressions for adults between 5 cm (2.0 in) and 6 cm (2.4 in) deep and at a rate of at least 100 to 120 per minute. The rescuer may also provide artificial ventilation by either exhaling air into the subject's mouth or nose (mouth-to-mouth resuscitation) or using a device that pushes air into the subject's lungs (mechanical ventilation). Current recommendations place emphasis on early and highquality chest compressions over artificial ventilation; a simplified CPR method involving chest compressions only is recommended for untrained rescuers. In children, however, only doing compressions may result in worse outcomes, because in children the problem normally arises from a respiratory, rather than cardiac problem. Chest compression to breathing ratios is set at 30 to 2 in adults. CPR alone is unlikely to restart the heart. Its main purpose is to restore partial flow of oxygenated blood to the brain and heart. The objective is to delay tissue death and to extend the brief window of opportunity for a successful resuscitation without permanent brain damage. Administration of an electric shock to the subject's heart, termed defibrillation, is usually needed in order to restore a viable or "perfusing" heart rhythm. Defibrillation is effective only for certain heart rhythms, namely ventricular fibrillation or pulseless ventricular tachycardia, rather than asystole or pulseless electrical activity. Early shock when appropriate is recommended. CPR may succeed in inducing a heart rhythm that may be shockable. In general, CPR is continued until the person has a return of spontaneous circulation (ROSC) or is declared dead.

Fig. 1.1 CPR PROCESS

CHAPTER 2

2.1 LITERATURE SURVEY

SL NO	TITLE	AUTHOR	DATE PUBLISHED/ ISSN	SUMMARY
1.	GSM Base Automated CPR Device Using Scotch-Yoke Mechanism	Mr. Bhushan Kumar N, Shinde, Surabhi Narkhede, Harshvardhn Wagh, & Onkar Wadekar	2021/ ISSN 2581-9429	The objective of the project was to achieve a product which would be economically viable so that the general population. The approach selected to achieve automated chest compressions was fabricated using aluminum, stainless steel and inexpensive hardware.
2.	Design of CPR Machine	Vinayak C.M, Shridhar G.M, Jeetendra, Prashanth S.K, & Shivasharanayya Swamy	2020 / ISSN 2229-5518	Using Arduino micro controller, Vcc board, Output board they are controlling the frequency. The motor is connected to connecting rod and yoke shaft connect where rotary motion is converted to linear motion. It will have a anatomical position with a frequency of 100 per minute and a duty cycle of 50%.
3.	R&D of smart CPR device using raw materials for cardiac arrest patients	Mohammad Monirujjaman Khan and Md. Mujtabir Alam	2020 / ISSN: 2155-9880	. The design of CPR device made using locally available raw materials for the treatment of cardiac arrest patients are demonstrated, This device is very user friendly, and anyone with basic educational knowledge can operate it

SL NO	TITLE	AUTHOR	DATE PUBLISHED /ISSN	SUMMARY
4.	IOT based artificial CPR	V.V. Varunjith1, M. Balakumaran, P, Jenifer, N. Kaleel Mohamed, D & Mohamed Azaruddin	▪ 2019 / 2395-0056	The PIC microcontroller acts as the central control of the whole unit to control both the monitoring phase and the mechanical phase. The software provides the application with the automatic cardiac wave of the patient.

TABLE NO 1.1 LITERATURE SURVEY

2.2 OUTCOME OF LITERATURE SURVEY

Based on an extensive literature survey, it has been conclusively established that the existing CPR device relies on a yoke-type mechanism. However, this mechanism poses several drawbacks, including the need for a larger physical footprint during construction and its impracticality for integration into portable machines. In response to these challenges, a transformative enhancement has been implemented in the device, introducing a piston-type mechanism. This innovative modification significantly improves the efficiency of the CPR process, expediting life-saving interventions for patients in critical situations. By incorporating the piston-type mechanism, the CPR device undergoes a remarkable evolution in functionality and performance. This mechanism revolutionizes the way chest compressions are delivered, allowing for more rapid and effective application during resuscitation efforts.

The piston's reciprocating motion facilitates a smoother and more consistent compression rhythm, minimizing interruptions and optimizing blood flow to vital organs. Consequently, the chances of successfully reviving a patient in cardiac arrest are greatly enhanced. In addition to addressing the limitations of the previous yoke-type mechanism, the piston-type enhancement also introduces newfound portability and ease of use. The reduced space requirements make the device more compact, enabling its integration into portable CPR machines.

This advancement empowers healthcare professionals with greater flexibility in delivering immediate life support in various settings, including emergency medical services, hospitals, and even remote or challenging environments. Furthermore, the piston-type mechanism brings user-friendly features to the forefront, enhancing the overall usability of the CPR device. The refined design simplifies operation and reduces the learning curve, allowing medical personnel to quickly adapt to the new technology. This promotes swift and accurate deployment of CPR, ensuring that crucial interventions are performed without delay. In summary, the integration of a piston-type mechanism represents a significant breakthrough in CPR technology. By replacing the yoke-type mechanism, this enhancement revolutionizes the device's functionality, making the resuscitation process faster and more efficient. The increased portability and user-friendliness further extend the device's applicability, empowering healthcare providers to deliver timely and effective CPR interventions, ultimately saving more lives in emergency.

CHAPTER 3

3.1 PROBLEM DEFINITION

As part of the CPR project, the piston mechanism has been used to improve the machine's design ensures that it is compact, making it easy to carry and transport & cost effective, integrated with IoT into the device, which allows patients to perform other health activities in the device as well.

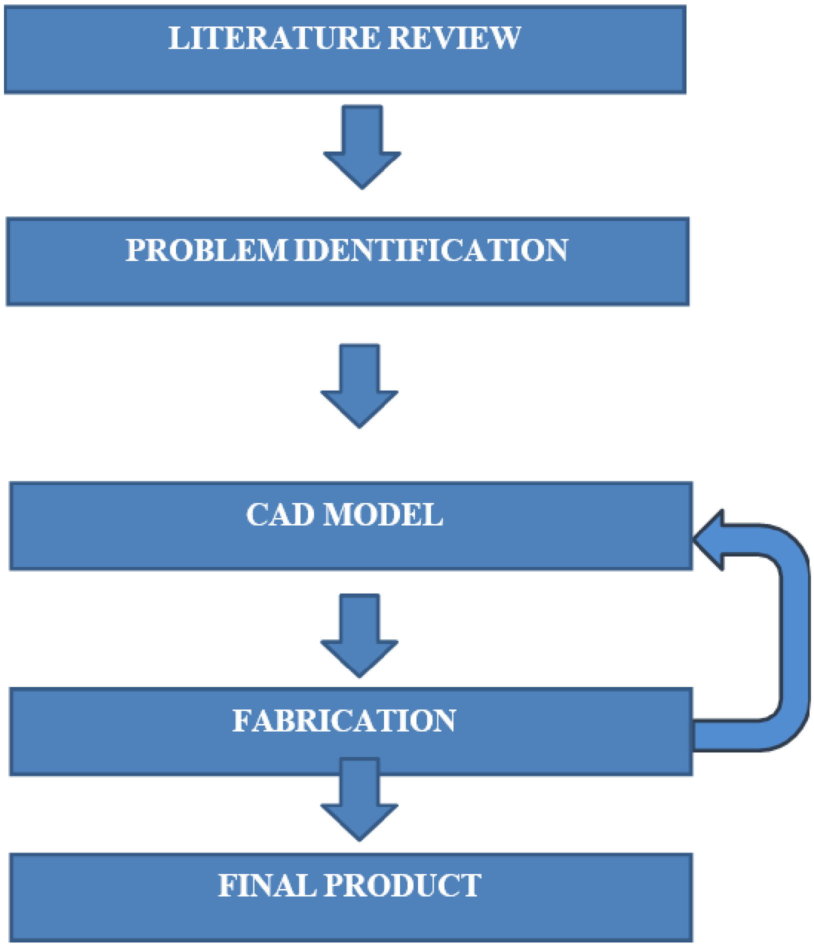
3.2 OBJECTIVE’s

- Portability and Lightweight Construction
- Design the device with minimal buttons or switches to minimize confusion and optimize ease of use for non-skilled operators.
- Ergonomic Design
- IoT Integration

CHAPTER 4

4.1METHODOLOGY

1. Conducting literature survey of the existing CPR machine.
2. Material study for fabrication.
3. Model design through CAD software.
4. Study the analysis of report.

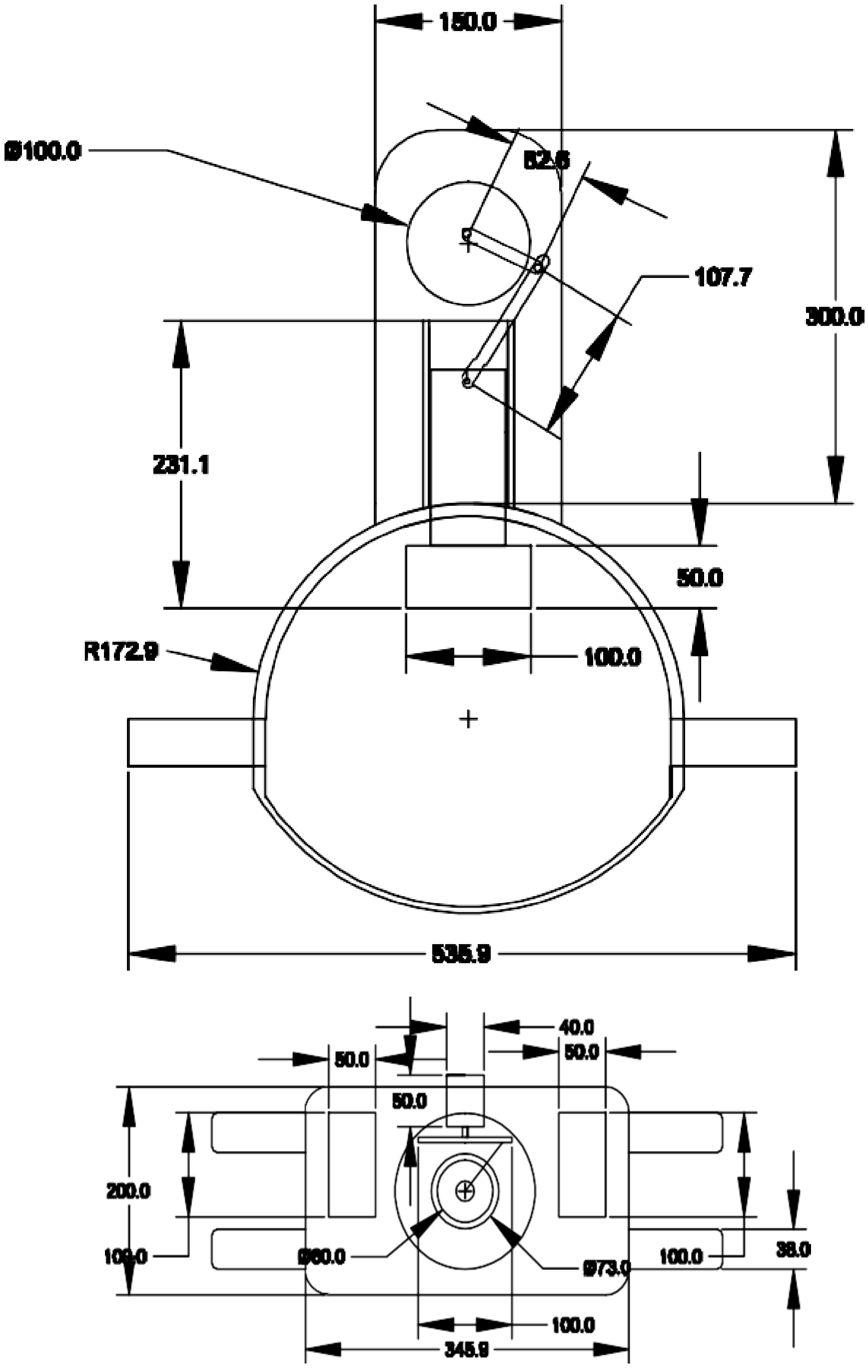


4.2 WORKING PROCESS

The mechanical setup starts to work when it receives the signal of the required range. The setup can be divided into two portions i.e, the DC motor and the Crankshaft. Initially the DC motor rotates when the relay switches on the setup and the Crankshaft model which is attached to motor also starts to move. The Crankshaft model will be consisting of the two components. One is the circular disk and another one is the long shaft. As the motor rotates the Crankshaft produces the longitudinal movements (up-down) which produces the compressions on the chest of the patient.

The motor which acts as the center for the mechanical setup drives the crankshaft mechanism. The efficiency of the motor and the programmed controller decides the number of strokes produced by the shaft onto the patient chest. The average number of compressions that are needed for the first aid of a cardiac arrest victim is 17 and 30 compressions per minute with a depth of 2 to 2.5 inches. This automatic CPR device produces about 30 compressions per minute with 2.5-inch depth. The compressions of the shaft are continued until the ECG of the patient becomes normal that is above the danger level. Here it is 60 beats per minute. When the data for the normal patient is given in the software during the running time of the device it does not affect any of the actions and the device automatically stops its compressions detecting the normal signal that is received from the controller. The mechanical setup is stopped because the relay is switched to OFF condition. The mechanical setup can be adjusted depending on the need of the patient. The vertical stand can be adjusted in 360° so that the device can be moved away from the patient for the further treatment. The horizontal stand that carries the DC motor and Crankshaft model can also be adjusted horizontally as per the need of the patient and the position in which the patient is lying.

4.3 CADD MODEL



Front view

Top view

Fig.1.2 2D CAD MODEL

ALL DIMENSIONS ARE IN MM

3D MODEL

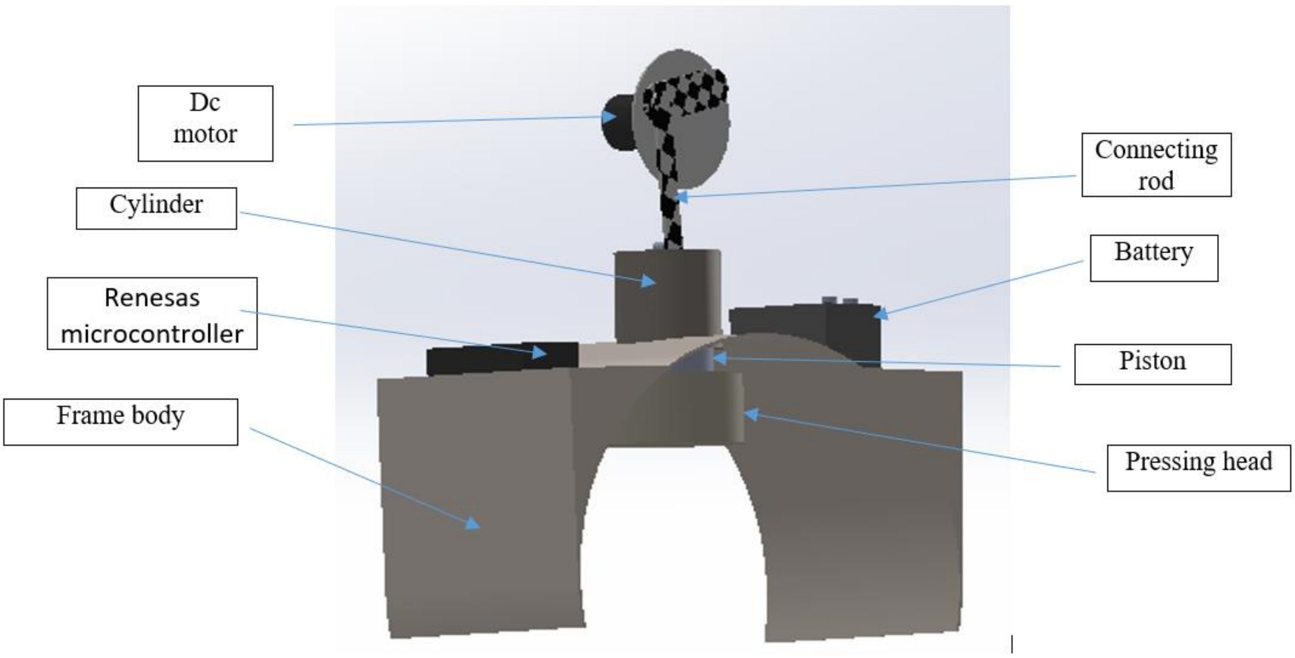


Fig. 1.3 3D model

4.4 PROGRAMMING

```
/*******************************************************************************
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*******************************************************************************
*****************************************/

/*******************************************************************************
******************************************
* File Name    : r_main.c
* Version      : CodeGenerator for RL78/G12 V1.02.01 [11 Oct 2011]
* Device(s)    : R5F102AA
* Tool-Chain   : CA78K0R
* Description  : This file implements main function.
* Creation Date: 6/14/2021
*******************************************************************************
*****************************************/

/*******************************************************************************
******************************************
Pragma directive
*******************************************************************************
*****************************************/
/* Start user code for pragma. Do not edit comment generated here */
```

```
/* End user code. Do not edit comment generated here */

/*****************************************************************************
*****************************************
Includes
******************************************************************************
****************************************/
#include "r_cg_macrodriver.h"
#include "r_cg_cgc.h"
#include "r_cg_port.h"
/* Start user code for include. Do not edit comment generated here */

#include "ALCD30.c"


#define Motor_Data1 P5.0
//#define Motor_Data2 P5.1


#define Key1 P0.0
#define Key2 P0.1
//#define Key3 P12.0


/* End user code. Do not edit comment generated here */
#include "r_cg_userdefine.h"

/*****************************************************************************
*****************************************
Global variables and functions
******************************************************************************
****************************************/
/* Start user code for global. Do not edit comment generated here */



void Device_Init(void);


/* End user code. Do not edit comment generated here */

/*****************************************************************************
*****************************************
* Function Name: main
* Description  : This function implements main function.
* Arguments    : None
* Return Value : None
******************************************************************************
****************************************/
```

```
void main(void)
{
    /* Start user code. Do not edit comment generated here */

    unsigned char i, j;

    Device_Init( );

    ALCD_Message( 0x80, "                " );
    ALCD_Message( 0xC0, "                " );
    MSDelay(2000);

    /* ALCD_Message( 0xC0, "    FORWARD     " );
    Motor_Data1 = 1;
    //Motor_Data2 = 0;
        MSDelay(1200);
    //Motor_Data1 = 0;
    //Motor_Data2 = 0;
        MSDelay(2000);

    /*ALCD_Message( 0xC0, "     RETURN     " );
    Motor_Data1 = 0;
    Motor_Data2 = 1;
        MSDelay(400);
    Motor_Data1 = 0;
    Motor_Data2 = 0;
        MSDelay(2000);*/


    ALCD_Comm( 0x01 );
    MSDelay(500);

    ALCD_Message( 0xC0, "PRESS THE SWITCH" );
    MSDelay(1000);

    while(1)
    {
        MSDelay(500);
        if( Key1 == 1 )
        {
            ALCD_Message( 0x80, "   LOW CYCLES   " );
            MSDelay(2000);

            for( j=0; j<3; j++ )
            {
                for( i=0; i<17; i++ )
                {
                    ALCD_Message( 0xC0, "    FORWARD     " );
```

```
                    Motor_Data1 = 1;
                    MSDelay(1375);

                    Motor_Data1 = 0;
                    //MSDelay(5000);
                }
                ALCD_Message( 0xC0, "    LOW REPEAT     " );
                MSDelay(4000);
            }
            ALCD_Comm( 0x01 );
            MSDelay(500);
        }
        else if( Key2 == 1)
        {
            ALCD_Message( 0x80, "  MEDIUM CYCLES " );
            MSDelay(2000);
            for( j=0; j<5; j++ )
            {
                for( i=0; i<30; i++ )
                {
                    ALCD_Message( 0xC0, "     FORWARD      " );
                    Motor_Data1 = 1;
                    MSDelay(1375);
                    Motor_Data1 = 0;
                }
                ALCD_Message( 0xC0, " MEDIUM REPEAT  " );
                MSDelay(4000);
            }
            ALCD_Comm( 0x01 );
            MSDelay(500);
        }
    }




    while (1U)
    {
        ;
    }
    /* End user code. Do not edit comment generated here */
}

/* Start user code for adding. Do not edit comment generated here */

void Device_Init(void)
{
    MSDelay(200);                                   // 0.5 sec delay
```

```
    ALCD_Init( );

    Motor_Data1 = 0;
    //Motor_Data2 = 0;

    ALCD_Message( 0x80, "      C P R     " );
    ALCD_Message( 0xC0, "     MACHINE    " );
    MSDelay(1000);

}


/* End user code. Do not edit comment generated here */
```

4.5 COMPONENTS USED

1. CYLINDER
2. PISTON
3. DC MOTOR
4. CONNECTING LINKS
5. TOGGLE BUTTONS
6. DISPLAY
7.BATTERY
8.CONTROLING CIRCUITS
9.RENESAS MICROCONTROLLER

CYLINDER

A single-acting cylinder in a reciprocating engine is a type of cylinder that relies on external forces to return the piston back to its initial position after the power stroke. Unlike double-acting cylinders that have two active sides, single-acting cylinders only have one active side where the combustion or expansion of gases occurs.

In a single-acting cylinder, the power stroke is generated when fuel combustion or compressed air forces the piston in one direction, creating the desired work output. However, when it comes to retracting the piston, it doesn't possess the ability to do so on its own. Instead, it relies on external mechanisms such as springs, the load being moved, other cylinders, or the momentum of a flywheel.

Due to their simplicity and cost-effectiveness, single-acting cylinders are widely used in various applications. They are commonly found in internal combustion engines, where the energy generated by the power stroke is utilized to perform work, while the return stroke is achieved using external forces. Additionally, single-acting cylinders are prevalent in industrial settings, such as hydraulic and pneumatic systems, where the assistance of external forces allows for efficient and controlled movements.

Overall, single-acting cylinders play a crucial role in reciprocating engines and numerous industrial applications by utilizing external forces to complete the piston's return stroke, offering a practical and reliable solution for power transmission and work generation.

Fig.1.4 CYLINDER

PISTON

The piston is a crucial component found in reciprocating engines, reciprocating pumps, gas compressors, hydraulic cylinders, pneumatic cylinders, and similar mechanisms. Its primary role is to convert the pressure generated by expanding gases or fluid into mechanical work.

In an engine, the piston is housed within a cylinder and forms a gas-tight seal with the help of piston rings. During the combustion process, the expanding gases push the piston down the cylinder, transferring force to the crankshaft through a piston rod and/or connecting rod. This rotational motion of the crankshaft is then converted into useful work, such as powering a vehicle or generating electricity. In reciprocating pumps, the function of the piston is reversed. The force is applied to the piston through the crankshaft, compressing or ejecting the fluid in the cylinder. This enables the pump to create pressure and move the fluid to the desired location.

Additionally, in certain engines, the piston serves as a valve. It covers and uncovers ports in the cylinder, controlling the intake and exhaust of gases or fluid. This valve-like action ensures proper timing and synchronization of the engine's internal processes, optimizing efficiency and performance. Overall, the piston plays a vital role in reciprocating mechanisms, facilitating the transfer of force and energy between the expanding gases or fluid and the crankshaft. It enables the conversion of pressure into mechanical work, making it a fundamental component in various types of engines, pumps, and cylinders.

Fig .1.5 PISTON

DC MOTOR

A DC motor is a type of rotary electrical motor that converts direct current (DC) electrical energy into mechanical energy. It is widely used in various applications where controlled and continuous rotational motion is required. DC motors operate based on the principle of electromagnetism, utilizing the forces produced by induced magnetic fields due to the flow of current in a coil. The most common types of DC motors consist of a stationary part called the stator, which houses permanent magnets or electromagnets, and a rotating part called the rotor, which contains a coil or armature. When a direct current is applied to the motor, it creates a magnetic field in the coil, interacting with the magnetic field of the stator. This interaction generates a mechanical force, causing the rotor to rotate.

To ensure continuous rotation, nearly all types of DC motors incorporate an internal mechanism to periodically change the direction of the current in a part of the motor. This mechanism is often achieved using commutators or electronic switches, which reverse the current flow in the coil at specific intervals. By constantly changing the direction of the current, the motor maintains its rotational motion. The ability to control the direction and speed of rotation is one of the advantages of DC motors. They offer precise control through the adjustment of the applied voltage or the use of external control devices. Due to their versatility, efficiency, and controllability, DC motors find applications in a wide range of industries, including automotive, robotics, industrial machinery, and aerospace.

Fig.1.6 DC MOTOR

CONNECTING RODS

A connecting rod is a crucial component in internal combustion engines that connects the piston to the crankshaft. Its primary function is to convert the reciprocating motion of the piston into the rotational motion of the crankshaft. The connecting rod plays a vital role in the engine's operation by transferring the compressive and tensile forces between the piston and the crankshaft. During the power stroke, when the expanding gases push the piston downward, the connecting rod transmits this force to the crankshaft, converting it into rotational motion. The design of a connecting rod allows for two types of motion. At the piston end, it allows pivoting or oscillation as the piston moves up and down within the cylinder. This flexibility accommodates the changing angles between the piston and the crankshaft as the engine goes through its cycles. At the crankshaft end, the connecting rod enables rotation. It connects to the crankshaft through a bearing, allowing smooth rotation as the crankshaft spins. The bearing provides support and reduces friction, ensuring efficient power transmission. Connecting rods are subjected to tremendous forces and must be robust and durable to withstand the stresses generated by the engine's operation. They are commonly made from high-strength steel or aluminum alloy to handle the forces and maintain structural integrity.

Fig.1.7 CONNECTING ROD

TOGGLE BUTTONS

A toggle switch is a type of electrical switch that is commonly used to control the on/off state of a circuit or device. It is actuated by physically moving a lever or toggle, hence the name "toggle switch." The lever typically appears rounded, providing a tactile and visual indication of the switch's position. Toggle switches are designed to have two distinct graphical states for the lever: up and down. These states represent the two possible positions of the switch. When the lever is in the "up" position, it indicates that the switch is in the "on" state, allowing current to flow through the circuit. Conversely, when the lever is in the "down" position, it signifies that the switch is in the "off" state, breaking the circuit and preventing the flow of current.

The graphical states of the toggle switch lever offer clear visual feedback to the user, making it easy to determine the current state of the switch at a glance. This visual representation helps users quickly understand whether a device or circuit is activated or deactivated. Toggle switches are widely used in various applications, including household appliances, electronic devices, control panels, and industrial equipment. They provide a straightforward and reliable means of controlling the power supply and enabling or disabling specific functions.

Fig. 1.8 TOGGLE SWITCH

DISPLAY

A display device is an output device for presentation of information in visual or tactile form When the input information that is supplied has an electrical signal the display is called an electronic display.

These are the technologies used to create the various displays in use today.

- Liquid crystal display (LCD)
    - Light-emitting diode (LED) backlit LCD
    - Thin-film transistor (TFT) LCD
    - Quantum dot (QLED) display
- Light-emitting diode (LED) display
    - OLED display
    - AMOLED display

LIQUID CRYSTAL DISPLAY

LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation. LEDs have a large and varying set of use cases for consumers and businesses, as they can be commonly found in smartphones, televisions, computer monitors and instrument panels.

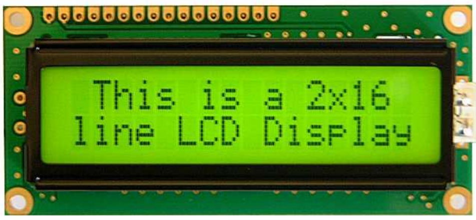

Fig.1.9 LIQUID CRYSTAL DISPLAY

BATTERY

A rechargeable battery, storage battery, secondary cell, or accumulator is a type of electrical battery which can be charged, discharged into a load, and recharged many times. We have used alkaline batteries for our project prototype. They have high capacity than their respective counter parts as well as small in size. Since motor was of 24 V and 14.7 A, two batteries of 12

V were sufficient to use.

BATTERY USED IN THE PROTOTYPE:

Sealed lead Battery:

Any battery without the fill caps is a sealed battery, regardless of its other design characteristics. Within this large group of new generation batteries are found several designs for numerous electrical duties. The modern maintenance-free design is achieved by keeping the minimal contents under a slight pressure. This pressure helps any gases condense back into liquid and flow back onto the battery plates. The result is that over the life of the battery so little acid is lost that it simply doesn’t need to be replenished.

Fig.2.1 SEALED LEAD BATTERY

CONTROLLING CIRCUIT

A control circuit is a special type of circuits used to control the operation of a completely separate power circuit. Consider a 1000 horsepower, large industrial motor driving a water pump. The motor is connected to the high voltage electrical supply of 2,400 volts.

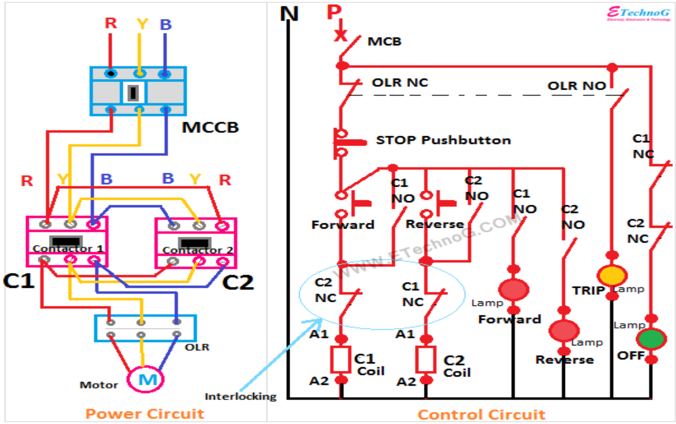

Fig.2.2 CONTROLLING CIRCUITS

RENESAS MICROCONTROLLER:

Renesas : Renesas is a semiconductor Industry which produces the Microcontrollers.

The RL78 MCU

RL78 is the family name for a range of 16-bit microcontrollers. These were the first new MCU to emerge from the new Renesas Electronics Company after the merger of NEC Electronics and Renesas Technology. These Microcontrollers incorporate the core features of the NEC 78K0R (150 nm MF2 flash process) and many familiar peripherals from legacy Renesas R8C microcontrollers. The RL78 core variants include the S1, S2, and S3 type cores which evolved from the NEC 78K0R core. The basic S1 core support 74 instructions, the S2 core adds register banking and supports 75 instructions, while the S3 core adds an on-chip multiplier / divider / multiple-accumulate and supports 81 instructions.

The RL78 was developed to address extremely low power but highly integrated microcontroller applications, to this end the core offered a novel low power mode of operation called “snooze mode” where the ADC or serial interface can be programmed to meet specific conditions to wake the device from the extreme low power STOP mode of 0.52uA.

Fig.2.3 RENESAS CONTROLLER

4.6 WORK PROGRESS

Fig.2.4 WELDING PROCESS

Fig. 2.5 PAINTING PROCESS

4.7 FABRICATED PROJECT

Fig. 2.6 FRONT VIEW

Fig.2.7 TOP VIEW

CHAPTER 5

5.1 FACTORS DETERMINING THE SELECTION OF MATERIALS

The various factors which determine the choice of material are discussed below. PROPERTIES The material selected must possess the necessary properties for the proposed application. The various requirements to be satisfied can be weight, surface finish, rigidity, ability to withstand environmental attack from chemicals, service life, reliability etc. The following four types of principle properties of materials decisively affect their selection

Types of factors:

- Physical
- Mechanical
- From manufacturing point of view
- Chemical

The various physical properties concerned are melting point, thermal Conductivity, specific heat, coefficient of thermal expansion, specific gravity, electrical conductivity, magnetic purposes etc. The various Mechanical Properties Concerned are strength in tensile, Compressive shear, bending, torsion and buckling load, fatigue resistance, impact resistance, elastic limit, endurance limit, and modulus of elasticity, hardness, wear resistance and sliding properties. The various properties concerned from the manufacturing point of view are:

- Cast ability
- Weld ability
- Surface properties
- Shrinkage
- Deep drawing etc.

Sometimes the demand for lowest possible manufacturing cost or surface qualities obtainable by the application of suitable coating substances may demand the use of special materials.

QUALITY REQUIRED: This generally affects the manufacturing process and ultimately the material. For example, it would never be desirable to go casting of a less number of components which can be fabricated much more economically by welding or hand forging the steel.

AVAILABILITY OF MATERIAL

Some materials may be scarce or in short supply, it then becomes obligatory for the designer to use some other material which though may not be a perfect substitute for the material designed. The delivery of materials and the delivery date of product should also be kept in mind.

SPACE CONSIDERATION

Sometimes high strength materials have to be selected because the forces involved are high and space limitations are there.

COST ESTIMATION: - Cost estimation may be defined as the process of forecasting the expenses that must be incurred to manufacture a product. These expenses take into a consideration all expenditure involved in a design and manufacturing with all related services facilities such as pattern making, tool, making as well as a portion of the general administrative and selling costs.

PURPOSE OF COST ESTIMATION

1. To determine the selling price of a product for a quotation or contract so as to ensure a reasonable profit to the company.
2. Check the quotation supplied by vendors.
3. Determine the most economical process or material to manufacture the product.
4. To determine standards of production performance that may be used to control the cost

5.2 COST ESTIMATION

SL NO.	MATERIAL	Quantity	COST (Rs.)
1	**SS sheet metal (304)**	1	255/kg
2	**Renesas microcontroller**	1	1699
3	**Technics 30 rpm 12v DC motor**	1	810
4	**Piston**	1	1200
5	**Battery 12v**	1	2000
6	**Belt**	1	800
7	**Toggle switch**	1	60
8	**Welding process**	-	500
9	**Labour cost**	-	1000
10	**Vacuum rubber pad**	1	750
11	**Miscellaneous**	-	1000
	Total		**10,074/- rupees**

TABLE NO 1.2 BILL OF MATERIALS

5.3 CONCLUSION

- Enhancing the mechanism by using piston type cylinder was achieved, machine is portable and compactable.
- Controlling of the machine for dual mode (Adult & Children) using Renesas module was achieved.
- Cost of the machine was less and efficient.

5.4 SCOPE OF FUTURE WORK

- In the future, we may be able to make lighter composite materials
- Heart rate sensors and pulse meters can be added or integrated into the application
- Using hydraulic mechanisms to enhance frame performance
- Integration with smart devices using AI

5.5 GANTT CHART

GANTT CHART										
Duration in Weeks										
Activity	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10
Idea Generation										
Literature Survey										
CAD Model										
Design Analysis										
Procurement of Materials										
Assembly										
Final product										

TABLE NO 1.3 GANTT CHART

5.6 REFERENCE

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